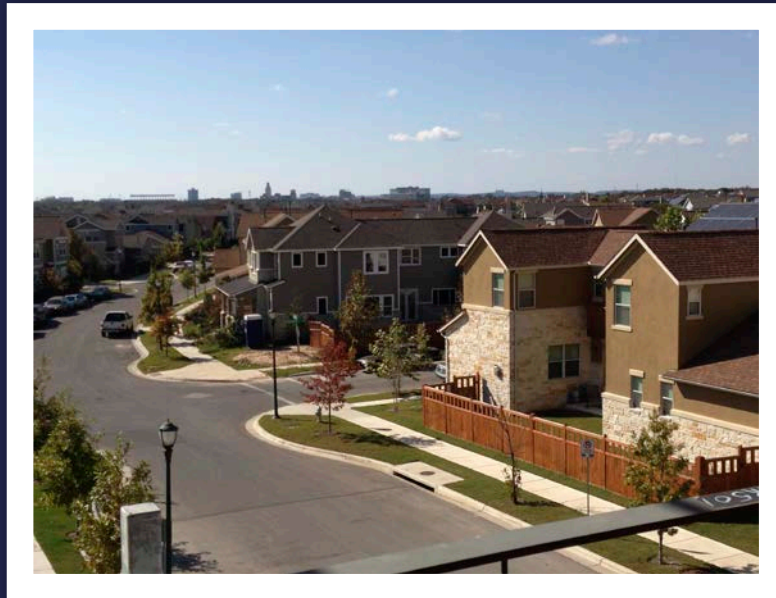


The Customers' Smart Grid: Pecan Street Inc.'s Energy Internet Demonstration Project



Institute for Energy and the Environment
Vermont Law School



The Institute for Energy and the Environment (IEE) is a national and international resource for energy law and policy. The institute offers a full course curriculum and a certificate of concentration during the academic year and through its Energy Summer seminars;

distributes scholarly, technical, and practical publications; provides forums and conferences for professional education and issue development; and serves as a center for graduate research on energy issues, with an environmental awareness.

The institute's research team is selected from top students in the energy and environmental programs at Vermont Law School. IEE student researchers work on some of the most pressing energy concerns the world faces today, including energy self-reliance, the smart grid, energy security and justice, carbon sequestration, and renewable energy sources. More information about IEE can be found at www.vermontlaw.edu/energy

Smart Grid Case Study Series – Case 5

January 2013

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SMART GRID PROJECT OVERVIEW



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The United States electric transmission and distribution system is on the verge of a digital energy revolution. At the center of this revolution is the introduction of new technology at the customer meter as well as the distribution and transmission system level. Unsurprisingly, the introduction of this new technology has presented new legal, policy, and regulatory challenges for state and federal regulators. The federal government has added additional momentum to this technological evolution by making a

smart electric grid a central component of the US clean energy agenda and awarding \$3.4 billion in smart grid investment grants to utilities and other entities as part of the American Recovery and Reinvestment Act.

THE SMART GRID CASE STUDIES SERIES

Vermont Law School's Institute for Energy and the Environment Smart Grid Project was initiated in 2010 through joint funding of the United States Department of Energy, with the support of Vermont Congressman Peter Welch, and Vermont Law School. Utilizing case study analysis of smart grid program implementation, the research project is examining the question: what legal, regulatory, and other policy changes can best ensure that Smart Grid implementation in the U.S. improves reliability, enhances consumer value, and meets our clean energy goals?

PROJECT FOCUS 2012 AND BEYOND

FERC Chairman John Wellinghoff has noted that climate change and a smart electric grid are both key issues for the energy industry and the federal

government, but rarely are these two issues linked in policy debates. The focus of the Institute for Energy and Environment's Smart Grid Project is to help better define this important link, and to promote smart policies that benefit both the climate and the electric grid. Research such as that conducted by Pacific Northwest National Laboratory (PNNL) and the Electric Power Research Institute have identified that a smarter grid is likely to be a significantly greener grid, which could lead to significant reductions in both energy usage and carbon emissions. PNNL's research suggests that a smart grid can lead to a 12% reduction in carbon emissions alone by 2030.

Building on our case study research during the second phase of our project, we are producing up to five smart grid policy reports. These reports will examine best practices, lessons learned, and policy issues related to:

- Legal and regulatory challenges to smart grid implementation, including customer data privacy;
- Integration of electric vehicles into the grid;
- Supercharging efficiency and expanding demand response;
- Integration of clean distributed generation and storage; and
- Distribution optimization and conservation voltage reduction.

More about the Institute's Smart Grid Project is available at: www.vermontlaw.edu/smartgrid

Our Smart Grid Case Study Series Includes:

- ✓ Central Vermont Public Service (Vermont)
- ✓ Commonwealth Edison (Illinois)
- ✓ Pecan Street Project (Texas)
- ✓ Sacramento Municipal Utility District (California)
- ✓ Salt River Project (Arizona)
- ✓ San Diego Gas and Electric (California)



Pecan Street Inc.

Our current electric grid has gone through several changes for over a century to become the system we use today. Beginning with the first central power system built by Thomas Edison in 1882, the development of power pools and utilities, the emergence of federal power, and the creation of three major interconnections, the grid has experienced many changes. In today's society, electric utilities prepare to put the grid through another change; turning the electric grid in to a *smart* electric grid. The Vermont Law School's Institute for Energy and the Environment seeks to explore this prospect further and to take a broader look at several of the early smart grid projects already being implemented.

The purpose of this case study is to examine Pecan Street Inc., a leading organization in the digital energy revolution, and its efforts to demonstrate the operability and functionality of a smart grid community. The case study explores how Pecan Street Inc. developed, its Energy Internet Demonstration project, the smart grid technologies

it plans to deploy, how those technologies will be integrated, as well as the policy and regulatory implications of the project. In addition, we will identify lessons learned from Pecan Street Inc. and policy solutions that can be adopted by decision-makers across the country. The U.S. Department of Energy awarded the Pecan Street Inc.

"For the smart grid to be truly transformative, the magic has to happen inside the house, and that's where we're going to focus our attention...customer value can't be an afterthought. Instead of imposing solutions on customers, smart grid must address these challenges by creating products and services that customers will value and voluntarily adopt."

Brewster McCracken

Executive Director, Pecan Street Project

\$10.4 million from the American Recovery and Reinvestment Act, which spurred interest in the project and this case study of its progress. The Pecan Street Inc. is highly unique due to its public-private partnership, which demonstrates how the public and private electricity sectors can work together to achieve smart grid innovation. This structure has allowed greater efficiency in working with regulatory organizations and resolving customer issues in order to develop an advanced smart grid test project.

The Pecan Street Inc. Energy Internet Demonstration, located in and around the Mueller development in Austin, Texas will demonstrate the capabilities of a fully-functioning smart grid community. The project focuses on four key program areas: a) utility side of the meter systems, b) customer-premises systems, c) pricing and commercialization, and d) data collection and management. After introducing the key members of the implementation team, the demonstration project is discussed in greater detail.

PECAN STREET INC.

