Texas

Summary and Analysis

Texas has strengths in renewable-energy generation, especially wind, but it has done less than other states to build up its manufacturing sector. Overall, there is very little policy implemented to encourage clean energy or green jobs. However, the state has extensive wind and solar resources that have not been substantially exploited, perhaps because the primary energy focus of the state is on oil and natural gas. With respect to demand-side policies, the state pioneered the idea of an energy efficiency portfolio standard in 1999 and settled on the location of $5 billion dollars in new transmission lines. Among innovations of policy and programs in Texas are the following:

- In West Texas, there is an emerging public-private partnership that will link wind-energy research with manufacturing.
- Austin Energy's Pecan Street Project will learn how to standardize, support, and manage the infrastructure of smart-grid technologies, in the process creating a new business model for utilities.
- Austin's Energy Conservation Audit and Disclosure Ordinance requires homeowners to complete an energy audit before the sale of a home, and commercial building owners must receive an energy rating. Austin Energy also supports building greening through a variety of programs.
- Austin also requires that all new single family homes be zero-energy (with on-site 100 percent renewable energy generation) by 2015.
- Austin successfully recruited the Clean Technology and Sustainable Industries Association to locate in the city.

General Background Policy

Energy Goals. Texas' heavy industry in combination with the cooling needs of residences and businesses means that the state both produces and consumes more electricity than any other (Combs 2008; U.S. Energy Information Administration 2010). According to data provided by the Energy Information Administration for 2007, in terms of total megawatt hours of non-hydroelectric renewable energy generated, Texas ranks second just behind California, primarily due to wind-energy generation (Doris, McLaren, Healey, and Hockett 2009). However, compared with other states in terms of megawatt-hours per capita, or, renewable energy as a percentage of total in-state generated energy, Texas' ranking is much lower. About 89 percent of the energy produced in the state is from natural gas (66 percent) and petroleum (23 percent); Texas provides approximately 30 percent of the natural gas produced in the U.S. (U.S. Energy Information Administration 2009; U.S. Energy Information Administration 2010). From 2003 to 2007 renewable-energy production (not including oil, natural gas, nuclear energy, coal, or biofuels) increased from 1.02 percent to 1.70 percent of the total energy produced within the state; however, during this time, biofuels were not being produced at all (U.S. Energy

Information Administration 2009). Most of the renewable energy (approximately 83 percent) came from wind (Combs 2008).

In 1999, Texas developed its first renewable-energy portfolio standard and the nation's first energy-efficiency portfolio standard (EEPS) (SB7). The program originally required utilities to use energy efficiency to off-set 10 percent of load growth, and in 2007 the goal was increased to 20 percent of load growth, with current discussions underway for an increase to 30 percent (American Council for an Energy Efficient Economy 2010). In 2005 the state expanded its renewable portfolio standard (SB20) to a goal of 5880 megawatts by 2015 (about 5 percent of the 2005 demand) and 10,000 megawatts by 2025 (Combs 2008). Two of the municipal public utilities (Austin and San Antonio) have their own standards. In March 2010, the Texas Public Utility Commission was considering a proposed Energy Efficiency Portfolio Standard increase that off-sets up to 30 percent of load growth by 2014.

The Public Utility Commission also had an open meeting in June, 2010, for considering a non-wind renewable portfolio standard. (In Senate Bill 20 there was a target for 500 megawatts of non-wind renewable energy that was interpreted as optional by the Public Utility Commission (Lewin 2010). The 2007 session of the legislature added language to the renewable portfolio standard to clarify that the target was mandatory, but one of the three commissioners still believed (as of July 2010) that the Public Utilities Commission does not have the authority to enforce the target as a mandate (Power 2010). Increasing the energy-efficiency portfolio standard or starting a non-wind renewable portfolio standard would be important for driving up demand and increasing jobs in the clean-energy sector. As Doug Lewin of the Good Company Associates stated, "We've got a significant number of green jobs in the state, particularly in West Texas for wind energy, but we need more policies to promote other forms of renewable energy and increase adoption of energy efficiency to create more clean energy jobs" (Lewin 2010). Also in Senate Bill 20, the Texas Public Utilities Commission was authorized to determine which places in Texas have both the capacity to generate renewable energy and the investors demonstrating a commitment to develop a renewable-energy project, and then designate the places as Competitive Renewable Energy Zones (CREZs) and authorize new transmission lines (Combs 2008; Doris, McLaren, Healey, and Hockett 2009). David Power from Public Citizen Texas (2010) pointed out that most "of the incentives on the books are for traditional energy sources." For example, the 45-cent-per-gallon ethanol subsidy will expire soon, and a recent Congressional report shows that BP, Exxon, and Valero have received the majority of these funds, which go to the blender of gasoline and ethanol instead of the original ethanol producer (Michaels 2010).

