



Clean Economy Rising

Texas winds generate economic growth

Overview

Texas is a giant in the domestic power industry. Among the 50 states, it is the largest generator of electricity, has the only independent electric grid within its borders, offers the greatest resource potential for wind and solar, and contains the largest installed capacity of industrial energy efficiency technologies.¹ Prime renewable resources and policies encouraging clean energy deployment have enabled the state to dominate national rankings in several clean energy sectors.² This brief examines the reasons for Texas' success in wind power and its growing leadership in other renewable energy technologies.

Clean energy policies

Texas' electricity sector is unlike any other in the nation. While the rest of the United States is divided into two main power grids transporting electricity to the east and west, most of Texas has its own grid, which is managed by ERCOT, the Electric Reliability Council of Texas.³

It is also one of only a handful of states with a deregulated electricity market, with customers free to select their own retail providers and utilities able to adjust rate and service offerings without prior approval from the Public Utilities Commission. Nearly 60 percent of customers in the state live in competitive areas; those with electric cooperatives or municipal utilities may be subject to local regulation.⁴ While the benefits and challenges of this model have been greatly debated, opening the power market to competition in 2002 helped promote renewable energy.⁵ In many areas of the state, electricity generated from wind is becoming the most cost-effective option.⁶

The state's modest renewable portfolio standard set a goal of installing 5.9 gigawatts of renewable energy by 2015, enough to meet approximately 5 percent of peak demand, and 10 GW by 2025. Texas surpassed the latter target in 2010, 15 years ahead of schedule, but does not appear poised to adopt a more aggressive goal.⁷ It also was the first state to call for utilities to meet increased energy demand by raising energy efficiency requirements to a specific percentage. This energy efficiency resource standard currently requires utilities to meet 30 percent of annual growth in electricity demand through efficiency.

Clean energy installations are eligible for corporate and property tax deductions or exemptions, as well as low-interest loans.⁸ These incentives reduce or eliminate upfront capital costs so projects can begin achieving cost savings shortly after installation.⁹

Key State Policies					
<input checked="" type="checkbox"/>	Renewable portfolio standard	<input checked="" type="checkbox"/>	Tax incentives	<input type="checkbox"/>	Green power purchasing
<input checked="" type="checkbox"/>	Interconnection standards	<input checked="" type="checkbox"/>	Bonds/loans/rebates/other financing	<input checked="" type="checkbox"/>	Nonutility sales of renewable electricity allowed

Source: North Carolina State University, Database of State Incentives for Renewables and Efficiency

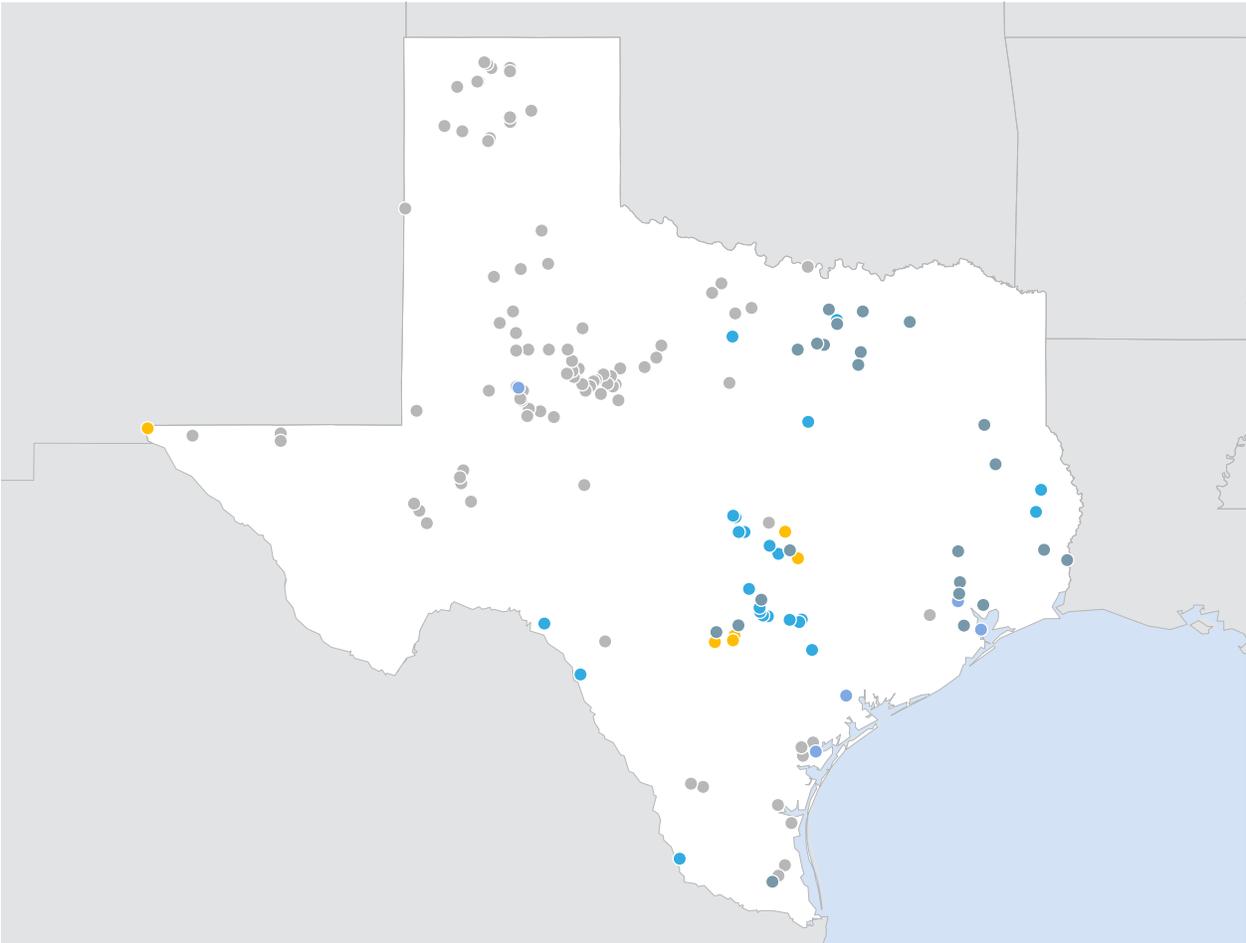
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Sources of power and economic growth