Pecan Street Inc. is a 501(c)(3) non-profit research organization headquartered at the University of Texas, and the lead team member for the Energy Internet Demonstration Project. The organization was formed in 2009 by representatives of the City of Austin, Austin Energy, The University of Texas, the Austin Technology Incubator, the Greater Austin Chamber of Commerce, and Environmental Defense Fund. These founding partners each have representatives on the board of directors of the Pecan Street Inc., while many are also members of the Demonstration Project implementation team.

The City of Austin relies on Austin Energy, the municipal utility provider, to supply a portion of its operating budget.¹ As Roger Duncan, former general manager of Austin Energy, states, “Our city budget is closely tied to a utility whose revenue is a direct result of how much energy it sells.”² Acknowledging that existing efforts by Austin Energy to promote energy efficiency and encourage development of distributed,

¹ Austin Energy is the City of Austin’s largest single source of revenue. (WGR pg 15)

² Working Group Recommendations pg 4

renewable energy will harm this business model and risk the City of Austin’s financial stability, Pecan Street Inc.’s founders recognized an opportunity to proactively address this issue. In developing Pecan Street Inc., they sought to “preserve Austin’s quality of life and chart a path toward new economic opportunity.”³ Environmental benefits were also recognized as a core benefit of the project. Over the course of a year, founding members crafted a deliberate strategy to accelerate the energy system evolution in Austin, and to position the community as a clean energy and smart grid leader. This effort, conducted prior to the Department of Energy’s solicitation for Smart Grid Demonstration Projects, and with a wider community development lens, sets the Energy Internet Demonstration Project apart from other demonstration projects. It reflects an active community engagement in defining and realizing a sustainable economic and energy future for the City of Austin. The Energy Internet Demonstration project is one component of a larger plan to transform Austin’s energy and economic future.

As it developed this plan, Pecan Street Inc. sought to answer the following questions:

1. How can the Austin community accelerate the evolution of its energy delivery system? and
2. Can we do it in a way that creates new economic opportunities for Central Texas?⁴

In developing answers to these questions, Pecan Street Inc.’s founders adhered to several unique guiding principles, which differentiate it from other smart grid projects. First, environmental protection is a core objective. The Environmental Defense Fund was invited into the process to ensure that this objective was realized. Second, as a result of wanting other communities to be able to learn from Austin’s experience, the project uses an “open source” approach, and intends to make its findings and lessons learned available to the public and the energy industry at large. Creation of new companies and jobs in Austin remains the third core focus of the project. As a result, Pecan Street Inc. will measure success in terms of utilizing Austin talent, installing equipment, and using services provided by Austin companies, not simply in terms of renewable energy capacity, environmental

³ Working Group Recommendations pg 2,4

⁴ WGR pg 6

benefits, or energy savings. The fourth objective is to preserve the economic stability of the City of Austin and Austin Energy, which means ensuring that the plan does not threaten the revenue stream of Austin Energy. Recognizing and capitalizing on the ability of smart grid technologies to empower consumers to use energy more efficiently or to install renewable energy systems is the fifth objective. The sixth objective integrates the community into the project in many different facets. The project envisions “tomorrow’s energy system as integrating all the systems and community assets that will consume or generate electricity,”⁵ including electric vehicles, homes and buildings, the city’s water utility, distributed generation facilities, as well as, the policies and programs that impact those assets. The final objective focuses on the collaborative process used to develop Pecan Street Inc. and its mission. More than 200 people from a wide spectrum of government, utility, academic, advocacy, and corporate backgrounds were involved in crafting the organization’s vision and the recommendations. Community members, civic leaders, and Austin Energy customers were also consulted throughout the process.

The resulting, March 2010, *Working Group Recommendations* create a roadmap for transforming Austin Energy from its current role as an energy provider, into a utility of the future as an energy manager. It also sets out a plan for harmonizing the water utility’s resources, the City of Austin’s policies, and the job training and economic development components needed to accelerate the shift to a sustainable energy and economic future for Austin. The recommendations for evolving Austin Energy fall within four broad areas; a) Renewable Distributed Energy Deployment and Testing, b) Smart Grid Testing and Pilots, c) New Rate Structure, and d) New Business Model. These recommendations are discussed in detail in Appendix A. The main focus of the remainder of this analysis is the Energy Internet Demonstration Project, an outgrowth of one portion of these recommendations. The results of this project will feed into Austin Energy’s and Pecan Street Inc.’s ongoing efforts to implement the remaining recommendations. Pecan Street Inc. implements the Energy Internet Demonstration Project, as well as,

⁵ WGR pg 10

contributes to efforts to realize the broader vision for Austin, Texas, as described in the Working Group Recommendations. Its main partners in both efforts are Austin Energy and the City of Austin.

AUSTIN ENERGY AND THE CITY OF AUSTIN

Austin Energy is the nation's 9th largest community-owned electric utility, serving more than 400,000 customers within the City of Austin, Travis County, and Williamson County. Austin Energy functions as a department of the City of Austin, with dividends returned to the community each year. With a service territory encompassing 437 square miles, Austin Energy owns more than 5,000 miles of overhead power lines, 4,000 miles of underground power lines, and 48 substations. It also owns 2,600 MW of generation, including three natural gas plants, one coal plant, partial ownership of the South Texas nuclear facility, a 13 MW landfill methane plant, and numerous wind farms with a total wind capacity of 439 MW. In early 2012, Austin Energy began operation of a 30 MW photovoltaic solar facility, the largest in Texas and the largest solar installation commissioned by a municipal utility.⁶

In October of 2009, Austin Energy completed implementation of its Smart Grid 1.0 program, the first fully-operational Smart Grid deployment in the U.S. It installed 86,000 smart thermostats and 410,000 smart meters (from Elster, GE, and AMI partner Landis + Gyr), covering its entire service territory.⁷ The deployment also includes 2,500 sensors and 3,000 computers, servers, and network gear, which gather "100 terabytes of data and service a million consumers and 43,000 businesses throughout the Austin metro area."⁸ As a result, Austin Energy's outage duration and frequency ratings rank among the best in the nation. At a cost of \$150 million, Austin Energy expects the benefits of this first generation of smart grid technology to come primarily in the form of more efficient and less costly data acquisition, and faster, more accurate information about how its customers

⁶ <http://www.earthtechling.com/2012/01/austin-fires-up-largest-solar-farm-in-texas/>

⁷ *LIGHTSON: Austin Energy Delivers First Smart Grid in the US*. Electric Energy Online.com http://www.electricenergyonline.com/?page=show_article&mag=60&article=451

⁸ Id.

consume electricity. Austin Energy also has extensive plans for a Smart Grid 2.0 program, within which the Energy Internet Demonstration Project will operate.

Austin Energy operates the nation's longest running and most subscribed green power program in the country.⁹ The GreenChoice program offers Austin Energy customers the option of subscribing to a batch of clean electricity resources. GreenChoice subscribers pay a fuel charge of 5.7 cents per kWh instead of the standard fuel charge of 3.105 cents per kWh. Customers, purchase 875 million kilowatt-hours of renewable energy annually.¹⁰ The program is supplied by renewable resources such as wind and methane gas from landfills.

Austin Energy also operates a solar rebate program for its commercial and residential customers. As of April 2011, the program supports more than 1,200 customer-owned solar energy systems, 100 commercial projects, 37 municipal projects, 32 school installations, and 6 libraries. Together, these produce more than 4.7 megawatts of generation capacity.¹¹

The City of Austin operates the country's oldest and largest green building program, which continues to lead the industry on sustainable building practices. The Austin Energy Green Building (AEGB) Program was created in 1990 and aims to lead the transformation of the building industry to a sustainable future. AEGB developed and maintains its own Austin-specific energy rating system, which it uses to pave the way for baseline building energy code changes.