Texas has an advantage in the energy sector because it has its own electricity grid, which is managed by the Electric Reliability Council of Texas (ERCOT). Texas is also the country's largest wind-energy producer and has significant solar radiation. However, considering the state's large size, its current renewable-energy production per capita is miniscule in comparison to the energy that it consumes (Combs 2008; U.S. Energy Information Administration 2010). It is behind the rest of the country in some of the basic demand-side policies. In addition to policies already discussed, a law passed in 2007 (House Bill 3693) mandated net metering, but the state's public utility commission and ERCOT weakened the definition and implementation of it, and a 2009 report card on net metering gave Texas a grade of D (Network for New Energy Choices 2008). As of May 2009, Texas was one of only seven states without a net metering policy and

one of thirteen states without renewable energy access laws (Doris, McLaren, Healey, and Hockett 2009). David Power from Public Citizen Texas (2010) pointed out that most "of the incentives on the books are for traditional energy sources", for example, the 45 cent per gallon ethanol subsidy will expire soon. A recent Congressional report shows that BP, Exxon, and Valero have received the majority of the funds, which go to the blender of gasoline and ethanol instead of the original ethanol producer (Michaels 2010).

Public Benefits Fund. Texas has a "system benefit fund; [however,] it is only partially distributed. Currently it is estimated to contain over $500 million dollars that is held as part of the general revenue fund to help balance the state budget"(Power 2010).

Green-Buildings Policy. Texas does not have specific targets, such as LEED-silver certification or energy reduction goals, but since 1995 it has had a statutory requirement for new government buildings and major building renovations. Specifically, the state has adopted the IECC 2009 building code for 2011 for commercial buildings and the 2009 IRC for residential buildings in 2012. Also, the State Energy Conservation Office is recommending that the cities amend the IRC to address regional temperature zones (Power 2010). The agency or department must undertake an analysis of building design and energy consumption with conventional assumptions, then compare the cost-effectiveness of using alternative energy sources (biomass, geothermal, solar, and wind energy). If the alternatives are cost effective, they must be included (DSIRE 2010). Specific cities such as Austin, Dallas, Houston, and San Antonio, as well as the municipality of McAllen, have green building requirements (Power 2010).

Green Jobs Training. For a large state only limited funds have gone into workforce development for clean energy (Young 2009). In 2009 the state passed legislation that authorized a Green Jobs Skills and Training Program (Senate Bill 108), which would dedicate 20 percent of the funds to low-income and unemployed persons. The estimated appropriation for the program was $5 million per year, in contrast with the $75 million for green jobs training in California. As of July, no funds had been appropriated for green jobs skills and training (Wood 2010). The state does have a skills development fund operated by the Texas Workforce Commission and funded through the U.S. Department of Labor; however, there is no formal benchmark for creating or training green jobs. However, training for green jobs has been identified as a high-need area; training for energy conservation related jobs and training for wind energy jobs have been funded through $5 million in ARRA funds (Wood 2010). The Texas Workforce Commission has also reviewed the *Texas Green Jobs Guidebook* that the Environmental Defense Fund put together for the state for distribution primarily to high school guidance counselors (Robertson and Smith 2010).

The Jobs and Education for Texans (JET) program, operated through the Texas Comptroller's office, identifies high-demand jobs and facilitates the creation of training programs for those jobs (e.g., electricians trained to work in solar and, or, wind installation; Wood 2010). Texas Tech University and Texas State Technical College in collaboration with the American Wind Energy Association and other organizations together formed the Texas Wind Energy Institute. Together they have received $1 million from the Texas Workforce Commission for the purpose of developing training programs to support the wind industry (Cranford 2008).

Good Company Associates is keeping track of the HomeStar Energy Retrofit Act of 2010, which has passed the U.S. House of Representatives (HR 5019) and is (as of July 2010) in the U.S. Senate (S 3434). The legislation would make the cost of a retrofit to one's home much more agreeable. Currently the lack of consistent sustained rebates and lack of financing options are barriers to the creation of jobs in solar energy and energy efficiency/retrofitting. Companies also complain of the lack of a correctly trained work force. To address the problem, Good Company Associates has a partnership with the Texas Foundation for Innovative Communities to create a Green Jobs Business Council and Green Jobs Initiative (Good Company Associates 2010). They are also involved in the Green Corridor Collaborative along Interstate-35, which includes seven community colleges, eight workforce boards, and forty companies (e.g. Siemens, Dell, Dow Chemical, renewable energy designers, solar installers, geothermal installers, etc.; Lewin 2010). The collaborative is currently developing twelve course modules to green the existing curriculum for skilled trades and to be offered as continuing education for both incumbent workers and job seekers.

Clean-Energy Industries

General Background. Texas has about 800 companies that are affiliated with clean and or renewable energy and some manufacturing, especially near Austin (Texas Clean Energy Park 2010). Although Texas has many advantages, the state government has not shown the same levels of commitment that has been seen in other states to developing the manufacturing and innovation side of clean-energy jobs, perhaps because Texas remains dominated by the oil and gas industries. An alternative explanation offered by the Local Government Assistance and Economic Development (LGAED) division of the Texas Comptroller's office is that Texas has not invested in renewable energy technologies (i.e., solar panels) at the same levels as other states because it is interested in investing taxpayer dollars in projects that are commercially viable (Wood 2010).