Wind accounts for almost 10 percent of power generation on Texas' internal electrical grid. Biomass, hydroelectric power, and solar are the next largest renewable energy sectors, respectively.¹⁰

In 2013, Texas was ninth in the nation in attracting private investment in clean energy, at \$553 million. Investment over the past five years (2009-13) totaled \$10.6 billion and will exceed \$42 billion over the next decade (2014-23), according to Navigant Research. The state ranks second nationwide in jobs supported by clean energy and other environment-related activities.¹¹

Renewable Electricity Power Plants, >1 Megawatt Capacity



● Hydro ● Wind ● Biomass ● Combined heat and power ● Solar

Source: Energy Information Administration

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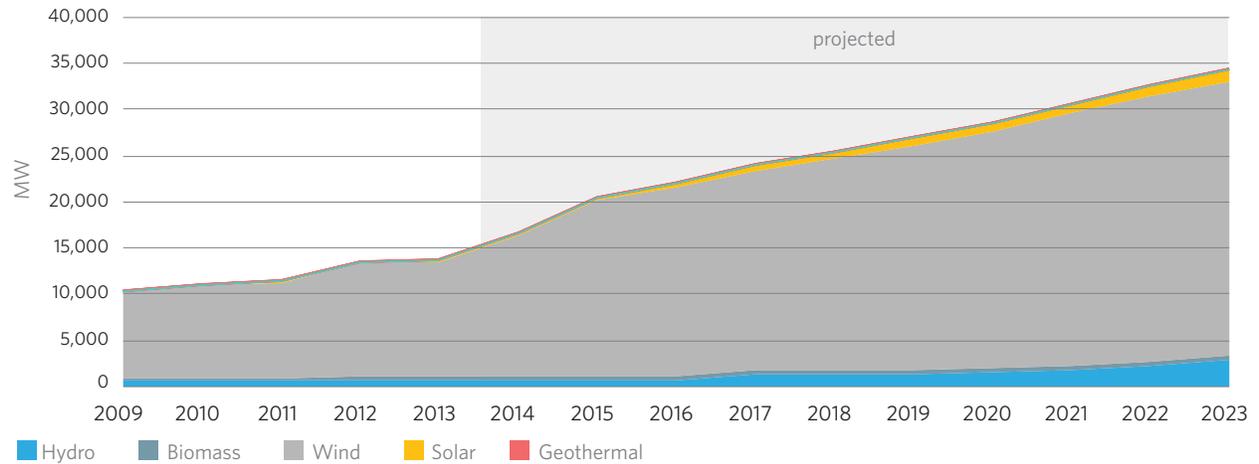


The Alamo 1 Solar Farm south of San Antonio.

