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An Applied Local Sustainable Energy Model

The Case of Austin, Texas

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Climate change is only one factor driving growing numbers of cities throughout the globe to reconsider conventional approaches to electricity generation and use. In the U.S., this momentum is incorporating a shift away from centralized, supply-side approaches reliant on fossil fuels and nuclear power, toward more distributed, flexible, and cleaner energy systems. In this regard, such systems entail elements of the emerging Sustainable Energy Utility (SEU) model enacted by the U.S. state of Delaware in 2007. The potential value of this model can be explored by examining those locales where elements of energy service compatible with an SEU have currently been adopted and implemented. This paper looks to one such community, Austin, Texas, to assess its utilization of an alternative energy pathway and the outcomes observed to date. Considered here are the technical, economic, and environmental dimensions of change, as well as the social dynamics accompanying new imperatives for energy development.

Keywords: *electricity; distributed generation; municipal utility; sustainable energy; renewable energy; communities*

A host of issues over the last decade have contributed to increasing social dissatisfaction with conventional energy systems, as linked to centralized power plants reliant on fossil fuels and nuclear resources and increasingly integrated transmission and distribution infrastructure. Negative impacts include the system's contributions to smog, acid rain, long-lived radioactive waste, respiratory and heart disease, cancer, and the generation of greenhouse gases linked to the emerging de-stabilization of earth's climate (Intergovernmental Panel on Climate Change [IPCC], 2001, 2007). Also noted are the technical vulnerabilities and risks of an increasingly integrated grid, where infrastructure may fail at any one point due to age, stress, accidents, or sabotage, but subsequently impact populations over much wider regions. For example, a blackout in August 2003 caused 50 million people in Canada and the northeast U.S. to experience electric service disruptions. The blackout, which resulted in economic losses of at least $4.5 billion, was triggered initially by a fallen tree (Sawin & Hughes, 2007, citing Electricity Consumers Resource Council, 2004).

Also problematic for consumers are the rising or fluctuating costs of energy, seen in the volatility of electricity markets in certain parts of the U.S. For example, in California, where a competitive electricity market opened in 1998, wholesale prices per megawatt hour (MWh) – by December 2000 – were 11 times above the average clearing price registered the previous year in December 1999. Some parts of the state faced rolling blackouts, while retail power prices in southern California hit a historical peak (Energy Information Administration, 2005; Beck, 2002; Block, 2001). Also illustrating the issue of rising energy prices has been the dramatic run-up in recent years in the price of oil, which hit an all-time high of $147 per barrel in July 2008 (Hopkins, 2008). While this trend is explained in part by rising demand in growing economies such as China and India, it has also been suggested that oil price spikes may be linked to investors moving funds into oil as a means to hedge against the decline in the value of the U.S. dollar (Brown, Virmani, & Alm, 2008). Adding to concerns about the affordability of energy has been

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increasing unease, within the U.S., regarding domestic reliance on foreign energy sources and the loss of local energy dollars to outside regions and markets. The economic impact of this outward flow of local revenue can translate to a lost opportunity for re-investment in community-based programs, services and infrastructure (Roseland, 2005).

Meanwhile, the increasing complexity of energy markets in the U.S. – which may encompass participation or oversight from local, state, and national government agencies and offices, as well as public and private utilities – has been implicated in the loss of community control with regard to influencing the types of resources, technologies, and strategies utilized to provide energy service to local populations (Byrne & Mun, 2003).

Together, these various challenges have encouraged increasing interest within the U.S. for altered models of energy service, entailing new technological, environmental, and economic approaches to meeting social needs. Elements of this altered approach are explored below, with particular attention to an emerging model in Delaware, the Sustainable Energy Utility (SEU).

An Emerging Alternative for Energy Service: The Sustainable Energy Utility

In response to observed shortcomings in conventional energy systems, some populations are demonstrating their desire for a new type of energy development model, one that can provide advanced services fitting the needs of a range of users, but in ways that lessen the environmental pollution, economic volatility, and technological lock-in associated with 20th century energy development.

Emergent models incorporate a much greater role for applications and service configurations that are small-scale, distributed, demand-sided, modular, and reliant on renewable resources, with overall energy demand lessened through conservation. Technologically, such applications are desirable due to their flexibility, adaptability, and reduced risk in the sense of their capacity for large-scale catastrophic accidents. Meanwhile, a greater reliance on renewable resources aims for improved consistency in energy prices, in that fuels such as wind, solar, geothermal and biomass tend to be abundant – to relative degrees – across a range of locales, in contrast to the indigenous availability of coal or natural gas. A reliance on renewables also speaks to their value in reducing energy sector contributions to the generation of harmful or toxic pollutants and the release of CO_2 emissions (Sawin & Hughes, 2007).

New models for energy service have additionally been linked to the achievement of broader social goals, such as economic development and the creation of high wage jobs, greater community security against larger market forces, and new capacity for citizen involvement in determining appropriate energy development pathways. Action here suggests that a type of dichotomy is emerging, between the dominant form of energy development as observed in the U.S. during most of the 20th century, and new post-2000 emerging forms of energy service provision (Hughes, 2008). The latter may thus be depicted as incorporating three primary elements for new priorities in energy use that may serve to distinguish its value compared with pre-existing, conventional systems. The first element, ecological protection, speaks to the need for energy systems to eventually shift to the majority use of resources that are non-depletable. Such resources should also lack environmental impacts (to include the release of greenhouse gas emissions) that exceed the absorptive capacity of the earth's atmosphere (Byrne, Wang, Lee, & Kim, 1998; IPCC, 2007). The second element, democratic participation, points to the imperative for populations to have a voice in affecting energy-related decisions that will directly impact their health, livelihoods, and well-being (Prayas Energy Group, 2001; Ranney, 2003; Rast, 1999; Warren et al., 1992). The third, equity, calls for energy-related outcomes that yield substantial benefits across groups, where new services, programs, and opportunities thereof are accessed more evenly by given populations (Agyeman & Evans, 2004; Byrne, Glover, & Martinez, 2002).

The practical aspects of these paradigmatic elements related to energy change are reflected in the Sustainable Energy Utility (SEU) model established by the State of Delaware through legislation passed in 2007. Drawing upon innovations in energy service delivery in states such as Massachusetts, Vermont, and New Jersey, the SEU's mission is to reduce overall energy consumption and to encourage reliance on cleaner energy sources. Rather than limiting its applicability to certain energy services, the SEU applies to lighting, heating and cooling in buildings, as well as transport. It targets all fuels and sectors, through conservation, energy efficiency, and customer-sited renewable energy, with the goal of financial self-sufficiency (Byrne, 2007; Sustainable Energy Utility Task Force, 2007).