In 2003 the state legislature passed SB 275, which called for an economic development strategy based on industrial clusters, including "manufactured energy systems." The Texas Enterprise Fund, billed as the largest "deal-closing" fund in the country, is used to recruit new businesses to the state and had an initial funding level of $295 million. In 2005 the state designated $200 million for the Texas Emerging Technology Fund (TETF), where the non-specific category of "energy" is one of six targeted industrial clusters. The others include advanced technologies and manufacturing, aerospace and defense, biotechnology and life sciences, information and computer technology, and petroleum refining and chemical products (HB 1765; Office of the Governor 2004). Each cluster had a team assigned to evaluate it, and in August 2005 the Texas Energy Industry Cluster Team published an evaluation of energy in Texas that stated there needs to be an increased "use of state incentives for emerging sources in [renewable and sustainable energy sources], in addition to the current efforts in wind energy [to] ...provide matching funds for a demonstration and testing facility for offshore wind energy generation; host a conference on renewable and sustainable energy similar to the Western Governors' Association Energy Conference held in Albuquerque; [increase] funding for research, as well as for commercialization... and promote research consortia within this sector"

(Billingsley et al 2005). Of the twenty-nine organizations making up the Texas Energy Industry Cluster Team (including the fossil-fuel industry, public colleges, and other organizations) that sent representatives to help make the report, Cielo Wind Power and Public Citizen Texas stand out as organizations that advocate renewable energy.

The TETF monies appear to have been disbursed to many high-tech industries and have not achieved the same level of concentrated "clean tech" support seen in other large states (University of Central Florida 2009). For example, our review in July, 2010, of the TETF website's case studies suggested the following: (1) many of the sixteen research superiority awards went to agriculture or medical biotechnology projects; (2) of the fifteen research matching awards, one went to the Texas A&M's Texas Agricultural Experiment Station in Pecos for algae-based biofuels, a second went to Lynntech, Inc in College Station for fuel-cell research; (3) of the seventy-nine commercialization awards, $1.5 million went to Solar Bridge in Austin for improved solar radiation harvesting technology in 2010, $250,000 went to ActaCell in Austin for lithium-ion batteries in 2009, $3.5 million went to 21st Century Silicon in Dallas for advanced solar panel manufacturing techniques in 2009, $750,000 went to Stellarray for flat panel radiation source technology in 2008, $250,000 went to Faradox Energy Storage in 2008, $250,000 went to Sunrise Ridge Algae in 2008, an unknown amount went to EQMA for ethyl alcohol production from industrial wastes, an unknown amount went to TXL Group in El Paso for waste-to-heat conversion, $250,000 went to Texas MicroPower (formerly called Texas Piezoelectric, Inc.) in Richardson for low energy harvesting, an unknown amount went to Xtreme Power in Kyle, Texas for advanced microgrid technology (Texas Emerging Technology Fund 2010). In summary, since 2005, our review of all of the awards listed on their website shows that the Texas Emerging Technology Fund has awarded at minimum a total of $6 million to two clean-energy research projects out of fifteen research projects listed and ten clean-energy commercialization projects out of seventy-nine commercialization projects listed (Texas Emerging Technology Fund 2010). Unfortunately, due to accounting errors, the TETF had to stop accepting applications, despite the fact that only $100 million has been disbursed by TETF out of the $203 million that was allocated to it by the legislature for the 2009-2011 budget (Lubbock Avalanche-Journal 2010; Power 2010). Texas has also attracted at least $716 million in private venture capital for clean tech from 2006 to 2008 (Lesser 2009). Some interesting start-up companies that have come out of University of Texas at Austin, including the fuel-cell research and development companies ActaCell and Graphene Energy, the biodiesel company Organic Fuels, and the solar company Inspired Solar (Lesser 2010).

Biofuels. Out of the many different types of biofuels, Texas may exhibit leadership in biodiesel. The state claims to be number one in biodiesel production with "22 plants capable of making 200 million gallons of the fuel each year" (Combs 2008) and "with [a total of] 30 production facilities, and 32 biodiesel distributors, from the Texas Panhandle to the Gulf Coast" (Biodiesel Coalition of Texas 2009). The biodiesel is primarily used by large city fleets in Dallas and Austin (Biodiesel Coalition of Texas 2009).

The large oil and natural gas cluster located in Texas is showing some signs of investment in biofuels. In addition to the investment of Exxon-Mobil in Synthetic Genomics in San Diego, the San Antonio-based Valero paid $477 million for VeraSun Energy, a South Dakota-based company that owns ethanol refineries (Ritch 2009). Conoco-Phillips entered into a

strategic partnership with Tyson Foods to make biodiesel (Childs 2007a), and it has also entered into a partnership with Iowa State University. The California-based company Chevron also has a biodiesel plant in Galveston, and it has launched a partnership with Texas A&M along with other universities (Georgia Tech, U. C. Davis, and the Colorado Center for Biorefining and Biofuels). In addition, there are strengths on algal biofuels research at the University of Texas at Austin, which has a $25 million grant to transform algal oil into jet fuel.