Snapshot: Texas' clean energy economy

Clean Energy Capacity, by Sector and Year

Actual (2009-13) and projected (2014-23) growth in cumulative capacity



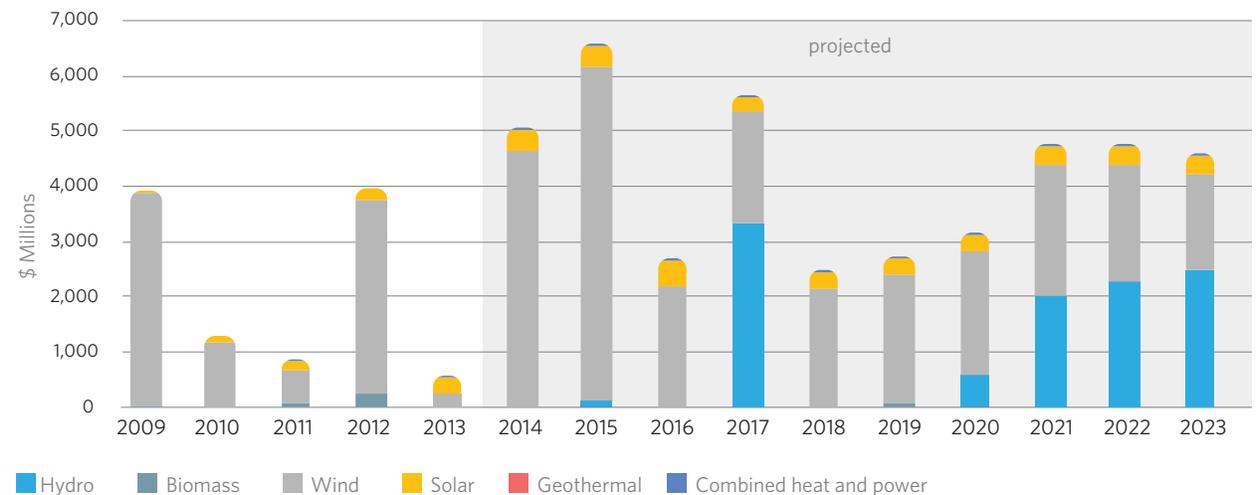
Note: Navigant Research provided data and projections of annual capacity additions from 2009 to 2023. These figures were added to baseline 2008 cumulative capacity data from the Energy Information Administration (except for wind and solar, for which cumulative data were available from Navigant Research). Navigant Research's methodology is described at the end of this brief, and that of the Energy Information Administration is available in Table 3, available at <http://www.eia.gov/renewable/state/texas/>.

Sources: Navigant Research, Energy Information Administration

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Clean Energy Investment, by Sector and Year

Actual (2009-13) and projected (2014-23) annual investment



Source: Navigant Research

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New Clean Energy Capacity Installed in 2013 (MW)

Wind accounted for majority of new projects

	Wind	141
	Solar	75
	Combined heat and power	20
	Hydro	0
	Biomass	0
	Geothermal	0
	Marine hydrokinetic	0
Total		236

Source: Navigant Research

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“ Texas ranked No. 4 in the nation in clean energy-related patents with 102 in 2012.”

—Office of the governor of Texas, 2014

National Rankings

Rank	
2nd	in energy- and environment-related jobs, 2011 (177,155)
7th	in new renewable capacity installations, 2013 (236 MW)
9th	in private investment, 2013 (\$553 million)

Sources: Navigant Research, Bureau of Labor Statistics

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Wind industry highlights

Texas generates the most electricity from wind of any state, accounting for nearly a quarter of the U.S. total.¹² To date, 12.8 GW of wind capacity have been installed and over 7 GW are under construction.¹³ The Electric Reliability Council of Texas has received requests to connect nearly 26 GW of potential projects to the grid, which are now under various stages of review.¹⁴

The state has five of the 10 largest wind farms in the country: Roscoe (782 MW), Horse Hollow (736 MW), Sweetwater (585 MW), Buffalo Gap (523 MW), and Panther Creek (458 MW).¹⁵

23%

The share of the nation's wind electricity generated in Texas.

Source: Energy Information Administration

Texas' unparalleled resource potential, along with its competitive electricity markets and clean energy policies and financing, has contributed to its leadership in the wind sector. The state established Competitive Renewable Energy Zones in 2008 enabling the transmission of 18.5 GW of wind power from West Texas and the Panhandle to highly populated areas around the state, creating a boon for the industry.¹⁶

Wind development in Texas has generated \$9.4 billion in investment over the past five years (2009 to 2013) and is projected to add \$27.8 billion over the next decade (2014 to 2023), according to Navigant Research. The sector also generated an estimated \$38 million in annual lease payments to landowners.¹⁷ In addition to its economic benefits, wind, which uses virtually no water in the creation of electricity,¹⁸ saves the state more than 7.8 billion gallons of water annually, equal to the residential water use of nearly 230,000 Texans.¹⁹ Water conservation is crucial, because for more than three years, Texas has endured its worst drought since the 1950s. Unsurprisingly, water rates are on the rise, adding to the cost of conventionally generated electricity, which requires large amounts of water.²⁰