Key priorities under the SEU entail the affordability of programs and their comprehensiveness in reach, allowing for the participation of all customers to include residential and commercial energy users. In essence, the SEU provides "one-stop shopping" (McDowell, 2007) for customers who may seek diverse strategies for reduced, cleaner, less expensive, and more reliable energy service, as well as funding and other resources by which to implement these strategies. It thereby stands in contrast to many traditional energy delivery scenarios, where customers may simply utilize energy as provided by utilities or seek out their own preferences through interactions with energy service companies, consulting firms, contractors, equipment distributors, and other entities. Under the SEU, customer-sided improvements are prioritized, rather than supply-side solutions, opening the door to a range of diverse technologies, applications, resources, and configurations. In this way, the SEU serves as a next-wave development for the "evolution" of energy service provision (Sustainable Energy Utility Task Force, 2007; McDowell, 2007).

Models comparable to an SEU approach have been manifested in a number of places in recent years, to include cities. Localities are acting to alter energy systems for a range of reasons, often specific to particular community imperatives. But, however varied their approaches, local efforts represent a type of response to perceived inaction at larger levels of government in addressing environmental and economic concerns associated with conventional energy. Included here is the lack of a national-level mandatory commitment to greenhouse gas reduction in the U.S. Meanwhile, even where U.S. states have enacted greenhouse gas reduction commitments as well as policies for energy efficiency and renewable energy development, which may in time yield substantial benefits in CO_2 reduction[i] (see Byrne, Hughes, Rickerson, & Kurdgelashvili, 2007), some cities have taken on even more aggressive targets. Along the way, these communities are revealing how altered models of energy service may redress existing environmental and economic problems and even contribute to new opportunities for revitalized urban development. This trend, with attention to the case of Austin, Texas, is examined below.

Local Energy Change: U.S. Trends and the Case of Austin, Texas

Amid fluctuations in energy prices and concerns for climate change, cities have pursued their own specific actions to alter the fuel source content for local electricity supply, to reduce the overall amount of energy utilized, and to do so in ways that achieve a host of improvements specific to the community. To aid cities in this endeavor, a number of supportive initiatives have arisen in the last two decades (Byrne, Kurdgelashvili, & Hughes, 2008; Sawin & Hughes, 2007).

One such framework is ICLEI-Local Governments for Sustainability (ICLEI, 2008), established in 1990. Its members include local governments representing almost 1,000 cities throughout the globe, to include 400 U.S. cities. They receive training, software, publications, and other assistance from ICLEI in devising and implementing practical strategies for greenhouse gas reduction. Meanwhile, the U.S. Mayors Climate Protection Agreement, launched February 16, 2005 by Seattle Mayor Greg Nickels, encourages U.S. cities to meet or beat the greenhouse gas reduction goals embedded in the Kyoto Protocol. With some 880 mayors as signatories by October 2008, the Agreement also encourages cities to push for state and national action to reduce greenhouse gas emissions (City of Seattle, 2008). A more recent effort, the Clinton Global Initiative (2008), founded by former U.S. President Bill Clinton in 2005, promotes collaborative strategies to address energy and climate change, alongside education, global health, and poverty reduction.

Another framework, the International Solar Cities Initiative (ISCI, 2005), pushes city members throughout the globe to adopt ambitious targets for greenhouse gas reductions to bring local per capita emissions toward 3.3 tons CO_2-equivalent per person, each year. This standard, devised by Byrne et al. (1998), referenced the need for greenhouse gas emission stabilization levels in 2050 as calculated by the IPCC to support avoidance of the worst scenarios of climate change. The 3.3 goal was based on a 60% reduction in CO_2 emissions to match global carbon sink capacity, with the volume of allowable emissions divided by 1989 world population of 5.2 billion.

One city that has acted to alter its fuel source content, its level of energy usage, and its greenhouse gas emissions is Austin, Texas. Located in the central portion of Texas, with a population of 718,900, Austin's dominant industries are government (the city is the state capital), academia, high-tech manufacturing, and information and software services. With temperate winters and very warm summers, the city claims almost 300 sunny days annually. The mean temperature is 85.3°F (29.6°C) (Austin Convention and Visitors Bureau, 2008).

The city, surrounding Travis County, and a part of nearby Williamson County – comprising a customer base of 388,000 and a population of some 900,000 – receive electric service from Austin Energy, a community-owned utility and the ninth biggest such utility in the country. Austin Energy is officially a municipal department within the City of Austin (Austin Energy, 2008a).

The municipal government of Austin, by 1996, had established two sets of goals for community CO_2 reductions by 2010, applicable but not limited to electricity generation and use. Based on a business-as-usual projection of 16.7 million tons CO_2 released by Austin in 2010, a "goal scenario" sought reductions of 9 million tons CO_2 that year, some 20% below the 1990 level. A smaller "aggressive scenario" sought a 10% reduction of 4.5 million tons by 2010 (City of Austin, 1997: Austin Energy, 2004a).

Austin's CO_2 targets were complemented by a 1999 city council decision to create a renewable portfolio standard (RPS), through which 5% of community electricity was to come from renewable sources by 2005 (Austin City Council, 1999). A new policy, enacted in 2003, increased the RPS, with renewable resources and energy efficiency to meet 20% and 15%, respectively, of 2020 energy demand. The renewable energy goal included 100 MW of local solar energy by 2020 (City of Austin, 2003). Renewable energy targets were later increased again in 2007, with the city's new Climate Protection Plan (City of Austin, 2007). Goals for 2020 now include the following: using renewable sources for 30% of total energy demand; making all municipal facilities and fleets carbon-neutral; and avoiding the need for 700 MW through conservation and energy efficiency. By 2012, all municipal facilities are to run on renewable energy. New single-family residences by 2015 should be "zero net-energy capable," with a 75% jump in energy efficiency for all remaining new buildings (City of Austin, 2007: 2). For existing homes, energy efficiency improvements will be required at the point of resale. More ambitious action to lower community CO_2 emissions will target landscapes, land use planning, waste management, transportation, and emerging technologies, supported by new educational initiatives.