Although the considerable capital available from the oil industry could lead to a vibrant biofuels industry in Texas, to date the companies appear to be investing across the continent. In other words, Texas companies such as Exxon, Conoco-Phillips, and Valero have made major investments outside the state, and likewise companies with headquarters outside Texas such as Chevron have invested in the state. The potential to develop a concentrated biofuels industry in the state is therefore limited, and there is no proactive state government policy to encourage a cluster in this industry with investments in next-generation biofuels biotechnology. To the contrary, a decision in 2006 by the Texas Commission on Environmental Quality indicated that it would ban the 20 percent biodiesel blend because of its nitrous oxide emissions. Although a compromise was reached with the Biodiesel Coalition of Texas (2009), the decision put the industry on edge. Furthermore, Governor Rick Perry opposed the federal ethanol guidelines, because they resulted in an increase in corn prices that hurt the state's cattle ranchers (Wall Street Journal 2008). The Biodiesel Coalition of Texas emphasizes the use of soybean oil when describing biodiesel production (2009).

Geothermal. As of July 2010, "[t]here are already 20,000 megawatts [worth] of existing wells drilled which are suitable for geopressure facilities," and "this high-pressure hot water is the 'bane' of the oil industry" (Power 2010). Instead of the tapped water shooting a geyser 100 feet in the air, its heat is removed and the brackish, nonpotable water is replaced back into the disposal well with two fortunate results: (1) the same skill set for oil exploration is used for geothermal, with the implication that less re-training is required than other renewable energy sources; and (2) the recovered energy generation process gives a constant base load, with the implication that it can mitigate some of the unreliability of other renewable energy sources in a diverse portfolio (ibid.). Public Citizen Texas reports that a state auction leased 60,000 acres for geothermal production to Nevada-based Ormat Technologies and a Texas company called Geopower Texas (which specializes in geopressure and geothermal), which is raising funds (ibid. 2010).

Smart-Grid and Building Technologies. There is considerable potential for leadership in smart-grid technologies, and Austin Energy has been a pioneer in this area (see "City of Austin" below). The U.S. Department of Energy allocated $620 million dollars of ARRA funding to award thirty-two smart-grid demonstration projects nationally out of 135 applications (Kin 2009). "U.S. Energy Secretary Steven Chu […] said the projects chosen — which include large-scale energy storage, smart meters, transmission system monitoring devices and a range of other smart technologies — will serve as models for the deployment of smart-grid systems on a broader scale"(Hawkins 2009). The state of Texas has received three awards out of those thirty-two awarded, including $10.4 million (out of a total project cost of $24.7 million) to Austin Energy's Pecan Street Project (described further below), $3.5 million (out of a total project cost of $7.3 million) to Dallas-based Oncor's transmission line testing, and $13.5 million (out of a

total project cost of $27.4 million) to the Center for the Commercialization of Electric Technologies (a public-private association of twenty-one companies company and five universities that includes Austin Energy and is based in Austin) to figure out how to regulate fluctuations in power caused by the addition of wind power within an electric energy transmission grid based in Houston (Mottola 2006 ; Hawkins 2009; King 2009; Leffingwell 2010).

Legislation in 2005 (HB 2129) established the basis for the deployment of smart meters. By 2012 there will be five million smart meters installed in the state, a number that is second only to the estimate for California (Finney 2010). However, opportunities to develop manufacturing and research strengths for smart grid in the state have not been fully pursued. For example, when CenterPoint Energy of Houston announced a $613-639 million smart-meter project (with $200 million in funding coming from an award by the Department of Energy's $3.4 billion SmartGrid Investment Grant program), it contracted with eMeter of Silicon Valley, Itron of Seattle, and IBM of New York (Ritch 2009). Without a concentrated state-government program dedicated to developing an in-state smart-grid industry, green jobs in this field will likely be in the installation and maintenance side of the industry rather than in manufacturing, software, and technology development. Although the state government has not provided the leadership, Austin Energy's leadership and connections with the state's information technology industry may create opportunities for a Texas-based manufacturing and software industry in smart-grid technologies.

Texas has a natural advantage for leadership in smart-grid technologies because the state has its own grid. The Electric Reliability Council of Texas (ERCOT) manages the Texan Interconnection, which is not well connected to the Eastern Interconnection or the Western Interconnection of the U.S. (hence New Mexico's aspirations to connect the three). However, the state government has focused more on internal transmission issues that its potential as an engine of innovation for smart-grid technologies. Within the current Texan Interconnection, the isolated areas of the panhandle and the southwest (which are known for their high wind speeds and intense solar radiation) are not well connected to the urban centers of the state. This is changing with the creation of the Competitive Renewable Energy Zones (CREZs), which are primarily focused on analyzing and approving wind power projects and transmission lines in central Texas (Combs 2008). The state has already identified $5 billion dollars in new transmission lines, in a commitment to bring power to the market (Wood 2010). The creation of CREZs is a long-term process; this first stage took over two years (Taylor 2010). The transmission lines will serve wind farms already in the western part of Texas and possibly solar farms (Wood 2010). With the multiplier effect, it is possible that "an economic benefit of $30.6 billion will be created, along with an additional 41,000 jobs for the State" (Sharp 2010).