Cyclical trends in the Texas wind industry exemplify policy challenges facing the sector nationwide. In 2012, Texas ranked first in the nation for new wind capacity additions (1.9 GW). The next year, when repeated lapses and last-minute renewals of the federal production tax credit dampened wind investment throughout the United States, wind installations in Texas fell to 141 MW. Projects that commenced just before the production tax credit expired at the end of December 2013 will go forward, resulting in significant construction in 2014 and 2015²¹ and bolstering investment. However, longer-term policy certainty would encourage more sustained growth in this sector. Wind in the state will generate an average of \$2.1 billion per year in revenues from 2016 through 2023, according to projections from Navigant Research—and perhaps even more if federal tax policy changes.

Texas Wind

National rankings and statistics, 2013

Rank	
1st	in total capacity (12.8 GW)
4th	in new capacity (141 MW)
4th	in private investment (\$254 million)
3.3 million	homes powered by wind
7.8 billion	gallons of water saved by wind power

Sources: American Wind Energy Association, Navigant Research

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Geographic Spotlight:

A Windfall in West Texas

West Texas—particularly Taylor, Nolan, Scurry, and Sterling counties—holds most of the state’s wind projects.[†] The industry also brings private investment, jobs, land payments, tax revenues, and other commerce to the region.

Competitive renewable energy zones and transmission projects

While the western part of Texas has the best wind potential, the most populous areas are in the east. In 2005, the state Legislature passed a law to facilitate development of wind resources where they are most plentiful and transmit the electricity to where it is most needed. This effort aims to meet the energy demands of a growing population, relieve congestion on power lines, and attract economic development to rural areas.[‡]

Under the direction of this law, the Texas Public Utilities Commission and the Electric Reliability Council of Texas worked to identify five Competitive Renewable Energy Zones for wind project development in west-central Texas and the Panhandle. They also approved new transmission lines to deliver power to millions of customers in metro Dallas, Fort Worth, Austin, and Houston.[‡] A 3,600-mile, \$6.9 billion transmission network—which can carry up to 18.5 GW of wind electricity—was completed in January 2014. These new capabilities—in combination with other state policies and the federal production tax credit—have attracted wind developers to the state, spurring economic activity.[§]

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Roscoe: Texas' largest wind farm

The largest wind farm in Texas—and second-largest in the nation—is the 782-MW Roscoe Wind Farm in Nolan, Mitchell, Scurry, and Fisher counties.^{**} E.ON Climate and Renewables North America developed the \$1 billion project, which came online in 2009 and powers 230,000 homes with electricity sold to the wholesale market.^{††} It reinvigorated economic activity in local towns by providing lease payments to farmers, employing 500 workers, and attracting new commercial businesses.^{‡‡} E.ON credited the state's transmission projects and federal production tax credit as important factors for its Texas projects.^{§§}



The Roscoe Wind Farm

^{*} Office of the Governor, *The Texas Renewable Energy Industry* (2014): 6, http://governor.state.tx.us/files/ecodev/renewable_energy.pdf.

[†] Ibid.

[‡] Public Utility Commission of Texas, "CREZ Transmission Program Information Center" (2010), <http://www.texascrezprojects.com/>; and Office of the Governor, *The Texas Renewable Energy Industry*, 6.

[§] Business Facilities, "2014 Business Facilities Rankings Report" (Aug. 7, 2014), <http://businessfacilities.com/2014-business-facilities-rankings-report/>.

^{**} Office of the Governor, *The Texas Renewable Energy Industry*, 14.

^{††} Eileen O'Grady, "E.ON Completes World's Largest Wind Farm in Texas," Reuters (Oct. 1, 2009), <http://www.reuters.com/article/2009/10/01/wind-texas-idUSN3023624320091001>.

^{‡‡} John Burnett, "Winds of Change Blow Into Roscoe, Texas," NPR (Nov. 27, 2007), <http://www.npr.org/templates/story/story.php?storyId=16658695>; and O'Grady, "E.ON Completes World's Largest Wind Farm in Texas."

^{§§} Dennis Stout, "Wind – A Great Panhandle Crop" (Feb. 23, 2012), http://members.class4winds.org/Resources/Documents/EON%20Climate%20_%20Renewables.pdf.