To achieve these targets, the city has utilized several strategies. Austin Energy encourages local customer participation in its green power purchasing program, GreenChoice®, which commenced in 2001 (Austin Energy, 2005a). To support solar energy development, Austin Energy offers rebates of $4.50 per watt for residential and commercial installations of solar PV and rebates of $1,500 to $2,000 for solar water heaters (Austin Energy, 2008b). Utility net metering on solar systems credits customer bills in exchange for the net electricity flowing into the grid multiplied by the existing fuel charge (Austin Energy, 2008c).

Austin's goals for energy efficiency and conservation are supported by a range of initiatives. A June 2000 city council resolution established the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED™) Silver Rating as the minimum standard for all municipal construction. Austin Energy's trailblazing Green Building program – the first of its kind in the U.S. – operates along several dimensions, from energy and water use to the embedded efficiency of construction materials. Major funding has come from Austin Energy and the local water utility, with expenditures rationalized through benefits in decreased peak load and water use. Its rating systems provide performance-based guidance to builders, while public education and marketing promote local demand for energy efficient homes and commercial structures (Austin Energy, 2008a; U.S. Conference of Mayors, 2001).

For new and existing commercial structures, the program partners with engineers and designers to reduce building operating costs, achieve better indoor air quality, and enhance employee productivity. For multi-family housing, the program works with building professionals to achieve structures that are low maintenance, durable, and effective in cutting energy costs for residents. Education, consulting, audits, rebates, and low- and zero-interest loans are used to identify changes offering the greatest potential savings and to cover certain upfront costs for improvements (Austin Energy, 2008d). Free weatherization is offered to low-income residents, senior citizens, individuals with disabilities, and homeowners with properties appraised below $150,000. Renters may also be eligible. Services include attic insulation, ductwork repair and caulking, weather stripping, and solar screen installation. The utility works with commercial lenders to offer a range of low-interest loan products for larger-scale customer-sided energy improvements to residential properties (Austin Energy, 2008e).

Through the Power Saver™ Program, Austin Energy contacts residential volunteers during the hot summer months, when electricity demand peaks, and asks them to curtail their power usage. The utility assists local commercial and industrial firms in voluntarily reducing energy use through changes in outdoor lighting, infrastructure leasing, and onsite energy systems for thermal energy storage, distributed generation, and district cooling (Austin Energy, 2007a). In the larger community, Austin Energy supports rebates for the installation of energy-saving technologies, as sometimes funded by grants obtained from the Public Utility Commission of Texas (Austin Energy, 2003a, 2008f).

Alongside specific efforts for cleaner and more efficient energy use, Austin has pursued a policy framework for an alternative energy pathway that goes beyond CO_2 reduction alone. This is evident in the technical, economic, transport-linked, and community-oriented dimensions to Austin's approach. With regard to technology, Austin is pursuing smart grid development (Burkhalter, 2008) and seeks to become an "urban laboratory" for ancillary energy services related to on-site generation and other forms of distributed power, through investigation of fuel cells, micro-turbines, flywheels, and thermal storage (Austin Energy, 2001a, 2002). For example, the city has partnered with the U.S. Department of Defense and the U.S. Department of Energy to install the first local fuel cell technology to power the Texas grid (U.S. Environmental Protection Agency, 2008), and to test a prototype utilizing waste heat from a natural gas-driven generator as the only fuel source for a chiller (Austin Energy, 2004b).

Drawing on its technical expertise, Austin Energy's Manage It Green program offers consulting services to other U.S. communities and utilities, helping them to launch their own green building programs. In this regard, Manage It Green is the first such utility-offered program of its kind in the nation (Austin Energy, 2008g). Clients have included the U.S. Green Building Council, Los Alamos National Laboratory, the California Public Utilities Commission, and Pacific Gas & Electric. Locally, Austin has utilized its experience to improve the quality of energy service delivery to Internet-based sales and biotechnology firms, which require high levels of reliability for their operations (City of Austin, 2003).

Along economic dimensions, Austin has pursued energy development directed toward the creation of local jobs and stronger regional prosperity. Relevant here are public-private partnerships such as the Clean Energy Development Council, devised in 2003 by the Greater Austin Chamber of Commerce and its Opportunity Austin initiative. While Opportunity Austin[ii] unites regional efforts for economic development in the larger five-county region, the Clean Energy Development Council specifically seeks to make Austin the "clean energy capital of the world" (Greater Austin Chamber of Commerce, 2006a, 2007a). Its promoters, in addition to the Chamber of Commerce, have included the municipal government, the University of Texas, the grassroots organizations Solar Austin and the Austin Clean Energy Initiative, and the Clean Energy Incubator (Austin Business Journal, 2005). The Clean Energy Incubator (2006) was established in 2001 to enhance financial and business support to alternative energy start-up ventures, the first such initiative in the U.S.

With regard to economic priorities associated with its energy policy, Austin has promoted a shift to renewable energy – specifically its GreenChoice® program – in ways that minimize costs and provide long-term financial stability to participants. Under the program, Austin Energy sells renewable electricity for durations of approximately 10 years (Austin Energy, 2005a). GreenChoice® customers benefit from the program's fixed cost fuel charge in place of the standard fuel charge found on conventional electric bills, so that GreenChoice® customers signing up in 2005, for example, receive the same rate from 2005 to 2013 (Austin Energy, 2005a). Against potential spikes in the price of electricity derived from fossil fuels, as occurred in 2000-2001 when natural gas prices in Texas increased 400% within 18 months (Austin Energy, 2001b), GreenChoice® can represent a bargain[iii] over time. More broadly, Austin has sought to undertake new investments in alternative energy resources and infrastructure in ways that do not threaten its ability to fund community programs beyond energy alone, a function of its role as a municipal utility.

Austin has additionally sought changes in energy use in the transport sector, but in ways going beyond the promotion of cycling, walking, telecommuting, and improved long-range public transit options (Murphy, 2005). Rather, Austin Energy is working to alter the type of personal vehicles utilized in the community, in ways that may simultaneously advance renewable electricity development. Austin Energy offers \$100-\$500 for utility customers who purchase qualifying all-electric vehicles, and since 2005 has encouraged the mass production of plug-in hybrid vehicles. The goal is to provide energy security to drivers, avoid oil revenue loss to other nations, improve air quality,[iv] and help secure long-term demand for renewable electricity procured by Austin Energy (2005b). In the latter case, the use of plug-in hybrids can help maximize the efficient use of wind resources, as turbine generation tends to peak during night hours. At that time, plug-in hybrids may be recharged through the grid at an estimated cost of 70 to 80 cents per "electric gallon" of fuel.