Solar. Texas has the one of the highest levels of solar energy radiation in the U.S. (ranked with the top seven, including Arizona, New Mexico, Utah, Nevada, Colorado and California). At the local level there is considerable support for distributed solar energy. For example, both Austin and San Antonio have public electricity utilities and were named Solar America cities by the U.S. Department of Energy. However, Texas lacks a developed solar industry cluster of manufacturing, state government initiatives, and large, university-based research centers. In 2009 the state legislature missed an opportunity to jump-start the solar

industry when it defeated a bill that would have allowed $500 million in solar energy rebates (Gold 2009). The rebates are necessary because "the cost of solar amortizes the entire cost of fuel that a regular plant would bill" in comparison to building a traditional fossil fuel plant where the fuels are not taxed, just the installation (Power 2010).

By combining solar energy with other forms of renewable energy, it is possible to overcome some of the intermittency problems. The peak load tends to lag the solar peak by a couple of hours; solar peak dies at 4pm. However, because the sun sets later in west Texas than the eastern portion of the state, placing concentrating solar wind farms in west Texas will help cover the load peak in east Texas (Power 2010). With wind farms in the west being most active at night, solar active in the morning, and coastal wind farms late in the day, then having diversity in renewable resources helps with load coverage. Public Citizen Texas has been suggesting this type of strategy for years (Power 2010).

Although there are some manufacturing companies (including HelioVolt in Austin), much of the Texas solar industry involves installation. The University of Texas did receive two of the large Energy Frontier Research Center grants from the U.S. Department of Energy (2009) and another award for photovoltaic research. The company Inspired Solar, a spin-off from the University of Texas, is developing solar tracking systems.

Transportation and Energy Storage. In Texas there are some beginnings of a fuel-cell industry. While Texas is the second highest producer of hydrogen in the U.S. and has significant hydrogen transportation infrastructure, it lags behind California, New York, and other states in terms of investments for research and development (Combs 2008). Texas' biggest claim is that "the inventor of the lithium-ion battery, John Goodenough, is a professor of mechanical engineering at UT" (Lesser 2010). There are two interesting spin-offs from the University of Texas. ActaCell is developing the "next generation high-power lithium ion batteries for motive applications," and Graphene Energy produces "nanotechnology based Ultracapacitors for energy storage" (Actacell, Inc 2009, Graphene Energy Inc 2009). There is other initial stage research going on at Texas A&M University and Rice University on ionic fluids and graphene, and there is limited research on energy storage. More research in this area is necessary because storage helps counter industry bias against unreliability of renewable energy generation (Power 2010; Public Citizen Texas 2010).

Wind. As of May 21, 2010, approximately 10,000 jobs in the state are related to wind energy (Sharp 2010). As of 2007, Texas: (1) produces the most wind power of any state in the U.S., even though it is ranked second behind North Dakota in terms of potential wind capacity (Combs 2008; U.S. Energy Information Administration 2010); (2) has the distinction of being the first state to install one gigawatt of wind in a year; and (3) has the largest wind power installation in the world, the Horse Hollow Wind Energy Center's 736-megawatt facility (U.S. Energy Information Administration 2010). In March 2008, the nonprofit Coastal Habitat Alliance attempted to block the construction of the 202-megawatt off-shore wind farm Peñascal Wind Power project, which successfully started operating in May 2009 (Combs 2008; Goldenberg 2009). In September 2009, Iberdrola received a $114 million stimulus grant to expand this coastal wind project (Power 2010; Michaels 2009). Within Texas the growth of electricity produced by wind has surpassed that of the growth of electricity produced by other

renewable energy and fossil fuels (Combs 2008). This has been driven in part by deliberate minimal state oversight; wind installations must follow federal and local regulations, but there are few state regulations (Combs 2008). Furthermore tax incentives such as school property-tax breaks "have been widely credited by the wind folks as a catalyst for wind development" (Wood 2010**)**. In west Texas there is a low population density and hence a low tax base; students previously often had at least a two-hour bus ride to school. Now the average tax is $4000 per year per turbine, and "apparently the cows don't mind wind turbines at all," so while wind turbines do get a tax break, they generally still pay a substantial school tax (Power 2010).

As of May, 2009, Texas, Colorado, and Arizona were the only states that have a line extension analysis policy, where new rural locations requiring connection to the electric grid are analyzed to determine if an on-site renewable energy generation system will be cheaper than extending a transmission line (Doris, McLaren, Healey, and Hockett 2009). A proposed $10 billion wind farm that would have been rated at 4000 megawatts (almost doubling Texas' 2007 wind production capacity) has been delayed and cites the lack of transmission lines to western Texas (Pilkington 2008; Souder 2009).