As a result of Austin Energy's early smart grid efforts and the City of Austin's green building program, the Pecan Street Inc. is uniquely situated to demonstrate the potential of a fully integrated smart utility grid. With a focus on the consumer experience and benefits of smart grid applications, instead of the benefits accrued to the

⁹ Proposal to DOE pg 5

¹⁰ <http://www.austinenergy.com/energy%20efficiency/Programs/Green%20Choice/index.htm> accessed 5/18/12

¹¹ <http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/solar%20rebates/index.htm> accessed 3/13/12

utility, Pecan Street Inc. is poised to deliver tangible benefits to the Mueller Community and demonstrate the breadth of smart grid capabilities for consumers across the country.

SMART GRID 2.0 AT AUSTIN ENERGY

Austin Energy's Smart Grid 2.0 is a comprehensive plan to build on and expand the utility's Smart Grid 1.0 efforts.¹² Under the Smart Grid 2.0 plan, 100% of Austin Energy's customers will be equipped with advanced two-way meters. This will allow the utility's entire service territory to be served with real time data management, visualization systems, and an automated transmission system. Austin Energy has already deployed the Landis +Gyr UtiliNet Mesh Network to provide two-way communications with customer meters. Smart Grid 2.0 includes plans for substation and distribution automation, smart electric vehicle chargers, energy control gateways, and customer-controlled energy management. In particular, Austin Energy is installing a new automated substation at the distribution feeder for the Mueller development, and has already upgraded its customer billing system to allow integration of innovative rate and incentive structures, both of which will support many of the Energy Internet Demonstration Project's research endeavors. The customer billing system will also provide real-time access to usage data, empowering customers to monitor and adapt their usage behavior. The Pecan Street Demonstration Project will play a key role in determining the most effective ways of communicating with customers, in order to maximize the benefits of Austin Energy's smart grid investments.

THE PECAN STREET ENERGY INTERNET DEMONSTRATION PROJECT: OVERVIEW

The Pecan Street Energy Internet Demonstration Project is a unique public-private partnership, with team members from different sectors of the energy industry. Team members include Pecan Street, Inc., the University of Texas, Austin Energy, the Environmental Defense Fund, National Renewable Energy Laboratory, City of

¹² Proposal to DOE pg 11

Austin, and a Technology Review and Advisory Committee.¹³ Pecan Street Inc. is leading the demonstration project.¹⁴

TECHNOLOGY REVIEW AND ADVISORY COMMITTEE

The Technology Review and Advisory Committee is a regional committee organized to provide a forum for knowledge and technology sharing in the Central Texas region. Members include, the Electric Reliability Council of Texas (ERCOT), Bluebonnet Electric Cooperative, CPS Energy of San Antonio, Oncor, and Pedernales Electric Cooperative.¹⁵ Like the City of Austin, which relies on Austin Energy for a portion of its operating revenues, several other Central Texas municipalities, including San Antonio, rely on their municipally-owned utility for revenue. The Technology Review and Advisory Committee will help inform Pecan Street [Inc.](#)'s development of a new utility business model and disseminate lessons learned throughout the region.

PROJECT GOALS

The main goal of Pecan Street Inc. is to transform Austin Energy into the urban power system of the future, while making the City of Austin and its local partners a model clean energy laboratory and hub for the world's emerging clean technology sector.¹⁶ More specifically, the demonstration project aims to, "give consumers more control over their electricity usage and bills, preserve utility finances, reduce water usage, greenhouse gases, criteria pollutants and other environmental impacts, and promote clean energy job opportunities."¹⁷ As a demonstration project, Pecan Street will implement and operate smart grid technologies in

¹³ DOE PMP pg 5

¹⁴ DOE PMP pg 5

¹⁵ DOE PMP pg 5

¹⁶ *LIGHTSON: Austin Energy Delivers First Smart Grid in the US*. Electric Energy Online.com http://www.electricenergyonline.com/?page=show_article&mag=60&article=451

¹⁷ Proposal to DOE pg 3

the Mueller Community on a level that is capable of being reproduced nationally, without the need for major technological redevelopments.

THE MUELLER COMMUNITY

The Mueller Community sits approximately three miles away from downtown Austin, Texas and comprises a 711-acre LEED New Development, mixed use, urban infill redevelopment community currently under development. Located on the site of the former Robert Mueller



The Mueller Community in Austin, Texas.

Municipal Airport, the Mueller community will provide an advanced platform for testing the impacts of a concentrated smart grid system. When fully developed, Mueller will have approximately three million square feet of commercial and institutional space, and 4,900 single-family and multi-family dwelling units housing more than 10,000 residents. At completion, at least 25% of the residential units will be affordable for households earning less than the median family income in Austin. The Mueller Community is already home to Austin Energy's Mueller Energy Center, the Dell Children's Hospital, the University of Texas Academic Research Center, as well as more than 2,000 people who live or work in the community.

Energy and environmental considerations are incorporated into all aspects of the Mueller community. All commercial buildings over 25,000 sq. ft. must achieve at least LEED or the AEGB program two-star rating, while all single-family homes must meet the AEGB three-star rating. Additional building specifications require the installation of programmable thermostats that can be managed through an online interface and advanced wiring that enables a homeowner to easily add home energy, irrigation, and lighting management upgrades. Water is also a concern, so native or water-wise plants must account for at least 90% of the landscaping in all public open

spaces, commercial, and residential lots. The Mueller Community will also utilize reclaimed water and a water-efficient irrigation system to irrigate public landscapes.

The Mueller Energy Center, adjacent to the Dell Children’s Medical Center, is a combined heat, cooling, and power plant installed by Austin Energy. The advanced energy system uses waste heat from natural gas turbines to create steam, which is used for building systems, hot water in the hospital, and to run a 930-ton absorption chiller. The water from this and two additional electric chillers are used to cool office buildings more efficiently. A third electric chiller is planned, and the entire energy system is expected generate half as much carbon as the national average for grid-supplied electricity.

More than 600 households are already complete and occupied; while an additional 1,000 housing units are expected to be completed within the next five years. As the Mueller Community is developed, the Pecan Street Project will recruit families and businesses to voluntarily participate in the smart grid demonstration project.

PROJECT DETAILS

Because Austin Energy had already deployed smart meter technology throughout its service territory, and developed a plan for implementing Smart Grid 2.0, Pecan Street Inc. is uniquely situated to focus on smart energy use and integration of innovative renewable and efficient technologies at the consumer level. The Pecan Street Project will recruit up to 1,000 residential meters and 75 commercial meters for the demonstration project.¹⁸ An additional 200 homes will further incorporate smart water and smart irrigation systems into the demonstration.¹⁹ Pecan Street [Inc.](#) will deploy smart appliances, electric vehicles, rooftop solar, home energy storage, and home energy gateways/networks in the participating homes and businesses. Project participants will

¹⁸ DOE PMP pg 14

¹⁹ Pecan Street Project Energy Internet Demonstration, Project Narrative. Pg.8

allow Pecan Street Inc. to record their energy use down to the device level, as well as monitor the impact that new energy technologies, price signals, and educational messaging have on participants' energy use.