Finally, as part of its new policy and programs for alternative energy development, Austin has established measurable goals for greater accountability, higher customer satisfaction, and more equitable economic development in the community. Specifically, utility efforts are to exceed the municipality's Minority and Women Business Enterprise goals by 2008, and by 2010 should expand the monetary amount of contracts assigned to local firms. Goals for customer service should support "exceptional system reliability," assessed against the SAIDI (system average interruption duration index) score of 60 minutes and the SAIFI (system average interruption frequency index) score of 0.8 interruptions per year (City of Austin, 2003).

Energy Outcomes in Austin: Compatibility to SEU Framework

Although pursuing its own relevant programs and strategies, Austin's actions for energy-related change have embraced various elements of the SEU model (Sustainable Energy Utility Task Force, 2007). To review, the policy priorities and programmatic structure associated with the SEU approach to energy service entail the following:

- "One-stop" shopping: services for energy are integrated by one central actor.
- All fuels, all sectors, all customers: programs apply to conservation, efficiency and renewable energy and are not limited to electricity or heating alone; they are open to participation by residential, low-income, commercial, industrial, and public sector energy users.
- Flexible offerings: the above services incorporate a range of structures and incentives by which to meet the needs of different groups.
- Generation of revenue: customer-sited energy services are offered and managed in ways that contribute to creation of energy savings and revenue allowing for organizational self-sufficiency.

(Byrne, 2007; McDowell, 2007)

Speaking to these criteria, Austin Energy – operating within the municipal government – acts to centrally coordinate, direct, implement and evaluate goals and programs for energy service. The types of programs utilized here, from Green Choice® and the Green Building program to the Power Saver™ initiative and the Plug-In Hybrid campaign, work comprehensively to target changes in electricity and transportation benefiting all end-use sectors, from residential and commercial to industrial and municipal realms. Moreover, Austin has devised incentives under its many programs that encourage the participation of individuals and organizations regardless of income or the type of energy service required. For example, renters – not only homeowners – are eligible for residential energy efficiency and green building assistance.

Similarly, attention to diverse and often exacting end-user needs is reflected in the mix of technologies and applications utilized to date by Austin, an approach recognized for its flexibility and responsiveness in blending technical change with public and private sector support. In rankings by SustainLane Government in 2006, regarding leading cities for venture capital, investor networks, research, and government involvement for "Cleantech" development, Austin received top honors. The ranking cited the efforts of seven local firms in alternative energy research and commercialization, in partnership with the University of Texas' Austin Technology Incubator, Austin Energy, the National Renewable Energy Laboratory, and the Texas Energy Conservation Office. The ranking also acknowledged utility innovations to "open up the grid as a test bed" for clean energy technologies as an "unparalleled" opportunity for start-up firms in the sector (Karlenzig, 2006; Austin Energy, 2004c).

Akin to the SEU model, a push for economic self-sufficiency is additionally demonstrated in Austin's approach to financing alternative energy development and new energy services. Municipal and utility costs from GreenChoice® have been minimized, as most program expenses are either incorporated into the premium paid by customers, or are offset by savings achieved through the utility's energy efficiency programs. The latter also have been observed to generate more local jobs and income than unmitigated electricity use, based on calculations from the Austin Electric Efficiency Impact Model. In evaluating support for solar energy, Austin Energy factored in the local economic benefits of new opportunities for manufacturing. Both energy efficiency and solar development have helped to forestall certain upgrades to grid infrastructure and investments in new power plant capacity, particularly for meeting peak demand (Austin Energy, 2004c; City of Austin, 1997, 2003).

Figure 1
A Comparison of the SEU Model to the Energy Service Model Utilized by Austin, Texas.

SEU Model	Austin's Approach
"One-stop" shopping: energy services integrated by one central actor/organization	Energy services integrated by municipal utility Austin Energy
All fuels, all sectors, and all customers: programs apply to conservation, efficiency and renewable energy and are not limited to electricity or heating alone; they are open to participation by residential, commercial, industrial and public sectors	Programs such as GreenChoice®, Green Building, Power Saver™, and the Plug-In Hybrid campaign apply to electricity, buildings, and transport across residential, commercial, industrial and municipal sectors
Flexible offerings: services incorporate a range of structures and incentives by which to meet the needs of different groups	General to specialized services include free assistance, education, audits, loans, rebates, fee-based programs, net metering, etc.
Generation of revenue: customer-sided energy services offered and managed in ways creating energy savings and revenue, for organizational self-sufficiency	Programs devised to offset need for new power plants (especially to meet peak demand); energy efficiency gains offset upfront costs for other programs; green power provides long-term rate stability

Related to economic self-sufficiency, Austin Energy has noted how a "diversified" portfolio could enhance "reliable" electricity service at "affordable" prices, while lessening the community's vulnerability to "geo-political risks" and likely future regulatory "restrictions" on CO_2 emissions (City of Austin, 2003: 7, 10, 21-22). This approach thus goes some way toward adopting a fuller life-cycle analysis of various energy resources and strategies, getting beyond approaches that in previous years facilitated energy development that ultimately proved problematic to the community. For example, the South Texas Nuclear Project of the 1970s, initially favored by Austin, had resulted in costs five times original estimates. In response to the nuclear cost overrun, the Sustainable Energy Task Force (1998: 10-11) in the late 1990s had articulated a need to reduce future "uncertainty" in resource planning through a wider evaluation process, under which renewable energy appeared "a clear-cut winner."

And in turn, what has been the result of Austin's approach – one indeed comparable with the goals and strategies of an SEU (see Figure 1) – in seeing to the provision of energy service for the community? Along environmental dimensions, Austin has in fact achieved a cleaner energy supply, one that increasingly draws upon indigenous renewable resources in the city and region rather than polluting, non-renewable energy stocks. GreenChoice® is the top-selling utility-run green power program in the country since 2003 (Austin Energy, 2007b), the same year that Austin Energy was recognized as the fifth largest creator of new green power sources in the nation (Austin Energy, 2003b, 2004c). By the end of 2006, sales of renewable electricity through GreenChoice® totaled almost 600 million kWh annually (Austin Energy, 2007b), as seen in Figure 2 below.