Solar industry highlights

The Solar Energy Industries Association estimates Texas receives enough sunlight to power the world twice over.²² The state attracted \$843 million in private investment in this sector over the past five years (2009 to 2013) and is expected to generate an additional \$3.3 billion over the next decade (2014 to 2023). In 2013, Texas' solar industry employed 4,100 people, ranking sixth nationwide.²³

The three largest solar farms that will operate in Texas by December 2014 are the 41-MW Alamo 1 Solar Farm in Bexar County, the 35-MW Webberville Solar Farm in Travis County, and First Solar's 22-MW Barilla Solar Project in Pecos County.²⁴

Texas Solar National rankings, 2013

Rank	
6th	in jobs (4,100)
8th	in new capacity (75 MW)
8th	in private investment (\$269 million)
13th	in total capacity (213 MW)
13th	In homes powered by solar (12,636)

Sources: Navigant Research, Solar Energy Industries Association, and Solar Foundation

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Texas has several policies to encourage solar energy's growth. The Public Utility Act of 1999 established the right to distributed power, which is generated on-site at residences and businesses. The state subsequently developed interconnection standards allowing such systems up to 10 MW in size to connect to the grid.²⁵ Texas also lets nonutilities—such as manufacturers or landowners who generate more electricity than they use—sell electricity generated on-site to third parties, creating additional market opportunities for renewable energy.²⁶

Nevertheless, Texas has one significant barrier to distributed solar: It is one of only seven states without a net metering policy requiring utilities to credit customers for power generated over and above the amount consumed on-site at their homes or businesses. Texas utilities may voluntarily establish such programs, but only three in the state have done so.²⁷

This limitation is one major reason why Texas ranks only 13th in the number of homes powered by solar, despite having the highest solar resource potential and the lowest residential solar installation price in the nation.²⁸ As detailed below, some cities have established programs promoting solar, with great success. Texas could more fully capitalize on its large solar resources if it adopted greater incentives for distributed generation on a statewide scale.

Geographic Spotlight:
Cities Soak Up the Sun

With local renewable portfolio standards far exceeding the state requirement, the cities of Austin and San Antonio account for 85 percent of installed solar capacity in Texas.* A number of other cities—including Houston, Dallas, Plano, and El Paso—have established rebates, low-interest loans, or other incentives for renewable energy and energy efficiency upgrades.†

San Antonio goes big on solar

San Antonio’s municipal utility, CPS Energy, offers a variety of customer rebates to help achieve the goal of obtaining 20 percent of its electricity from renewable sources by 2020.‡ The utility also has a 25-year agreement with San Antonio-based OCI Solar Power to purchase power from the 400-MW Alamo Solar Farm, which when completed in 2016 will be the largest in the nation. In addition to powering nearly 70,000 homes, the Alamo Solar Farm will generate \$1 billion in construction investment, \$700 million in annual economic output, and 800 permanent jobs.§ So far, OCI has completed the first three phases, with a combined capacity of 85 MW.**



The Alamo 4 Solar Farm in Bracketville.

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Austin: Sun capital

Austin Energy, a municipal utility, intends to obtain 35 percent of electricity from renewable sources by 2020 and is offering rebates and incentives to encourage installations.^{††} The capital city enjoys another distinction: In 2012, its utility became the first in the nation to establish a value of solar tariff. This is a credit on customers' bills for solar electricity generated at their homes, which is calculated based on avoided costs that would otherwise be borne by the utility and its ratepayers (such as fuel, additional power generation, and transmission and distribution). The utility established this compensation method as an alternative to traditional net metering.^{‡‡}

Austin Energy also has invested in large solar farms. The utility has a 25-year contract to buy power from the 35-MW Webberville Solar Farm constructed by RES Renewables.^{§§} In 2014, Austin Energy selected Recurrent Energy, a solar project developer, to build a 150-MW solar farm by 2016 to supply power to the city. The 20-year agreement between the utility and developer locked in one of the lowest recorded prices for a solar contract—less than 5 cents per kilowatt-hour—offsetting the volatility of natural gas prices and potentially reducing Austin's electricity rates.^{***}

[†] Critical Systems Blog, "Texas Has Double the Solar Potential of Other States—Lacks Solar-Friendly Policies" (2014), <http://www.criticalsystemsinc.com/uncategorized/texas-has-double-the-solar-potential-of-other-states-lacks-solar-friendly-policies.html>.

^{††} North Carolina State University, Database of State Incentives for Renewables and Efficiency, "Texas Incentives/Policies for Renewables and Efficiency," <http://www.dsireusa.org/incentives/index.cfm?State=TX>.

[‡] North Carolina State University, Database of State Incentives for Renewables and Efficiency, "Texas Incentives/Policies for Renewables and Efficiency: San Antonio City Public Service (CPS Energy)—Renewables Portfolio Goal" (Nov. 20, 2012), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX15R&re=1&ee=1.