The Project will use internet and cable modems in the homes and businesses to act as the two-way gateway for information flow, and to create an "energy internet." This technology allows the Project to receive energy use data four times a minute.²⁰ Using the internet technology, Pecan Street [Inc.](#) will demonstrate: 1) Energy Internet capabilities on the utility side of the meter 2) Energy Internet capabilities on the customer side of the meter; and 3) Plug-in electric vehicle integration onto the local grid.²¹ By mimicking the internet's ability to connect several different aspects of society, Pecan Street Inc. expects to use the same technology to integrate the several different energy systems within a community, such as electricity use, transportation systems (electric vehicles), and water systems (transport and treatment).

In addition to using volunteers in the Mueller community to test home energy management systems and new technologies, the Pecan Street Inc. is building a demonstration house and research facility located in the Mueller community. Pecan Street Inc. also intends to create a medium where new technology can be developed and tested. The Project seeks to deploy a minimum of 300 megawatts of clean distributed energy within Austin Energy's service territory by 2020, and introduce Austin Energy's grid as a "test lab" for companies developing and testing clean technology in the future.

Pecan Street Inc. aims to achieve five objectives through its demonstration project:

- 1) Create an interoperable, standards-based technical approach that can be integrated into other systems with minimal additional engineering and design;
- 2) Establish a cyber security protocol that can be integrated into other systems without risking the security and privacy of participants;

²⁰ Interview with Colin Rowan

²¹ Pecan Street Project Energy Internet Demonstration, Project Narrative. Pg.8

- 3) Demonstrate and optimize integration of customer-side smart grid systems along with deployment of utility scale distributed solar and storage on the distribution feeders serving the Mueller Community;
- 4) Deploy and compare different pricing models and features, including dynamic pricing, decoupled pricing and net metering, to identify a menu of pricing options that incentivize investments in smart grid systems without jeopardizing utilities' revenue stream; and
- 5) Construct and operate a demonstration house located in the Mueller Community that will serve as a testing laboratory and public education facility.

PROJECT PARTNERS

In addition to Pecan Street, Inc. and Austin Energy, the regional demonstration project includes The University of Texas, Environmental Defense Fund, and the City of Austin. The University of Texas will lead the data collection and analysis aspect of the project, and support commercialization of new technologies through its Austin Technology Incubator. The Environmental Defense Fund (EDF) will serve as an independent, third party ensuring environmental benefits are maximized and actually realized. EDF will also share best practices and lessons-learned with other utilities and stakeholders across the country. The City of Austin will manage the Mueller redevelopment as it relates to the demonstration project.

PROJECT COSTS AND METRICS

The Pecan Street Inc. estimates the demonstration project will cost \$25 million, and has received funding from three main sources. The United States Department of Energy awarded Pecan Street Inc. a \$10.5 million Smart Grid Demonstration Project grant to conduct research in the newly-developed Mueller neighborhood. The Doris Duke Foundation provided a matching \$350,000 grant to extend this research to include 100 existing homes in surrounding neighborhoods. The remaining funding came collectively from the Pecan Street Inc.'s partners, which contributed about \$14 million. This includes the following contributions:

	Contribution
Austin Energy	\$5,609,375
Austin Technology Incubator	\$320,663
Environmental Defense Fund	\$250,000
University of Texas	\$729,974
City of Austin	\$7,343,530
Total Local Match	\$14,253,509

Because the goal of this project is to demonstrate the capability of smart grid technologies in a modern community, the demonstration project does not include a utility business case. Rather, the experimental technologies demonstrated in the community will be evaluated to determine whether smart grid technology in the home and business will create value for the customer. In particular, the project metrics will analyze how the deployed smart grid technologies:

- Influence the customer’s environmental impact;
- Affect the customer’s electric bill;
- Promote private sector interest in offering innovative new products and services;
- Provide financial incentive the customers, utilities, and the private sector to invest in energy efficiency;
- Impact load curve of customers; and
- Impact utility revenues.

These metrics reflect the Pecan Street, Inc.’s guiding principles, which focus on environmental improvement, creating value for the utility customer, and creating a sustainable business model for Austin Energy. This focus sets the Pecan Street demonstration apart from other more traditional approaches to smart grid implementation which focus more exclusively on a utility’s bottom line.

OBJECTIVE 1: CREATE AN INTEROPERABLE, STANDARDS-BASED TECHNICAL APPROACH

Implementing Pecan Street Inc.'s comprehensive smart grid demonstration project requires integrating a wide variety of technologies and functions from both the customer premise and the utility system. This means figuring out how to get all the "pieces of the puzzle," including smart appliances, smart meters, solar panels, customers, home area networks, the utility distribution system, and utility dispatchers to communicate with each other in a way that is meaningful to each component. Although the National Institute of Standards and Technology (NIST) is actively engaged in developing such interoperability standards, absent national standards defining this communications protocol, the plethora of companies working in this field developed different communications platforms for their smart grid components. Thus, Pecan Street [Inc.](#) will create an interoperable system, which facilitates effective communication among these components. Pecan Street [Inc.](#) is also striving to develop a smart grid system in which new technologies can be integrated with minimal additional engineering or tweaking.

THE HOME ENERGY MANAGEMENT SYSTEM (HEMS)

The key component to creating Pecan Street [Inc.](#)'s interoperable system is the Home Energy Management System (HEMS). Installed on the customer premise, the HEMS is a communications gateway, which enables different smart grid components to communicate with each other and provide meaningful information to the consumer. The HEMS will use the customer's home area network, or internet hub, to communicate with the different devices and potentially manage energy usage, based on customer preferences and price signals from Austin Energy. The HEMS does not allow the utility itself to directly control usage inside the home. Instead, the customer or a third party service provider will manage systems in the home through the HEMS. Using an open RFI process, Pecan Street Inc. identified four HEMS service providers to deploy and test their services. Best Buy

with Check-it, Intel, Sony, and Whirlpool will each deploy their proprietary HEMS systems in a discrete group of test homes.

INTEROPERABILITY AND STANDARDS

Pecan Street [Inc.](#) is following open platform principles in this endeavor. Much like open source software allows anyone to access the computer coding that drives the software in order to add new features or change the software to suit their needs, the technical specifications of Pecan Street Inc.'s open platform approach will be open to the public and industry at large. This will allow others to build on Pecan Street [Inc.](#)'s expertise and refine the system to suit an individual utility's system, or for technology developers to design their products to integrate easily with the Pecan Street system. Similar to the Internet, the neighborhood electric grid of the Pecan Street project will be an open platform that allows third parties to deploy their applications on the system. Pecan Street Inc. anticipates that this open source, plug and play approach will foster innovation and development of third party "applications" that complement the values of [the](#) project, such as reducing carbon emissions and water usage associated with electricity consumption.

A Standards Committee will evaluate and test the interoperability standards developed for the Pecan Street system. Reflecting the importance of interoperability, the Standards Committee is co-led by Bert Haskell, Pecan Street Inc.'s technology director and a former executive with the Microelectronics and Computer Technology Corp., and Dr. Robert Hebner, the director of University of Texas' Center for Electromechanics and the former acting director of NIST.²² Committee members will also actively engage in the NIST process, as well as the Institute of Electrical and Electronics Engineers (IEEE) Standards Association, to share lessons learned from the Pecan Street Demonstration Project and advance the interoperability of smart grid systems nationwide.