With subscriptions rising under GreenChoice®, Austin Energy on average has increased the share of renewables in its total electricity supply by 1% annually (Climate Group, 2007a). Early estimates for 2008 show that 743 million kWh, or 8% of Austin Energy's total electricity[v], comes from renewable sources (Austin Energy, 2008h). This compares to 0.5% renewables in 1998 (Sustainable Energy Task Force, 1998). As a result of such trends, the community, in moving toward its 2020 goals for clean power, as of 2005 claimed no new energy production from fossil fuels (McCluskey, 2005). Proportionally, this places Austin ahead of the State of Texas, which derives 2% of its electricity from renewables as a function of its own RPS enacted in 1999 (Governor's Competitiveness Council, 2008).

Figure 2
Austin Energy's GreenChoice® sales (in kWh), 2002-2006 (based on information in the municipal utility's annual report; see Austin Energy, 2007b).

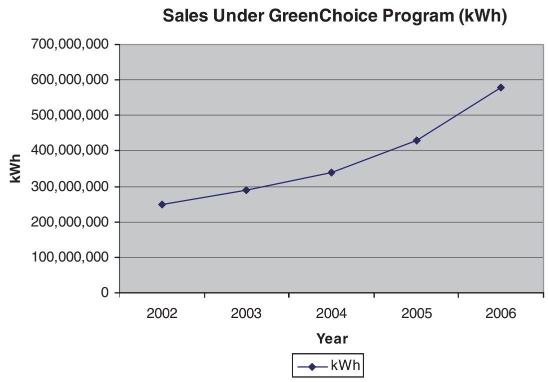
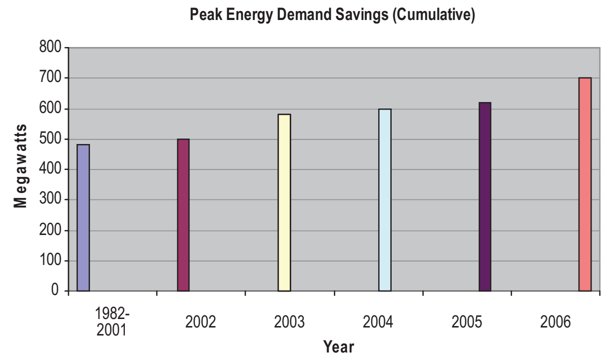


Figure 3
Peak energy demand savings (cumulative) from Austin Energy efficiency programs, 1982-2006 (based on information in the municipal utility's annual report; see Austin Energy, 2007b).



Due to energy efficiency efforts from 1982 through 2006 that have avoided the energy that would have been produced by a 700 MW power plant, as shown in Figure 3, Austin reported an 8% drop in its CO_2-equivalent emissions from 2000 through 2005 (Austin Energy, 2007b; Climate Group, 2007b), even as the city's population increased from 656,562 to 692,000 during that time. Avoided emissions through local participation in GreenChoice®, by 2006, were akin to removing some 80,000 vehicles off Austin's roads each year (Austin Energy, 2007b).

With regard to equitable economic impacts, Austin's energy programs have resulted in benefits for a number of groups. By December 2007, some 30,000 residential customers and 3,000 businesses had avoided the use of 94 million kWh and saved $10 million in energy costs, just in the previous year alone (Austin Energy, 2007c). Residential participants in energy efficiency programs saved an average of $262 in energy expenses per customer, in 2006 (Austin Energy, 2007b). Some 19% of new homes and 1 million square feet of commercial space received a green rating (Austin Energy, 2007c). Community groups such as Casa Verde since 1994 have trained more than 1,000 Austinites aged 17 to 26 in energy efficient residential construction (City of Austin, 2001a, 1998). The program has further assisted 90 families with low incomes in purchasing a home both centrally located in the city and equipped to minimize energy bills. More broadly, the availability of energy efficient homes in Austin is not restricted to economic elites, as level-five green construction residences have become common "at any price range" (Beers, 2005).

Despite the provision of these varied programs, Austin Energy's base electric rates, as of 2006, had not increased from 1994, and continued to stay beneath national and state averages. Its fuel charge to customers was one of the smallest in Texas (Austin Energy, 2007b). Subscribers to GreenChoice® for the program's first four batches of green power, representing contracts extending as far as 2015, by May 2008 were paying green fuel charges lower than the present standard fuel charge of 3.65 cents per kWh. GreenChoice® subscriptions, not limited to residential customers, included 514 firms, with some 428 businesses receiving 100% green power for their yearly consumption of electricity. This helped Austin to claim more 100% green-powered businesses than any other city in the nation (Austin Energy, 2008i). Also participating are educational institutions such as the Austin Independent School District and local Concordia University, the first U.S. college or university to buy 100% green power for its facility needs.

By 2004, some eight solar companies were operating under the utility's initiative for solar rebates, with four of these companies establishing a presence in Austin that year for the first time (Austin Energy, 2004d). By January 2005, the Austin region counted the presence of some 80 clean energy firms (Austin Business Journal, 2005; Greater Austin Chamber of Commerce, 2006b, 2007a,b). In just 3 years, the Clean Energy Incubator in Austin had helped young local companies acquire start-up funding ranging from $1.8 to $2.8 million.

Austin Energy (2007b) has supported local economic development initiatives that have resulted in firms opening offices or new operations in Austin. These include a new Samsung Austin Semiconductor plant and two Hewlett-Packard data centers. For the second time in a 4-year period, Austin Energy's bond rating was raised in May 2006. The utility transferred $77 million in funding, in 2006 alone, to the City of Austin to support libraries, the arts, parks, and fire and police departments (Austin Energy, 2007b). From 1976 through 2008, the amount of money returned by the utility (Austin Energy, 2008a) to the city has totaled $1.5 billion.

Aside from beneficial environmental and economic impacts, Austin's efforts have further been associated with new opportunities for local democratic participation. Specifically, local leaders and larger grassroots groups have utilized or even created new institutions and bodies to achieve policy reform linking energy development to new social agendas. These actors and dynamics are explored below.

Social Dimensions of Energy Change in Austin: Implications for Democratic Action

Alternative energy development in Austin over the last two decades is clearly linked to the grassroots activism of a number of individuals and organizations, who have specifically worked to enhance local participation in energy-related decision making.