[§] Office of the Governor, *The Texas Renewable Energy Industry* (2014), 21, http://governor.state.tx.us/files/ecodev/renewable_energy.pdf.

^{**} OCI Solar Power, "Texas" (2013), <http://www.ocsolarpower.com/texas.html>.

^{††} North Carolina State University, Database of State Incentives for Renewables and Efficiency, "Texas Incentives/Policies for Renewables and Efficiency: City of Austin - Renewables Portfolio Standard" (Nov. 5, 2012), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX11R&re=1&ee=1.

^{‡‡} Annie Lappé, "Austin Energy's Value of Solar Tariff: Could It Work Anywhere Else?" (March 8, 2013), Greentech Solar, <http://www.greentechmedia.com/articles/read/austin-energys-value-of-solar-tariff-could-it-work-anywhere-else>.

^{§§} WebbervilleSolar.com, "Project Overview," <http://webbervillesolar.com/ProjectOverview.html>; and Kelly Pickerel, "30-MW Texas Solar Farm Sold to MetLife and Longsol Holdings" (Feb. 29, 2012), *Solar Builder*, <http://solarbuildermag.com/news/30-mw-texas-solar-farm-sold-to-metlife-and-longsol-holdings/>.

^{***} Nora Ankrum, "AE's Solar Deal: 'Game Changer': Recurrent Energy Price Could Lower Electricity Rates" (July 4, 2014), *The Austin Chronicle*, <http://www.austinchronicle.com/news/2014-07-04/aes-solar-deal-game-changer/>.

Institution Spotlight:

Military Invests in Renewables

As one of the world's largest energy users, the U.S. Department of Defense is deploying clean energy to save money, improve energy security, and comply with directives by Congress and the executive branch.[†] Twenty percent of the military's \$21 billion annual energy bill is for energy use at facilities, such as military bases.[‡] The military branches can save billions of dollars and reduce vulnerability to disruptions in the power grid by transitioning to clean sources of electricity generated on-site. Texas is the epicenter for many of these efforts, with 16 military installations—the third-most of any state.[‡]

Fort Bliss

Fort Bliss in El Paso contains the Army's largest training area.[§] It also numbers among 17 bases in a pilot program to become net zero for energy—that is, meeting or exceeding its energy demand with on-site generation. SolarCity is installing solar panels on 4,400 military homes through a privately financed agreement with the base's housing provider. El Paso Electric also is building a 20-MW solar farm on Fort Bliss' buildings and fields, the largest renewable energy project on a U.S. military base.^{**} These efforts are combined with a project by Lockheed Martin to construct a microgrid, an independent power network on the base that will integrate renewable energy, storage, and efficiency measures. The microgrid will provide uninterrupted electricity even when there are disruptions to the external power grid, and will help reduce the base's energy consumption by at least 20 percent.^{††}

Fort Hood

Another large Army installation, Fort Hood in Killeen also has invested in clean energy by installing a privately financed, 1 MW solar project and placing electricity meters on virtually every building to reduce energy consumption.^{‡‡}

Camp Mabry

Camp Mabry in Austin, one of the state's oldest military installations, houses the Texas National Guard and Texas State Guard. With the assistance of the U.S. Department of Energy, the base installed a 150-kW solar panel system on a carport adjacent to the headquarters building.^{§§} The project, developed by Texas Solar Power Co., is expected to save an estimated \$22,500 per year, repaying the initial investment in nine years.^{***}

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Solar photovoltaic system on a carport at Camp Mabry.

[†] The Pew Charitable Trusts, *Power Surge: How the Department of Defense Leverages Private Resources to Enhance Energy Security and Save Money on U.S. Military Bases* (January 2014): 2, 7, 8, <http://www.pewtrusts.org/~media/legacy/uploadedfiles/peg/publications/report/PEWDoDReport2013KS10020314pdf.pdf>.

[†] Department of Defense, "Annual Energy Management Report Fiscal Year 2012" (June 2013), 16, http://www.acq.osd.mil/ie/energy/energymgmt_report/FY%202012%20AEMR.pdf.

[‡] USAMilitaryBenefits.com, "U.S. Military Bases by State," <http://www.usarmilitarybenefits.com/military-bases-by-state.html>.

[§] U.S. Army, "Welcome to Fort Bliss," <https://www.bliss.army.mil/welcome.html>.

^{**} The Pew Charitable Trusts, *Power Surge*: 12, 18; and Donna Miles, "Fort Bliss to Launch Military's Largest Renewable Energy Project," U.S. Department of Defense (April 5, 2013), <http://www.defense.gov/News/NewsArticle.aspx?ID=119715>.