STANDARDS AND BEST PRACTICES FOR MANAGING ENVIRONMENTAL IMPACT

²² RFI pg 39

In keeping with its focus on the environmental impact of smart grid technology, Pecan Street Inc. also intends to develop standards and best practices for managing household environmental impact. These standards will eventually allow consumers to manage their energy use, not just to reduce costs or overall usage, but to also minimize the environmental impact of their electricity consumption. Pecan Street Inc. is supporting the Galvin Electricity Initiative's Perfect Power Seal of Approval (PPSoA). Galvin Electricity Initiative, a non-profit organization, created the PPSoA as a comprehensive, consumer-centric, data-driven system for evaluating power system performance. Launched in October 2011, PPSoA evaluates a microgrid's performance in four key areas: Reliability, Cost, Efficiency and Environment, and Consumer Empowerment. Pecan Street Inc. is the first institution to adopt the PPSoA metrics and will use its experience with the demonstration project to help refine the PPSoA for future users.²³ As such, each HEMS provider will be evaluated and must meet the PPSoA metrics.

OBJECTIVE 2: ESTABLISH A CYBER SECURITY PROTOCOL

In recognition of the importance of preserving participants' privacy and ensuring a reliable, secure electricity grid, Pecan Street Project will devote significant resources to ensuring this objective is realized. Austin Energy's Interoperability and Cyber Security Plan, already being implemented as part of its Smart Grid 2.0 efforts, will also be used for the Pecan Street demonstration project. The comprehensive approach ensures that, "cybersecurity will be addressed in every phase of the engineering lifecycle...including design and procurement, installation and commissioning, and the provision of ongoing maintenance and support."²⁴ Austin Energy anticipates developing a methodology and guidelines consistent with international standards ISO 9001 and ITIL certification. In addition, a third party will audit Austin Energy's equipment and system architecture before it is deployed to its customers and the Pecan Street demonstration project participants.

OBJECTIVE 3: DEMONSTRATE AND OPTIMIZE INTEGRATION OF CUSTOMER-SIDE SMART GRID SYSTEMS

²³ <http://perfectpowerinstitute.org/apply-seal/evaluate-projects-0>

²⁴ Proposal pg 41

The bulk of Pecan Street [Inc.](#)'s efforts will be dedicated to creating and optimizing a customer-focused smart grid system, which includes both utility scale distributed solar and storage along the distribution feeders serving the Mueller Community. Participating households will have the opportunity to test new smart grid technologies, such as smart appliances, HEMS services, electric vehicles, and distributed solar within the context of their everyday lives. Pecan Street [Inc.](#) will evaluate how these technologies impact utility operations, as well as determine what combination of pricing models, features, and incentives maximize the benefits of the technology. Pricing will be discussed in the next section.

OPEN INNOVATION STRATEGY

In May, 2011, Pecan Street Inc. issued a Request of Information seeking like-minded companies to participate in the demonstration project. The RFI included a summary of the challenges facing Austin Energy, ~~the~~ Pecan Street [Inc.](#)'s mission and core principles, and a description of the unique opportunity to participate in this demonstration project. Pecan Street [Inc.](#) sought companies to participate in three areas:

- Up to five (5) HEMS providers
- Core project assets, such as rooftop PV, electric vehicles and charging stations, home energy storage, and fuel cells
- Open innovation, such as LED lighting, vehicles powered by alternative fuels, web and smart-phone applications, smart appliances, and other distributed generation

As a result of this RFI, Pecan Street Inc. is partnering with the following companies:

- **HEMS Providers:** Best Buy with Check-It, Intel, Sony, and Whirlpool
- **Core Project Assets:**
 - Electric Vehicles: Chevrolet will provide 100 Chevrolet Volts for lease or purchase to participating residents.
 - Smart Appliances: Whirlpool and Best Buy's Geek Squad

- Rooftop Solar PV: SunEdison
- **Open Innovation:**
 - Home Solar Charging of EVs: SunEdison

Pecan Street Inc.'s open innovation strategy benefits the private partners and the demonstration project in several ways. First, the partnering companies will benefit by using the project participants as a real-world test-market for rapidly developing technology before it reaches the marketplace. Second, Pecan Street, Inc. is stretching its federal research funding by partnering with private companies to supply a significant amount of the technology it will deploy. In many cases, Pecan Street Inc. is providing an incentive or matching an existing Austin Energy incentive, instead of purchasing the technology outright. This also benefits the project by ensuring that participants are interested in and will use the technology, because they've had to invest their own resources in procuring it. Third, in selecting HEMS providers, Pecan Street Inc. identified several different companies with different HEMS platforms and services. Because this is still a developing technology, Pecan Street [Inc.](#) is providing an opportunity for the different service providers to refine and enhance their products, which will ultimately benefit the larger smart grid marketplace. This approach also avoids picking a "winner" before the market is fully developed.

THE PARTICIPANT EXPERIENCE

Pecan Street Inc. conducted a baseline survey of 100 homes for one year before deploying any technology. These homes were monitored without receiving any feedback about their usage and without the use of any energy management devices. This data will serve as the baseline against which the demonstration project results will be measured.

Pecan Street Inc. is recruiting households from the Mueller community and surrounding neighborhoods to participate in the demonstration project. The organization has developed relationships with the developer of the community, a neighborhood council, as well as early participants to market the project and recruit

participants. Most recruitment has taken place via community events and neighbor-to-neighbor outreach. As such, there is concern that the study group comprises early-adopters and those who are eager to demonstrate their “green” credentials. Pecan Street Inc. is cognizant of these issues and conducted a demographic survey of the study participants to determine how the study group differs from the general population. University of Texas researchers and Pecan Street Inc. will use this data to inform the demonstration project results and determine how replicable the results are.

Each participating household will be equipped with a HEMS provided by one of the selected companies. The HEMS will be the enabling platform to allow integration of other smart grid technologies. HEMS will also be capable of providing services such as home security, energy management, health care monitoring, home improvement, entertainment, and labor-saving services. Participating households will also be equipped with smart appliances provided by Whirlpool and other manufacturers.

Although participating households must make some commitments to Pecan Street [Inc.](#), they are free to use the technology as they wish. In order to participate in the demonstration project, households must commit to participate in the project for at least one year, purchase continuous broadband internet service during their participation, and provide Pecan Street Inc. and its service providers with access to their home in order to install the smart grid technology. In return, Pecan Street Inc. will provide households with the necessary technology to participate in the demonstration project, including the HEMS system and smart appliances. Pecan Street [Inc.](#) will divide its participating households into four discrete groups, with each group receiving a different HEMS technology. Select homes will also receive rooftop solar devices, and others can choose to purchase a Chevrolet Volt at a reduced price through the project. Once the technology is installed, Pecan Street [Inc.](#) will monitor how the households interact with and utilize the new technology.

ROOFTOP SOLAR

The Austin Energy PowerSaver program offers its residential customers a financial incentive for installing rooftop solar PV. In order to qualify for the rebate, homes must meet established energy efficiency criteria, the solar panels must face south (with some exceptions for east or west orientation), and the system must be installed by an approved contractor. The standard rebate for qualifying equipment is \$2.50 per watt (nameplate), with an additional incentive up to a total of \$3.125/watt for qualifying equipment at least sixty percent manufactured or assembled within the Austin Energy service area.