A utility proposal in the mid-1970s to acquire nuclear power for the growing city of Austin focused community attention on the topic of energy resources. In 1976, Roger Duncan, a recent college graduate and aide to a new city council member, wrote a white paper detailing how renewable energy could be pursued by the municipality in place of nuclear power, given the latter's likely expenses for construction, operation, and cleanup. Duncan met regularly with other citizens to discuss energy issues and formed the Tuesday Evening Lemonade Club, which lobbied the city council to create citizens' advisory groups on energy. The city subsequently established the Renewable Energy Resources Commission and the Energy Conservation Commission, both serving the city council. Around this time, Austin resident T. Paul Robbins founded a Solar Speakers Bureau to visit local groups and organizations to discuss the merits of renewable energy (Cole & Skerrett, 1995).

Amid growing public pressure for official attention to such technologies and resources, the city council established and funded an Office of Energy Conservation and Renewable Resources. In 1981, the Office along with the Renewable Energy Resources Commission released two reports, made possible by the involvement of more than 100 citizens, describing how alternative energy could prove viable for meeting local needs. That same year, Roger Duncan and Larry Deuser, advocates for renewable energy and conservation, were elected to the city council. In 1983, they helped make possible a new energy strategy, the "conservation power plant." This demand-side strategy involved all customer classes in reducing electricity use as a means to meet local energy demand, rather than building new power plants (City of Austin, 2003). With some 550 MW of additional capacity to be avoided from 1983 through 1997 (Cole & Skerrett, 1995; Beers, 2005; Austin Clean Energy Initiative, 2002a), the conservation goal was assisted by a more equitable utility electric rate structure approved by Austin voters in 1981, following five years of advocacy by various groups. With these strategies in force, Austinites voted for the city to divest its partial ownership in a South Texas nuclear facility at whatever time the municipality could find a buyer for its share (Cole & Skerrett, 1995).

Other local actors such as Pliny Fisk pushed Austin to strengthen its Energy Star Program, established by the city council in 1985 to assist the construction industry in marketing more energy efficient residences (Austin Energy, 2007d). Urban planners, city officials, architects, builders and activists took part in cooperative efforts to devise a larger rating system that looked at materials and impacts related to waste, water and air quality, rather than energy use alone (Martin, 2005). Assistance in the form of grants came from the U.S. Department of Energy and the Urban Consortium's Energy Task Force of Public Technology, with additional support from the Austin City Council (U.S. Conference of Mayors, 2001). By 1991, the local Energy Star Program had grown into a Green Building Program for residential structures, which would become an official platform within Austin Energy by 1998 (Austin Energy, 2007d). At a national level, this groundbreaking effort contributed to the emergence of the U.S. Green Building Council LEED Green Building Rating System™ (Martin, 2005; U.S. Green Building Council, 2002). Meanwhile, within Austin, green building was supported by a Sustainable Building Coalition of homeowners and industry professionals (Beers, 2005) and by individuals such as Richard Halpin, who started the Casa Verde Builders Program in 1995. Casa Verde provides young people with marketable "green" job skills and directs its construction efforts to affordable green homes in low-income neighborhoods (Capitol Crowd, 2007).

The local green building effort in turn inspired other Austinites to form the Sustainable Communities Initiative in 1996. The Initiative called for Austin to "achieve economic prosperity, social justice, and ecological health" as part of "a democratic society in which all people are able to develop to their fullest potential" (City of Austin, 2001a,b, 2003). In June 1997, the Initiative brought together local stakeholders from government, business, and nonprofit realms to form a subcommittee tasked with devising ways of transitioning Austin Energy to greater reliance on renewable energy.

That subcommittee, known as the Sustainable Energy Task Force, researched changes in the U.S. deregulated telecommunications industry, and found that a shift from monopoly to competition had resulted in a wider range of available services through Internet, cellular, long distance, fax, paging, and messaging applications. The Task Force then looked to studies of restructured – or deregulated – electricity markets, where green power had showed the potential to win over 15% and 5% of residential and commercial sectors, respectively (Sustainable Energy Task Force, 1998). The Task Force concluded that renewable energy development could boost Austin Energy's programs for the "largely unserved" off-grid sector, thereby increasing the utility's attractiveness if ever forced into a competitive electricity market (Sustainable Energy Task Force, 1998: 1, 3, 8 and 10). At the same time, the Task Force examined polls in Texas and found consistent public support for renewable energy and energy efficiency, even at extra cost, as these options were perceived capable of stabilizing long-term power prices and reducing pollution and global warming. For Austin specifically, the Task Force suggested that a shift to green power could ratchet down local per capita CO_2 emissions, which in the mid-1990s were 20 times above those in India and Indonesia.

Also pushing for alternative energy development, yet as a means for new local market opportunities and employment, was the Austin Clean Energy Initiative. Its volunteer members from a range of industries calculated that 1 MW of clean installed energy could translate to jobs for 15 to 19 people, aided by Austin's "proximity to large natural resources"[vi] and its "supportive infrastructure for technology and innovation" (Austin Clean Energy Initiative, 2002a,b). Referencing the late 1990s dot-com industry failure in Austin, the Initiative detailed how a more virtuous cycle of clean technology research, manufacturing, installation and servicing could lessen the impact of future boom and bust economic cycles in the region. The Austin Clean Energy Initiative (2002c) further identified state legislation or programs that could assist local clean energy development, and carried out supportive activities such as public education, company recruitment, hosting of workshops, and industry analyses.

Wider social involvement in local energy change also has been seen with regard to formal policy making. Austin Energy's new 2003 energy strategy emerged from a more comprehensive planning initiative conducted the previous year, when the utility sought to update its long-term goals. Its planning process entailed not only industry and technology research, but also interviews with local activists, city council members, and some 600 utility employees (City of Austin, 2003). With regard to devising the practical aspects of energy-related programs, social involvement is additionally seen in the participation of local institutions such as the University of Texas. Its faculty and students have contributed design assistance for initiatives such as a matrix used by the city to evaluate the sustainability of proposed capital improvements (City of Austin, 2001c) and have hosted a roundtable series and an electronic bulletin board on sustainability issues (City of Austin, 1998).

The capacity for greater community monitoring of municipal efforts has been enhanced through the availability of annual reports prepared jointly by Austin Energy and other city departments (Murphy, 2005). The reports assess progress not only in energy and air quality but also in waste, water supply and watersheds, and parks and open spaces. Yet local grassroots actors have additionally put pressure on the municipal government and the utility to meet existing energy policy targets and to adopt even more aggressive goals. For example, some individuals who originally served in activist roles in relation to energy matters have over time assumed official leadership positions within the municipality. A special case is Roger Duncan, who from his early days in the late 1970s as an aide to a city council member would himself run for office and win a place on the city council. He then became Sustainability Officer for the City of Austin in the 1990s and eventually assumed the role of Austin Energy's General Manager in 2008 (City of Austin, 1998, 2008).