^{††} Lisa Ferdinando, "Fort Bliss Unveils Army's First Microgrid," U.S. Army (May 17, 2013), http://www.army.mil/article/103577/Fort_Bliss_unveils_Army_s_first_microgrid/.

^{‡‡} Kate Galbraith, "Texas Army Bases Go Green, but Challenges Remain," *The Texas Tribune* (April 27, 2012), <http://www.texastribune.org/2012/04/27/texas-army-bases-go-green-challenges-remain/>.

^{§§} State Energy Conservation Office, "Success Stories: Distributed Renewable Energy Technology Program," <http://www.seco.cpa.state.tx.us/arra/stories/dret.php>.

^{***} Texas Solar Power Co., "Case Study: Texas National Guard Camp Mabry," http://www.txspc.com/PDF/TXSPC_Carport_Case_Study.pdf; and State Energy Conservation Office.

Industrial energy efficiency highlights

Texas has a strong and growing manufacturing sector, which accounts for 15 percent of the state's total economic output. Petroleum refining is one of many energy-intensive industries in the state.²⁹ Consequently, Texas' industrial energy use ranks highest in the nation and accounts for more than half of the state's total electricity use.³⁰

Industrial energy efficiency technologies can help manufacturers reduce energy consumption, costs, and water use—all of which are critical in Texas given the state's high electricity prices and chronic water shortages. Such technologies include: combined heat and power to simultaneously generate electricity and heat from a single fuel source (often natural gas) and waste heat to power, which captures wasted heat from an industrial facility that otherwise would be vented and uses it to generate electricity. Compared with traditional central-station power generation systems, these technologies typically cut energy use by nearly half.³¹

Texas has installed the largest capacity of combined heat and power of any state (17 GW), one-fifth of the U.S. total.³² It attracted \$36 million in private investment in this sector over the past five years (2009 to 2013) and will reap an additional \$293 million over the next decade (2014 to 2023), according to Navigant Research.

Texas Industrial Energy Efficiency

National rankings and statistics, 2013

Rank	
1st	total capacity (17 GW)
4th	new capacity (20 MW)
4th	private investment (\$30 million)
126	projects statewide

Sources: Navigant Research, U.S. Department of Energy

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State policies have encouraged the use of industrial energy efficiency technologies in Texas. Combined heat and power qualifies under state law to meet the energy efficiency resource standard, which was established in 1999 and recently strengthened by two bills signed into law by Governor Rick Perry.³³

The Public Utility Act of 1999 and other policies supporting on-site, distributed generation also have promoted this sector's growth.³⁴ A 2013 law clarified that combined heat and power facilities may sell electricity and heat to customers nearby, opening market opportunities for excess power generated at industrial or commercial buildings.³⁵ A federal investment tax credit can help finance industrial energy efficiency projects, as well. This federal incentive, however, is relatively small compared to those for other energy technologies, and its limitations exclude many worthy projects.³⁶

Natural disasters such as Hurricanes Ike and Rita also prompted Texas to establish policies supporting industrial energy efficiency, which can provide a secure, localized source of electricity when the grid experiences disruptions.³⁷ For example, critical government buildings in the state are required to evaluate the potential installation of combined heat and power before undertaking any new construction or major renovation.³⁸ The U.S. Department of Energy has assisted Texas' efforts to improve resiliency by providing \$10 million toward the construction of a 48-MW combined heat and power system at Texas Medical Center in Houston, which improves efficiency and will power the campus in an emergency.³⁹

Company Spotlights:

Harnessing Wasted Heat to Power Industry

Gulf Coast Green Energy's natural gas field project

Gulf Coast Green Energy, a Bay City business that sells and installs waste heat to power systems, has developed several projects for the oil and gas industry in Texas and other states. The company installed the Green Machine—created by its business partner, ElectraTherm—to capture low-temperature wasted heat from equipment in a natural gas field in South Texas. The 50-kW system generates enough electricity to power 20 homes. This type of installation has potential applications in natural gas fields throughout North America.*

Integral Power's Port Arthur steam energy project

Integral Power, a Houston-based waste heat to power project developer, installed a 5-MW project owned and operated by Port Arthur Steam Energy LP. The system creates steam by capturing high-temperature exhaust from an Oxbow Corp. plant that processes petroleum coke. Some of the steam is sold to the neighboring Valero-Port Arthur refinery, while the rest makes electricity on-site for Oxbow or is sold into the grid. The project achieves up to \$5 million per year in cost savings, provides 15 jobs, and keeps these facilities in business during electric grid disruptions.†



Waste heat to power installation at a South Texas natural gas field.



Industrial energy efficiency project by Integral Power.