Rather than invest its limited budget in purchasing and installing PV equipment for a small number of study participants, Pecan Street Inc. is capitalizing on Austin Energy's existing incentive by providing an additional \$0.50/watt for south-facing panels and \$0.75/watt for west-facing panels to its demonstration project participants. As a result, more than 165 participating homes have installed PV systems. An additional 40 non-participating homes in the same neighborhood have installed PV through the Austin Energy program alone, resulting in more than 1 MW of installed PV in the Mueller neighborhood and surrounding community. Pecan Street Inc. believes this is the densest deployment of retrofit (installed on existing homes, not as part of new construction) solar PV in the country.

PV systems are usually installed with the panels facing south, to maximize electricity generation. However, Pecan Street Inc. believes that although west-facing panels produce slightly less electricity overall, the production matches the demand curve more closely than output from south-facing panels. As a result, it hypothesizes that west-facing panels will have a greater impact on mitigating peak demand than will south-facing panels. Over the course of the demonstration project, Pecan Street Inc. will monitor and analyze the impact of both south and west facing PV installations to determine whether its hypothesis is correct.

Customers with a solar system may enroll in Austin Energy's net-billing program. Each kilowatt hour generated, up to the amount consumed in a given month, is credited the full retail rate (8.065 cents/kwh up to 500 kwh and 12.875 cents/kwh for more than 500 kwh), which includes the base energy rate, plus a fuel adjustment charge and transmission service adjustment rider. Each additional kilowatt hour above the amount consumed is

credited to the customer at the adjustable fuel charge rate (3.615 cents/kwh in 2012), not the full retail rate.²⁵ Thus, these customers receive only a modest incentive to make additional energy efficiency improvements in their homes or to install a larger PV system, because they do not receive the full benefit of the costs avoided by the utility. Pecan Street Inc. will explore how different pricing schemes, including paying the full retail rate for net generation each month impacts both the utility's bottom line and the customer.

Austin Energy is in the process of revising its entire rate structure, including the way its solar generating customers are compensated. In its December 2011 rate proposal, Austin Energy staff recommend crediting all residential solar PV generation at an annually calculated, *value of solar rate* (12.8 cents/kWh in 2011).²⁶ At the same time, these residential customers would pay the applicable retail rate for all electricity consumed.²⁷ Austin Energy expects the proposed changes to provide these customers, "a more fair and equitable rate" while maintaining the incentive to conserve through continuing to pay an inclining rate for electricity consumed.²⁸ Pecan Street Inc. is waiting for Austin Energy to complete its rate case before the Austin City Council to determine what rates its participants will pay. It may simulate this proposed rate to demonstrate its effect to customers, however the existing rates will be used to determine actual utility bills.

²⁵ See Electric Rate Schedule and <http://www.austinenergy.com/About%20Us/Rates/Fuel%20Adjustment%20Factors.htm>. Calculations assume standard summer residential rate, monthly consumption equal to 1,000 kWh, and use 2012 fuel adjustment factor.

²⁶ Austin Energy Rate Analysis and Recommendations Summary Report, December 19, 2011 pg 25

²⁷ Under the proposed rate, residential customers would pay in inclining rate per kwh consumed. The proposed residential rates are discussed in more detail in section X.

²⁸ Pg 185 full rate proposal

ELECTRIC VEHICLES

Participating households will have the option of purchasing or leasing a Chevrolet Volt at a reduced price. Chevrolet agreed to make 100 Volts available to participating households, and Pecan Street Inc.



is providing a financial incentive of \$7,500 towards the purchase of the vehicle.²⁹ When combined with the federal tax incentive currently available, the purchase price for a new Volt will be reduced to approximately \$25,000 for demonstration project participants. These participants may also choose to install a Level 2 home-charging station (220/240V) free of charge. Austin Energy's pilot Plug-In Partner's program provides a 50% rebate (up to \$1,500) on the installation of a level 2 in-home charging station, and Pecan Street Inc. is covering the remaining 50% of the cost for these project participants.

SunEdison will provide 150 rooftop solar installations, which will provide solar-charging services to most of the Volt-owners. Some Volt-owners will also receive in-home battery storage technology. All of the solar installations will integrate with the HEMS services provided by the participating companies. Pecan Street Inc. will monitor and evaluate the participants' home-charging and public-charging (via OnStar) patterns.

Austin Energy provides public charging through its Plug-In EVERYwhere network. It currently has 116 charging Level 2 stations at 57 locations throughout its service territory.³⁰ Access to the stations is gained by

²⁹ A smaller, \$3,000 incentive is available for households that choose to lease instead of purchase the Volt.

³⁰ <http://www.austinenergy.com/About%20Us/Environmental%20Initiatives/plug-in%20Partners/index.htm>

joining the network for a 6-month fee of \$25, which provides unlimited charging at the public stations. Austin Energy supplies the electricity to these charging stations with its GreenChoice renewable energy. Pecan Street Inc. project participants may also sign up for this program and share their charging habits with project researchers via OnStar.

Pecan Street Inc. will study a number of factors related to electric vehicles. Researchers will document how participants charge and use their electric vehicles, as well as how they respond to different price signals. This will help inform future rates for electric vehicle charging both at home and at public charging stations. Level 2 home charging stations are expected to strain existing transformers in some areas. Pecan Street Inc.'s high concentration of electric vehicle owners, utilizing Level 2 home-charging stations, will give researchers the opportunity to see if these problems materialize. The researchers will also experiment with different price signals to encourage charging behavior that avoids overloading the local transformers. Pecan Street Inc.'s research will also document the environmental benefits of switching to electric vehicles in the Austin Energy service territory, as well as test the ability to charge the Volt using solar PV technology.

HOME ENERGY STORAGE

Pecan Street Inc. will provide up to 50 participating homes with energy storage technology. The details of this aspect of the project are still in development. However, the storage technology will be installed in combination with other project technology. For example, some homes with a Volt will receive the storage technology, as will homes with solar PV, as will homes with a combination of Volt and PV technology. Other homes without any additional technology will also receive the storage technology.

COMMERCIAL-SCALE SOLAR INSTALLATIONS

Pecan Street Inc. plans to support a community solar installation in the Mueller neighborhood. However the details of this aspect of the project are not finalized. Pecan Street Inc. expects to partner with Austin Energy to leverage existing resources.

OBJECTIVE 4: DEPLOY AND COMPARE DIFFERENT PRICING MODELS

While installing smart grid technology is key to realizing Pecan Street Inc.'s goal of demonstrating tomorrow's energy system, designing and deploying effective pricing models is crucial to its success. Pecan Street Inc. will develop several different pricing models, including dynamic pricing, decoupled pricing, and net metering to test how participants respond to different pricing structures and signals. These pricing models will be evaluated based on their ability to incentivize additional investment in smart grid technology without jeopardizing a utility's revenue stream.