There is some wind manufacturing in the state, such as Trinity Industries, Wind Clean, and TECO-Westinghouse (Combs 2008). There are wind-energy research groups at the University of Texas, Texas Tech University, and West Texas A&M University, so some of the crucial elements of a successful regional innovation system are in place. However, it appears that the state government has invested minimally in wind energy research and development, instead relying on a deregulated investment environment, tax breaks for installers and consumers of renewable energy, and, the federal production tax credit to drive the industry growth (Combs 2008; State Energy Conservation Office n.d). That may be changing; in 2010 Texas Tech University announced a new public-private research consortium that will focus on wind energy, the National Institute for Renewable Energy (NIRE) (Cranford 2010). Because "the National Renewable Energy Laboratory estimates that six to ten permanent operations and maintenance jobs are created for every 100 megawatts of installed wind capacity" (Combs 2008), it may be that continued growth in this method of electricity production will produce a new energy industry for Texas, as it appears to have done in the town of Sweetwater (Pilkington 2008). An alternative explanation for Sweetwater's success is less a fascination with wind, and more a commonsensical attitude to diversify businesses in the small town economy and therefore increase their ability to weather economic recessions and the typical ups and downs of a fossil fuel economy. This may be why former trucking and rail companies convert some or all of their business to wind power (Taylor 2010). For example, the town of Brownwood had a machine shop that became involved with the wind industry and has grown, possibly indicating that a skilled workforce is more necessary than an incentive package for clean-energy companies to relocate to Texas towns (Wood 2010).

Austin

Sustainability Plans. The capital of Texas and home of the University of Texas has developed a reputation for its software and semiconductor industry, but it also has ambitions to become a clean-tech center. The community in Austin is considered to be environmentally

conscious, and those values are reflected in the city's public utility, Austin Energy (Beceiro 2010). The public power organization has a national reputation as a leader in green electricity. Its innovative Green Choice program resells wind power directly to the customer through a long-term fixed-price contract. The standard rate is 3.5 cents per kilowatt-hour to 4cents per kilowatt-hour, which is locked in for ten to fifteen years (Beceiro 2010).

The dividends from the utility are about $100 million each year and are paid into the city's general fund (Leffingwell 2010); it is the largest contributor to the city budget. Austin Energy has exhibited leadership in programs that facilitated energy-efficiency improvements, solar panels, and smart grid.

In 2007 the city launched its Climate Protection Plan to reduce greenhouse gas emissions. It has five sub plans: a municipal plan, utility plan, homes and buildings plan, community plan, and "going neutral" plan. The municipal plan involves both making the facilities use renewable energy and making the city vehicle fleet carbon neutral by 2012. The utility plan governs Austin Energy's renewable-energy portfolio. The city's public utility has had a renewable-energy portfolio standard since 1999, and in 2010 the city increased its renewable-energy portfolio requirements to 30 percent by 2020 with 100 megawatts of solar and 700 megawatts conserved through energy efficiency (Austin Smart Energy 2010, Beceiro 2010). In 2010 the renewable portfolio standard was increased to 35 percent by 2020, and the energy-efficiency portfolio standard to 15 percent by 2020 with a set-aside of 200 megawatts for solar. In order to fulfill its renewable-energy portfolio goals, in 2008 Austin Energy was interested in building both 100 megawatts of solar capacity via a solar farm on land that the city owns as well as within parking lots, and also in creating a biomass plant in East Texas and a 600-megawatt wind farm (Mottola 2008). As part of the "going neutral" plan, Austin Energy offers a carbon calculator tool and carbon return on investment matrix for residential and commercial users to take advantage of (Duncan 2007). Austin Energy will reduce its carbon dioxide output by purchasing carbon offsets. The utility is also currently debating the Generation Plan, which lays out a plan for "reducing Austin Energy's carbon emissions by 20 percent, from 2005 levels, by 2020" (Leffingwell 2010). The Austin City Council also wants to create a plan to reduce carbon dioxide emissions, generate energy in a way that is carbon neutral, and to save 700 megawatts through energy efficiency and load-shifting (Austin Smart Energy 2010).

In 2010 Mayor Lee Leffingwell pointed in out in his state of the city address that Austin is one of the most congested large cities in the U.S., especially Interstate 35. He called for a November transportation bond election, which would potentially include new and repaired roads, sidewalks, bike lanes, and urban rail and could potentially add to (or at least maintain) the economic strength of Austin's downtown (Leffingwell 2010). The newly created transportation department has just issued a list of 3000 mobility projects and is continuing to develop the Strategic Mobility Plan, with sustainability as one component (City of Austin - Austin Strategic Mobility Plan 2010). The 200 participants gave pretty consistent positive feedback in regards to social justice, multi-modal and environmental goals of the comprehensive development plan (Austin City Connection 2010).

Green-Building and Smart-Grid Initiatives. The city has had a green building program since the 1980s. It began using green technologies in its municipal buildings in 1993 and

mandated that all municipal buildings be LEED Silver certified in 2000 (Austin Energy 2010a). A best practices development in Austin is the city's Energy Conservation Audit and Disclosure Ordinance, which requires homeowners to have an energy audit completed before the sale of a home. Likewise, owners of a commercial building that receives energy from Austin Energy must receive an energy rating. Under Austin's Climate Protection Plan, the city's buildings will all be powered by renewable energy by 2020 (City of Austin 2007). Furthermore, new single-family homes after 2015 will be "zero-energy," that is they will be required to produce as much energy as they consumer and use on-site renewable energy generation by (Leffingwell 2010). All other new buildings will need to be 75 percent more efficient by 2015. Austin Energy offers a wide variety of energy-efficiency and weatherization programs, including rebates for solar energy and energy-efficiency improvements and free home energy improvements for low- and moderate-income customers (Austin Energy 2010b). Austin Energy, unlike the state of Texas, has a feed-in tariff program, where the utility pays for energy generated by the customer. These policies have spurred the growth of renewable energy industry in Austin (Beceiro 2010). Austin Energy also spent $3.3 million out of $4.5 million for the 2010 fiscal year before informing solar installers that they were out of money; it then restructured the program to stretch the remaining million (Ankrum 2009).