Another local player that has nudged city and utility action for energy change is Solar Austin, a nonprofit organization founded in 2002. Its information campaigns promoted RPS and solar energy policies – to include a 100 MW solar goal for 2020 – all of which were eventually enacted by the municipal government (Gouchoe, Gillette, & Herig, 2004). Alongside other supporters, Solar Austin participated in a petition drive to document local interest in alternative energy (Buehler & Smith, 2003) and hosted public meetings on the topic. The group additionally maintained "pressure" on Austin Energy to achieve its earlier 1999 goal for 5% renewables by 2005 (Solar Austin, 2007: 2).

In the spring of 2003, Austin voters elected candidates to mayoral and city council offices who had linked their political platforms to clean energy as a vital strategy for economic progress (Clark-Madison, 2003). The local group Liveable City, in June 2003, then encouraged an ongoing interest in these issues by polling 500 residents and spotlighting community preferences for local energy and economic policy. Findings revealed that more than 65% of residents desired an emphasis on renewable energy applications, toward more "balanced" distribution of jobs and other benefits (Liveable City, 2003). The group Public Citizen-Texas has pushed Austin Energy to be more forthcoming in disclosing information regarding its operations and to do more to solicit public input on its various initiatives (Clark-Madison, 2003), while the Austin Clean Energy Initiative (2002c: 1) has spotlighted "courageous makers of public policy" for green energy. Meanwhile, Austin Energy itself has set into motion a new mechanism for greater accountability in reaching its goals, having become a member of the California Climate Action Registry (2005).

Austin's case as depicted above suggests that caution is required in assuming that greater sustainability in energy will emerge as merely a "natural" outgrowth of economic or technical progress over time, or that change will occur due to a solitary one-time programmatic switch. Rather, advances for a cleaner, more technologically advanced, and more economically equitable energy infrastructure may occur as a wider social phenomenon, as individuals and groups consciously act over years to pursue alternatives to status quo conditions. As observed in Austin, with regard to the origins of energy change and how such action has gained momentum through the years, it appears that efforts for smaller-scale, distributed, and renewable-based approaches may serve to reinvigorate – or be accompanied by – more democratic processes and goals. These considerations are discussed below.

While the specific motivators for energy-related policies and programs may vary, it is interesting to observe how *motivation* for change actually has come to result in the *achievement* of change within Austin. In moving from status quo energy conditions to new goals, strategies, and outcomes compatible with greater sustainability, certain "connectors" – i.e., community-based movements entailing local, participatory, and accountability-based action – have appeared to rise up to support reform over time. These movements in turn are driven by four interacting assets: local leadership, wider citizen mobilization, the use of local institutions and forums, and new policy priorities for energy in meeting social goals.

"Leaders" – those with an interest in energy matters, who choose to act upon such interest – may be experts or laypersons as regards specialized knowledge of the field. What distinguishes them from others is their exposure and openness to new ideas for energy development and their willingness to assume the initial burden of pushing for change. Their leadership appears most effective when they call attention to problems and opportunities, educate the larger public that change is necessary and feasible, conduct research into local conditions, draft concrete proposals for reform, demonstrate technologies or other potential solutions, and engage in outreach to garner community ideas and support. Also important is the role of leaders in pushing for political support of favored options, through participating in official hearings, promoting local referenda, advocating the election of candidates, and even themselves running for office.

Other community assets for energy change are the wider local groups who join and support early leaders in strategic ways. Their involvement may be based on their particular experiences or histories in the community as somehow impacted by energy-related conditions, with local leaders perhaps "activating" them to recognize the need for action and then focusing any resulting mobilization in meaningful ways. Their involvement is important if the burden of change is to be transferred from the shoulders of a few early activists onto a larger group of proponents, so that action for reform more closely matches the size and scale of the community. The participation of wider groups also can help ensure the viability of the cause or movement, where elected officials or grassroots leaders will not or cannot stay the course. In this way, the wider involvement of multiple stakeholders serves to sustain given initiatives regardless of the shifting fortunes that surround current leadership.

Also assisting energy-related change are local institutional assets of various kinds. Through these local forums, tasks previously undertaken by individuals or small groups can be coalesced, organized and broadened, and citizens and officials can interact to debate, craft, implement, and evaluate policy.

Institutional assets may be historically active ones, such as a city hall or municipal utility, whose mandate or performance may be altered in support of energy change. Or, they may be new institutions and forums created by local groups, such as campaigns, advisory groups, task forces, speakers' series, and neighborhood meetings. Regardless of their public or private origin, effective institutions appear to seek out input and participation from the public, and to open up "space" in which new conceptual and practical alternatives to conventional energy choices can be incubated.

The interplay of local leaders and groups, in taking advantage of a range of venues to promote widened participation on energy, have appeared to entail some larger discussion of what development choices should constitute the goals of "community" life. Along the way, the "community" has been depicted as a place affected by larger ecological, economic and social conditions, but also driven in part by one's own choices as a consumer or voter. Such efforts, by encouraging a shared identity based on common interests among citizens, and by promoting energy change as something to be consciously debated in response to social needs, is cultivating openness to new possibilities for what "problems" are identified and what "solutions" are deemed acceptable or desirable.

In such a manner, the above three assets serving the cause of energy change also appear linked to a resulting fourth asset: new policy development that places energy within a broader set of priorities for improving local social, environmental and economic conditions. Specifically, policy and programs are targeting not only strict elements of electricity generation and use, but are expanding to cover buildings, transport, economic development, and other action areas. New initiatives support equity, in capturing broader benefits – such as jobs, higher quality energy service, and improvements to other community programs – for citizens through energy change. They also advance ecological protection, by curbing energy consumption where possible and shifting to cleaner, safer, and less CO_2-intensive forms of energy service delivery. With accountability mechanisms and educational initiatives accompanying official efforts, emergent policy is localizing the social advantages of going "green."