Pecan Street Inc. anticipates developing additional pricing features that can be applied across the pricing models. Pricing features will be layered on top of the various pricing models to further incent desired energy consumption patterns. The pricing features will be compatible with all pricing models, and will include information such as real-time usage data, carbon impact information, and peer to peer comparisons of energy consumption or patterns. Participants will receive this information from the HEMS systems, as well as an internet information portal. Pecan Street Inc. is developing different internet portals, which will be tested for their efficacy in shifting participant behavior. Participants will also be able to program their HEMS system to respond automatically to price or other signals from Austin Energy and Pecan Street Inc. Pecan Street [Inc.](#) will use the data collected from the demonstration project participants to determine the most effective combination of pricing models and features.

PRICING MODELS

Traditional utility rates tie the recovery of the cost of providing electricity service to a flat cost per kilowatt hour consumed. This is calculated based on the expected sales of electricity. Pricing models will range from traditional volumetric pricing, in which a customer pays an established price per kilowatt-hour, to non-volumetric pricing, in which the customer pays a flat-fee for electricity service.

OBJECTIVE 5: CONSTRUCT AND OPERATE A DEMONSTRATION HOUSE AND LABORATORY

Originally conceived as a demonstration home and laboratory, Pecan Street Inc. is now constructing the Pike Powers Commercialization Laboratory. Pecan Street Inc. partnered with the National Renewable Energy Laboratory (NREL) to develop the technical specifications for the Lab, which will provide a neutral, third-party facility in which multiple utilities and vendors can work collaboratively alongside University of Texas and NREL researchers to conduct real-world smart grid research.

PIKE POWERS COMMERCIALIZATION LABORATORY

The Pike Powers Commercialization Laboratory (Lab) will be the nation's first nonprofit smart grid research lab. Located within the Mueller community, the lab will promote research, commercialization, and educational opportunities for both University of Texas students and faculty, and start-up companies from the Austin



Pike Powers Lab under construction in the Pecan Street Project's Mueller neighborhood in Austin, Texas.

Technology Incubator. -The Lab is scheduled to open in 2012/2013. -The

mission of the Pike Powers Commercialization Lab is to serve as an elite, industry-caliber facility where Pecan Street Inc. and University of Texas students and researchers can collaborate with the private sector on cutting-edge applied research in consumer-focused smart grid, wireless, IT, clean energy, and healthcare applications. The Lab will provide commercialization opportunities, including the ability to test, refine, and demonstrate

products to commercialize new technologies, and bring advanced products to market, such as electric vehicle chargers with integrated demand management and energy monitoring. The Lab will also provide opportunities to conduct field testing, establish interoperability among smart grid-enabled appliances, measure the impact of new equipment on the grid, and test prototype devices for standards compliance.

In 2012, Pecan Street [Inc.](#) ~~will~~ hosted its first weeklong Commercialization Bootcamp, at which selected UT students and aspiring entrepreneurs ~~will~~ spent a week working with the lab's team and advanced testing equipment to develop the skills necessary to create successful companies. Pecan Street [Inc.](#) also anticipates developing educational materials to teach policymakers about smart grid technology and energy conservation, as well as materials on commercialization and testing for smart grid entrepreneurs.

The three-story Lab will serve as both a research and outreach facility. The first floor will be open to the public, including education space and opportunities for general outreach to the community. The second and third floors will contain the research lab, including a "home" on the third floor. This third floor home will be capable of simulating multiple home environments. Before deploying HEMS and smart appliance technology into participants' homes, the technology will first be installed and tested in the home laboratory. This will give participating companies an opportunity to test their new and developing technology before it is deployed to consumer homes to ensure a positive experience for the study participants.

OBSERVATIONS AND CONCLUSION

Since its inception, the Pecan Street Inc. Energy Internet Demonstration project has received positive coverage from both the popular and industry media outlets. Much of this praise is well-deserved, and the results of Pecan Street Inc.'s research will likely play a positive role in shaping the future of the smart grid experience across the country. With its focus on the customer's experience, maximizing environmental impact, and minimizing the impact on utility revenue streams, Pecan Street Inc. is addressing the challenges facing every utility in the U.S. Although the full results of the study are several years away, Pecan Street Inc.'s demonstration project offers several early lessons.

DEMONSTRATION PROJECTS ARE CRITICAL TO ADVANCING CUSTOMER ACCEPTANCE OF SMART GRID

In some parts of the country, customer opposition to smart grid technology and smart meters in particular, is delaying the roll-out and full implementation of the utility-side of the technology. In others, customers lack a full appreciation of the opportunities presented by smart grid, and adoption of customer-side technology is slow. The Pecan Street Energy Internet Demonstration project and others funded by DOE will play a critical role in documenting real customer experiences with smart grid technology, as well as proving the technology effective. Demonstration projects are important to identify challenges, develop workable solutions, and document the benefits of the technology. The lessons learned and best practices identified by Pecan Street Inc. over the next several years will provide a solid foundation for other utilities to implement smart grid on a larger scale. In addition to the technical solutions identified by Pecan Street Inc., the participant experiences will also need to be shared and disseminated.

In order to justify the costs of smart grid technology, most utilities have focused on the business case for smart grid and used long-term operational savings to justify investments. This focus on saving money has left many customers wondering, "What's in it for me?" Pecan Street Inc.'s focus on the customer experience and its attempts to open the historically closed utility system to innovation and new market actors will help develop answers to that question. Utilities across the country would be wise to examine Pecan Street Inc.'s results and apply the answers in their own service territories.

PUBLIC-PRIVATE PARTNERSHIPS SPUR INNOVATION

The Department of Energy's American Recovery and Reinvestment Act funds support 16 Smart Grid Regional Demonstration Projects in nine states. The government's \$433,216,568 investment was matched with \$442,927,439 in direct private-sector funding, although indirect private investment is likely to bring this total even

higher.³¹ For example, Pecan Street Inc. leveraged its initial project funding to attract additional private investment in the form of HEMS systems for deployment and testing, and successfully encouraged project participants to invest in smart grid technology by matching existing incentives for solar PV and electric vehicles. DOE's grant funding also supported the development of the Pike Powers Commercialization Lab, which will conduct smart grid research and support commercialization of new technologies long after the initial grant funding is spent. This kind of public-private partnership is needed to drive innovation and advancement of smart grid technologies. More funding for demonstration projects, particularly those aimed at maximizing the customer experience and demonstrating a fully integrated smart grid system, are needed to ensure that the benefits of smart grid are fully realized.

COMMUNITY APPROACH TO ENERGY-PLANNING IS A MODEL FOR OTHER COMMUNITIES

Pecan Street Inc. grew out of an effort to transform the energy system in Austin, as well as revitalize the community. With its focus on capturing environmental benefits, ensuring a positive customer experience, sustaining utility revenues, and committed community engagement, Pecan Street Inc. is a model for other municipal utilities facing similar challenges. Pecan Street Inc.'s community engagement in the planning process, as well as the implementation of the demonstration project can also serve as models for utilities engaged in smart grid implementation. Neighbor-to-neighbor education and involvement, as well as efforts by community groups have driven much of the participation in the project. Although the Mueller community likely comprises some "early-adopters" inclined to embrace smart grid technology, the project's use of community engagement has reached others who wouldn't necessarily seek out the opportunity to participate in the demonstration project. The engagement process has built community interest and support for the technology that will be tested and demonstrated through the project, and will likely lead to greater support for the changes in rate structure and incentives Austin Energy will make in the future.