In 2008 Austin Energy has also joined the city government, the University of Texas, Austin Technology Incubator, Greater Austin Chamber of Commerce, Environmental Defense, and nearly a dozen companies (including Dell, IBM, Oracle, Cisco, Applied Materials, GE, Intel and Microsoft) to form the Pecan Street Project. The Pecan Street Project is a nonprofit corporation dedicated to enhancing the city's position as a leader in the smart-grid industry by allowing startup companies to test their smart-grid technologies 'live' while Austin Energy figures out the smart-grid business model (Gregor 2008).

> The Pecan Street summary depicts a fictional resident [...] monitoring her electricity and water usage from her mobile phone, while her rooftop solar panels feed juice to the 'Energy Internet' and her 'home energy gateway system' adjusts appliances, monitors and adjusts sprinkler performance, and even shuts off a leaking toilet. The DOE grant will help buy a 'demonstration project' to 'create, operate, and evaluate' an Internet-style smart grid, according to the summary, that will involve 200 in-home smart-grid water systems, 200 smart sprinkler systems, and 1,000 residential and 75 commercial meters, distributed to neighborhood volunteers (King 2009).

Whereas other smart-grid projects are using U.S. Department of Energy grants to make improvements to infrastructure (i.e. smart meter installation), Austin Energy was already ahead of most utilities when stimulus funding became available (Rowan 2010). For example, by 2009 Austin Energy had already paid for and installed smart-grid meters in most of the city's buildings. As a result, the Pecan Street Project is not simply a technology deployment project; instead it is the next level, or, "Smart Grid 2.0" (Rowan 2010). The Pecan Street Project is a unique type of smart-grid project because of the Texas Interconnection, which allows the testing of innovative technologies with great speed and flexibility; the collaborative nature of the project, which is comprehensive and community-driven, including a publically owned utility, government agencies, and civil society organizations as well as businesses; its emphasis on integration, which must include, for example, water infrastructure (as the water utility is the

largest user of municipal energy for treating and moving water) as well as the efficiency of irrigation systems; and the fact that the project results will be "open-source from the get-go," published and available for anyone to learn from including other private or public utilities and environmental conservation organizations (Rowan 2010). The Pecan Street Project shares an interest in the behavior of energy consumers with other smart-grid projects (i.e. Xcel Energy's smart grid city Boulder, Colorado) and advocates that a Center of Excellence for Energy Use Behavior is necessary (Rowan 2010).

Changing people's behavior is difficult; it is especially hard to change private industry such as an investor-owned utility, which is likely to be protective of its business model because it provides reliable revenue and keeps their stock price up. In contrast, a publicly owned utility can conduct itself in a way that is consistent with the population it serves (Rowan 2010). In Austin, there is pressure on the utility to "do the right thing." Colin Rowan of the Pecan Street Project stated, "What we're trying to figure out is how do we reinvent the business model of the utility so that utilities and city councils and state governments can get on the same side of the incentives equation in figuring out how we can build a more robust energy system that is just as reliable, cleaner, affordable, but that uses less energy from fossil fuel sources, and makes us less dependent on burning stuff" (2010). To that effect they published a report in March, 2009, that "has thirty-seven recommendations for the region to lead in this area; five or six are being addressed at this time via the demonstration project at Mueller"(Rowan 2010). Rowan does not think it is necessary to leverage the financial resources of oil and gas companies who work on a traditional business model. Instead, he points out that the energy industry is actually two industries: electricity and transportation. With the move away from fossil fuels toward renewable energy, there is a concomitant move away from the traditional energy business model to the telecommunications-based business model. Rowan believes that "[i]n the same way that the telecom industry spends on front-end capital (one time) and it depreciates, the smart grid...is going to rely less on fuel and more on technology deployment. With Austin a hotbed of the semiconductor industry, AT&T headquartered in Dallas, Dell in Austin, Compaq in Houston, and a telecom corridor from Dallas through Austin down to San Antonio and into Houston...Austin is well positioned to play a prominent role. It's been doing it with internet companies for fifteen years and with mainframes and semiconductors before that" (2010). The city also has a good testing facility, Drumond Laboratories, that is involved in the Pacific Northwest smart-grid project.

Green Jobs Training. Although the city government does not directly manage green job training programs, it has partnered with a prominent nonprofit organization that does. American Youth Works was founded in 1976 to help youth and adults who had dropped out of high school to get job training. In partnership with the City of Austin and the federal government, the organization has run two green jobs programs since the mid-1990s: Casa Verde Builders, a green building training program, and Environmental Corps, a parks and public lands preservation program that was founded. In 2009 the organization won a $750,000 grant from the U.S. Department of Commerce to launch a Green Jobs Training Center. Austin Community College also received grants to start up weatherization and solar energy training programs. In 2009 the Chamber of Commerce launched the Green Job Task Force to coordinate job training (Austin Chamber of Commerce 2009). See also the discussion above at the state level.