* Gulf Coast Green Energy, "South Texas Gas Compressor Station" (2014), <http://gulfcoastgreenenergy.com/waste-heat-to-power-projects/south-texas-gas-compressor-station/>; and Loy Sneary, Gulf Coast Green Energy, pers. comm.

† Heat is Power Association, "Project Profile: Waste Heat to Power From Petroleum Coke Calcining," <http://www.heatispower.org/wp-content/uploads/2014/03/PASE-Project-Profile-FINAL.pdf>.

Institution Spotlight:

Saving Energy and Money at Texas A&M University

In 2011, Texas A&M University in College Station completed installation of a natural gas-fired, combined heat and power system able to run at 70 to 75 percent efficiency, more than double the efficiency of traditional power generation technologies.

The 50-MW system supports two-thirds of electricity needs and four-fifths of heating and cooling needs on the 5,200-acre campus.* The school's Utilities and Energy Services team partnered with Jacobs Engineering and Harvey Cleary Buildings on the project, constructed with \$40 million in private funding and a \$10 million grant from the U.S. Department of Energy.†

In addition to saving approximately \$6 million to \$10 million per year in energy costs, the combined heat and power system helps reduce water consumption and enables the campus to power critical facilities during disruptions to the electric grid.‡



Combined heat and power system at Texas A&M University.

* U.S. Department of Energy, "Combined Heat and Power System Achieves Millions in Cost Savings at Large University" (May 2014), <http://utilities.tamu.edu/wp-content/uploads/2014/05/DOE-Recovery-Act-Case-Study.pdf>.

† U.S. Department of Energy, "Texas A&M University Combined Heat and Power System" (Dec. 2011), https://utilities.tamu.edu/wp-content/uploads/2012/03/Texas-AM_chp_powersystem.pdf; and *Ibid.*

‡ Texas A&M University, "Texas A&M Attaining Multi-Million-Dollar Savings Through Energy and Water Use Efficiencies" (March 4, 2013), http://tamutimes.tamu.edu/2013/03/04/texas-am-attaining-multi-million-dollar-savings-through-energy-and-water-use-efficiencies/?utm_source=tamutimes&utm_medium=email&utm_campaign=2013-03-05#U_J92PldW0U; and U.S. Department of Energy, "Combined Heat and Power System Achieves Millions in cost Savings at Large University."

Emerging opportunities

Texas is tapping into some of its existing strengths to generate new clean energy industries.

The state is emerging as a leader in the innovation and manufacturing of next-generation wind technology, with research underway at Texas A&M University's Wind Energy Center, Texas Tech University's National Wind Institute, and other institutions. The state-run Texas Emerging Technology Fund has invested \$12 million in wind technology firms and research organizations. Texas ranked fourth nationwide in clean energy-related patents (with 102) in 2012,⁴⁰ thanks to investments like these and its strong research programs and business sector.

However, offshore wind energy along the Gulf Coast of Texas remains untapped. This technology has been deployed in many European countries but is relatively new to the United States. Texas ranks sixth among states for offshore wind potential and could see future development in this area.⁴¹

Finally, Texas has the nation's best resource potential for concentrating solar power.⁴² This technology uses mirrors to reflect solar energy toward a tower of fluids that collect and store heat energy, releasing it when needed—even when the sun isn't shining.⁴³ Currently, Texas has no concentrating solar projects.

Conclusion

With unparalleled wind and solar resources and a large manufacturing industry suitable for deploying industrial energy efficiency, Texas has emerged as a leader in clean energy. The state can continue to tap into its potential for generating clean energy and economic growth with further policy support, including a stronger renewable portfolio standard; policies that remove barriers to distributed solar deployment; and renewal of the federal production tax credit for wind.

Endnotes

- 1 U.S. Energy Information Administration, "Electric Power Monthly" (July 28, 2014), Table 1.6.A. Net Generation, http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_1_6_a; "Solar Energy," Window on Statement Government, <http://www.window.state.tx.us/specialrpt/energy/renewable/solar.php>; A. Lopez et al., U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis, National Renewable Energy Laboratory (July 2012): 10-14, <http://www.nrel.gov/docs/fy12osti/51946.pdf>; and U.S. Department of Energy, "Combined Heat and Power Installation Database," <http://www.eea-inc.com/chpdata/>.
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Unless otherwise specified, data on capacity additions and investment were provided by Navigant Research, an energy market research firm, and include solar photovoltaics, industrial sector combined heat and power, geothermal power (excluding heat pumps), biomass power (excluding landfill-gas, anaerobic digesters, and biogas recovery), hydropower projects, permanently installed (not pilot) marine and hydrokinetic projects, and wind projects greater than 1 megawatt.

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