³¹ <http://energy.gov/sites/prod/files/SGDP%20Awards%20Combined%20%202011%2011%2008%201353.pdf>

The Pacific Northwest National Laboratory estimates that smart grid technology can lead to a 12% reduction in carbon emissions in 2030. However this estimate assumes aggressive adoption of the technology across the country. The Pecan Street Inc.'s Energy Internet Demonstration Project is embracing this possibility and attempting to design and implement an electricity system capable of capturing and maximizing these environmental benefits. More study and development will be needed, however the results of Pecan Street Inc.'s work will provide an excellent starting point on which to build future smart grid implementation across the country.

The first phase of the project for the most part occurred in 2010 and into January 2011 and involved brainstorming ideas to figure out what the project should achieve and what needs to happen to reach its goals. The brainstorming session among the Project partners produced four categories of recommendations: 1) Austin Energy Recommendations, 2) Water Management Recommendations, 3) Public Policy Recommendations (beyond Austin Energy), and 4) Economic Development and Job Training Recommendations.

1) Austin Energy Recommendations

As a crucial player in the success of the Pecan Street Project, Austin Energy received the majority of recommendations that were developed by the brainstorming sessions. First off, it was determined Austin Energy should “quickly deploy additional renewable energy resources, pilot test additional system improvements and develop the programs that will be needed to prepare Austin Energy for coming changes in electric technologies, protect against fossil fuel price spikes and help maintain the region’s leadership in clean technology.”³² In order to deploy the 300 megawatts of clean distributed energy throughout Austin Energy’s grid system, the Project recommends Austin Energy deploy at least “100 megawatts of distributed renewable energy that would be owned and financed by the utility” and about 200 megawatts coming from distributive generation financed and owned by private residences or businesses³³.

In order to meet this recommendation, Austin Energy should deploy 20 MW of new distributed renewable resources through a mixture of distributed technologies by 2012³⁴. The Phase Two Request for Information can be used to encourage applicants to propose several different distributive technologies and deployment strategies. This method should also help keep prices competitive. After 20 MW of distributed

³² The Pecan Street Project: Working Group Recommendations, pg. 19, March 2010

³³ Id.

³⁴ The Pecan Street Project: Working Group Recommendations, pg. 19, March 2010

generation have been implemented and analyzed, Austin Energy should work to quantify the true value of distributed generation, i.e. an accurate and exhaustive analysis of the true costs and benefits. Once the “true” value of distributed generation has been established, Austin Energy should continue to deploy distributed renewable energy until it reaches the 100 MW target³⁵.

Pecan Street Project partners also encourage Austin Energy to conduct specific pilots that quantify the efficacy, cost, and potential generation of additional local renewable energy sources to help further the renewable distributed energy deployment and testing³⁶. Some recommended pilots included up to 2 MW of co-op solar, solar shades at the Austin-Bergstrom Airport parking facilities, micro-wind generation on high-rise buildings, geothermal heat pumps, big-box rooftop solar, and the Fayette Power Plant co-firing with bio-mass.

Austin Energy should also expand its demand response program³⁷. The utility already has an impressive record with energy efficiency and demand response programs however, expanding the demand response program could help offset the negative impacts of intermittent energy sources, wind and solar. Without storage capabilities for these energy resources or reliable back up power, wind and solar will maintain a bad reputation as unreliable. Austin Energy can use demand response to decrease these issues by increasing its ability to control the load during peak times³⁸. Demand response would take the place of back-up power. While Austin Energy is using demand response to back up wind and solar power, it should be researching and testing energy storage for these power resources³⁹. The University of Texas (UT) presently conducts “world-class research in energy

³⁵ Id at 20

³⁶ Id.

³⁷ Id.

³⁸ The Pecan Street Project: Working Group Recommendations, pg. 21, March 2010

³⁹ Id.

storage” and it should connect with Austin Energy and expanded to explore how different types of storage interacts with variable generation sources⁴⁰.

The partners also recommended to Austin Energy that it needs to develop Smart Grid testing and pilots. The main way to achieve this is to launch a residential and commercial smart grid demonstration project. This recommendation had already been acted upon by the Pecan Street Project through its ability to receive funding for the smart grid demonstration project at Mueller Community. In order for this demonstration to be successful, partners figured a user interface must be designed and tested, and the project must build a demonstration house and business to allow for onsite testing and measurement of future technologies as well as public education⁴¹. Austin Energy was also encouraged to promote plug-in electric vehicle penetration as a potential revenue source and method for reducing carbon emissions. In accordance with the goal to make Austin Energy’s grid system a “test lab” partners also thought Austin Energy should establish an open source on-grid testing program⁴².

To protect and prepare Austin Energy from future changes, Pecan Street Partners recommended the utility change its rate design by unbundling rates, design a new solar program with wholesale peak rates, and moving to a dynamic pricing model⁴³. In conjunction with a new rate design, Austin Energy is encouraged to create a new business model by expanding energy services, developing new revenue model options, such as a “flat-rate”⁴⁴ business model, as well as encouraging a third party electric services market – similar to the App Store designed by Apple.⁴⁵

⁴⁰ Id.

⁴¹ The Pecan Street Project: Working Group Recommendations, pg. 23, March 2010

⁴² The Pecan Street Project: Working Group Recommendations, pg. 23, March 2010

⁴³ Id.

⁴⁴ A “flat-rate” business model would provide customers access to energy at a set monthly fee in exchange for participation in new efficiency and energy management programs. See The Pecan Street Project: Working Group Recommendations, pg. 24, March 2010

⁴⁵ The Pecan Street Project: Working Group Recommendations, pg. 24-25, March 2010

2) Water Management Recommendations

Because water treatment and transport makes up a large portion of Austin's electricity consumption, Pecan Street Project partners recommend Austin Energy integrate water planning into its energy management plan⁴⁶. Water-related recommendations include pricing water to spur conservation and load shifting, installing and testing smart water meters, providing more usage information to water consumers (similar to electricity usage information provided in the smart grid design), cross-training city water and energy auditors, reducing landscape water use, and establishing city water use targets⁴⁷.

3) Public Policy Recommendations (Beyond Austin Energy)

In order for the Pecan Street Project to affect change outside the Austin, TX metroplex it must establish and pursue public policy changes, otherwise it loses the ability to replicate its findings outside the Project⁴⁸. Some of the public policy platforms Project partners encourage include requiring solar-ready construction in building codes, requiring lighting controls, adopting performance based building codes, using solar and other efficient water heating, creating construction efficiency incentives, modifying municipal lighting, spurring multi-family PEV construction, enacting solar financing legislation, launching smart strip partnership with cable and electronic providers, and designing and launching a regional purchasing partnership⁴⁹.

4) Economic Development and Job Training Recommendations

Economic development is one of the Pecan Street Project's guiding principles and the brainstorming session came up with several recommendations for furthering this objective as the Project was implemented. These recommendations include expanding start-up and incubation support of companies working on

⁴⁶ Id at 25

⁴⁷ Id at 25-26

⁴⁸ Id at 26

⁴⁹ Id at 27-28

technologies for the project, developing local preference criteria for smart grid procurement, coordinating marketing and incentive efforts, pursuing a new energy consortium focused on the technology, policy, and intellectual property that will drive the evolution of the system, developing standard green job training curricula, and consolidating and coordinating green job efforts.

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