Green Business Initiatives. In 2007 the city's Chamber of Commerce announced a five-year economic development plan that included clean energy as a crucial cluster. In February of 2010, Mayor Leffingwell stated, "Renewable energy, creative media, and medical technology—[t]hese industries are the future of Austin's economy"(Leffingwell 2010). There are over thirty-five independent solar installers in Austin (Beceiro 2010). The clean technology incubator is part of the Austin Technology Incubator at the University of Texas at Austin. It assists start up companies focused on clean energy, with resources from angel networks, venture capital firms, and practical skills such as how to put together and execute business plans. It also has a partnership with Austin Energy to beta test technology; Austin Energy provides grants to incubator businesses.

In 2009 the Chamber of Commerce's Clean Energy Council announced that the leading industry association, the Clean Technology and Sustainable Industries Association, would move its global headquarters from Massachusetts to Austin. The University of Texas, which is located in the city, also has a Center for the Commercialization of Clean Technologies. The Texas Workforce Commission, Austin Energy, and University of Texas also supported the creation of the Texas Clean Energy Park, which attracted the solar manufacturer HelioVolt (Fitzgerald 2009). HelioVolt will manufacture solar panels and create 150 jobs (Austin Chamber of Commerce 2008).

Unfortunately, Austin is not seeing the hoped for development of a large-scale solar-energy industry. To date, HelioVolt is the only company in the Austin area producing solar panels (Beceiro 2010). Most of the solar-energy employment growth has been in system design and installation. This is not trivial but only provides a couple of thousand jobs (Fitzgerald 2009). Joan Fitzgerald, who studies green economic development policies, adds that one company explained that New Mexico and New York were offering "more attractive financial packages" and that the city has lost some companies due to interstate competition (Fitzgerald 2010: 54).

Any development plan must keep in mind the specific makeup of this large city where "90 percent of companies in Austin have fewer than ten employees, and about 75 percent of all Austin jobs are with companies that employ fewer than 100 people," indicating the importance of small businesses to the economy of the city (Leffingwell 2010). Austin Energy is well aware of this, with three newsletters that target**:** (1) residents, (2) environmentalists and (3) small businesses.

City Society Organizations and Policy

The Center for the Commercialization of Electric Technology in Austin has been criticized by the Texas Ratepayers' Organization to Save Energy as being industry-oriented and not particularly concerned with energy efficiency (despite its interest in smart meters/grids as more efficient; Mottola 2006). In particular, the Texas Ratepayers' Organization to Save Energy, which represents low-income consumers, is not a fan of smart-metering which has the potential to increase the price of electricity during periods of high demand, regardless of a person's ability to pay. The executive director, Carol Biedrzycki, is more interested in building

weatherization, energy-efficient appliances, and stricter building codes as methods of managing demand on the electric grid (Mottola 2006).

The Clean AIR Force of Central Texas is a nonprofit organization founded in 1993 that in the past has been involved in clean air research, creating and distributing educational materials about air quality and reducing ozone in Austin and other areas of central Texas (Clean AIR Force of Central Texas 2010).

Public Citizen was started by Ralph Nader in the 1970s and has an office in Washington, D.C., and Texas. In the Austin office, Public Citizen Texas works on policy, spending a lot of time meeting with legislators on changes to bills, tweaking bills and encouraging legislators to file them earlier. On average it takes three sessions to get a bill passed, the first to get everyone familiar with the bill's content, the second to determine who is for and who is in opposition to it and work out compromises and the third session to get the bill actually passed (Power 2010). There are exceptions of course, for example, "we actually found sponsors for our Green Fees bill (HB 3353 & SB 2182), which allows students of any university that votes for it to impose a fee at their campuses to green the campus. Much to our surprise this sailed right through; it was approved at five universities, and each campus has its own fund and has a group of students that evaluate projects and choose what will happen on their campus" (Power 2010). Public Citizen Texas finds that in general, "the perception is still perpetuated that renewables are too expensive; that is something that we have to overcome" (Power 2010). Public Citizen Texas was involved in the two-year process with Austin Energy that created the Generation Plan (Power 2010). They work on supporting PACE legislation, tracking the stimulus dollars as well as other funds the federal government has for renewables, promoting energy storage for wind power, and educating utilities and public cooperatives about clean energy (Power 2010; Public Citizen 2010). They find that they are fighting a three-pronged opposition: (1) traditional energy companies have figured out that renewable energy helps moderate the cost of electricity; (2) large commercial customers do not want to see additions to their utility bills (even though state ordinances exempt them); and (3) some customers do not like the bill impacts (the incentives do not pay for themselves; Power 2010).

Additional References

For some of the best references, please peruse the state of Texas energy report produced under Susan Combs, the state comptroller, in 2008 for a very thorough breakdown of energy production and consumption by energy type (http://www.window.state.tx.us/specialrpt/energy/). The City of Austin (http://www.ci.austin.tx.us) and the Austin Chamber of Commerce's (http://www.austin-chamber.org) websites were useful in providing information about the city's current clean-energy plans and industry. The U.S. Department of Energy website provided useful statistics (http://www.eia.doe.gov/).

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