Community assets, as seen in the case of Austin, are thereby demonstrating some capacity to overcome what has sometimes proved to be obstacles elsewhere to local energy change. These obstacles range from a lack of understanding regarding the need for change, to a lack of knowledge or social urgency with regard to perceived problems. More broadly, the above community assets and dynamics have revealed a type of virtuous cycle of action for sustainability in energy, as follows. Local actors help to create or nurture a process of education, by launching or pushing efforts to experiment with new technologies, methods and behaviors for altered energy generation and use – in effect "fitting" them to community conditions. Larger groups who are exposed to these activities learn more about new energy options, and come to support targeted action for new policies and programs through participation in various institutional venues. As first-wave efforts are evaluated according to a range of community-negotiated criteria, individuals observe the benefits of change – such as reduced exposure to localized pollutants, or the improved retention of local energy dollars – and this builds greater social enthusiasm and commitment to more ambitious action.

Observed bottom-up efforts in Austin to alter local forms of political participation, the utilization of institutions, and the development of policy frameworks, all in support of meaningful energy-related change, add weight to the suggestion made by Agyeman and Evans (2004) that social efforts to address sustainability may entail as many implications for politics as they do for the environment. They also suggest that these types of local efforts – ones compatible with an emergent SEU model – may prove critical in demystifying "sustainability," making the concept practical and workable in daily life.

Conclusion

Austin's achievements to date do not suggest that its efforts are yet sufficient, in achieving a sustainable level of greenhouse gas release. For Austin, and many other cities, substantial challenges remain in addressing the emerging impacts of a growing transport sector, alongside the consumption of goods and services beyond electricity alone, as a means of moving closer to the 3.3 ton CO_2 per capita standard for sustainability. Meanwhile, in many other locales, the relevant challenge entails overcoming the almost sheer lack of social action to address any of these phenomena. These conditions suggest that cities and their populations may need to build on existing efforts to address larger national conditions that impede – or fail to motivate – local and regional capacity for sustainability in the U.S. (Byrne et al., 2008).

Yet even in "leader" cities, some vigilance may be required to sustain forward momentum, as it is unlikely that a one-time success in advocating for and choosing policies for sustainability will in itself lead lockstep to lasting supportive conditions. Successful forward movement is likely to require continued investments of time and energy among local residents and groups in fighting off oppositional efforts and overcoming entrenched status quo conditions. This speaks to the likely importance of the social dimensions of energy change, and the potential for SEU-type approaches to be accompanied by invigorated democratic institutions and processes in urban life, in ways that may open up new possibilities for urban development linked in part to electricity generation and use but perhaps extending into other realms.

Specifically, cities may go about the process of energy change according to the particular opportunities and pressures faced within their jurisdictions, along economic, technological, environmental, and social dimensions. For example, Austin's policy and programmatic choices reflect local conditions and imperatives in that community, yet local conditions can require different approaches elsewhere. Take the cases of Chicago and San Francisco, which both lack community-owned or municipal utilities. In Chicago, the municipality has supported investments in local energy efficiency and distributed generation, as well as installations for green roofs, through a financial settlement obtained with private utility ComEd (Regelson, 2005; U.S. Conference of Mayors, 2001). In San Francisco, the city has utilized a $100 million bond initiative, plus an emergent effort for community choice aggregation, to support similar investments (DSIRE, 2007). Meanwhile, where indigenous resource conditions in Austin and Chicago have contributed to an emphasis on solar and wind development, San Francisco has explored the use of additional resources fitting its own geography, specifically tidal power (San Francisco Public Utilities Commission, 2006).

The point, here, is that urban efforts for energy change may reflect different challenges or opportunities, and may thus be emerging according to different frameworks for local action and associated development choices. Still more diversity in their ultimate approaches is possible over time, as cities and regions create and experiment with assorted programs, learn along the way and make changes where necessary, and adapt to changing conditions that are now difficult if not impossible to predict. Moreover, if benefits from these early efforts proliferate, then efforts for sustainability in energy are likely to reinforce new social expectations regarding appropriate development pathways for communities, with regard to consumer preferences in housing and neighborhood amenities, increasing cognizance and acceptance of the need to account for greenhouse gas emissions, new interest for cultivating regionally desirable economic sectors and infrastructure, etc.

In essence, what may begin as an exploration of the financial, environmental, and economic benefits of new energy technologies and resources for given locales, may also be accompanied by social dynamics that open up very real possibilities for new directions in community life. The shift to a lower-carbon, renewable, decentralized, and modular energy system – one compatible with a sustainability energy model, SEU or otherwise – may simultaneously play a role in the self-determination of cities in charting development pathways that hold the potential to depart in meaningful ways from their 20th century forebears.

Notes

i As calculated by Byrne et al. (2007), these areas of state policy action (excluding energy efficiency policies targeting transport) may yield emissions savings of 1822 million tons CO2 in 2020, compared to a business-as-usual scenario of 2812 million tons CO2 (Energy Information Administration, 2007), a 65% improvement compared to business-as-usual.

ii Other foci of Opportunity Austin include wireless, biomedical, pharmaceutical, and automotive firms as well as software, semiconductor, transportation/logistics, and digital media industries. Costs for the initiative have largely been borne by private sector actors, who have contributed some $12.8 million to supportive activities (Greater Austin Chamber of Commerce, 2006a).

iii Also helping to make wind power – the bulk source of GreenChoice® electricity – competitive with natural gas in Texas has been a state RPS enacted in 1999, which initially required Texas to source 3% of its electricity (some 2,880 MW total) from renewable sources by 2009. The RPS was applicable to all electricity retailers in competitive markets, as well as municipal utilities and coops that opt in to retail competition. The state's RPS has subsequently increased to 5,880 MW by 2015 (Texas State Senate, 2005). Also aiding the competitiveness of wind power in Texas was a federal production tax credit circa 2001 of $18 per MWh for the first 10 years of plant operation (Public Utility Commission of Texas, 2003; Real de Azua, 2001).

iv These efforts serve as one way to address air quality, as automobile use in Austin is responsible for some 60% of emissions leading to local smog and as Central Texas in 2005 was recording ground-level ozone levels bordering on or surpassing federal limits (Murphy, 2005).

v In 2008, early estimates indicate that Austin's 2,600 MW of electric generation comes from natural gas at 53%, coal at 23%, nuclear at 15%, wind at 8%, and landfill methane at 1% (Austin Energy, 2008h).

vi Such descriptions allude to renewable energy potential in Texas, which was suggested in the 1990s to offer more solar and biomass development potential than any other U.S. state and the second highest level of wind potential (City of Austin, 1997).

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