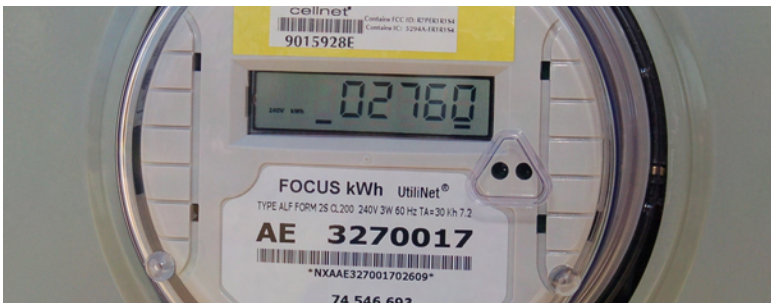
THE PECAN STREET PROJECT

WORKING GROUP RECOMMENDATIONS



AUSTIN, TEXAS • MARCH 2010

The Pecan Street Project
Introduction

Imagine that it's 2030. And imagine that our city – Austin, Texas – is leading the evolution of America's energy delivery system.

Residents and business owners across the city are seizing new opportunities to manage their energy use, enabled by modifications to Austin Energy's system that allow for a real-time, two-way flow of energy and data. Customers who install solar or other renewable distributed generation equipment at their homes or businesses sell their excess power seamlessly back to the grid. Users are monitoring and managing their use and consumption online and on their phones as easily as they can pay bills or buy a movie ticket.

Austin Energy has transitioned to a new pricing system that not only allows customers a real-time gauge of the true cost of energy, but also has helped the utility more aggressively control peak demand on Austin's hottest days. It has stayed in the black while encouraging customers to use less energy. Customers are using more tech products than ever before, but their use is more efficient.

New financing options are available to help commercial and residential customers invest in renewable energy. "Going solar" now costs less per month than the utility bill savings it produces. Austin now has two net-zero energy neighborhoods; their contribution to the Austin grid completely offsets what they consume from it.

The City has implemented building standards and planning guidelines based on energy performance. It has integrated grid management of the electric and water utilities, increasing the efficiency of both.

Austin Energy has not built or expanded a fossil fuel power plant in nearly 30 years. It has reduced its carbon output and other air pollutants beyond targeted goals. Widespread deployment of smart water systems has helped customers significantly reduce water usage. A growing portion of the energy used by Austin Energy customers is generated within the city limits and is emissions free, and the utility now has a firm plan to retire all its fossil fuel generation facilities. The utility's timing was good – it began to wean the region from fossil fuels just before their costs skyrocketed (again).

In the process, area jobs were saved by repurposing billions in semiconductor investment

This report is a narrative of the deliberations, assumptions, conclusions and recommendations of the Pecan Street Project team. It is by no means a comprehensive day-to-day reporting of every idea, every discussion or every topic covered in the last year. Rather, we hope it is viewed as a strong articulation of the Pecan Street Project's objectives, rationale and shared opinion about the steps Central Texas should take to lead in the creation of a strong renewable energy economy and to protect itself against the inevitable changes in the energy market.

into renewable energy production capacity. Thousands of new jobs have helped established Austin as the clean energy capital of the U.S. The University of Texas leads the nation in clean energy patents and startup companies. And Austin is providing a sustainable clean economy roadmap to cities and utilities around the world. The phrase "The Austin Model" – once used to describe how Austin built its semiconductor industry in the 1980s – is now synonymous with "clean energy" and "smart grid."

If Austin's semiconductor industry made history in the 1980s, what this city has accomplished since 2010 has rewritten it altogether.

This scenario is not as far-fetched as it sounds.

In fact, most energy experts think that's where the world is headed. Getting there might not require a total reinvention of today's energy system, as some have suggested, but rather a thoughtful and purposeful evolution that is driven as much by utilities and the communities they serve as by the changing world and technology.

The Pecan Street Project was formed to accelerate that evolution in Austin.

Change is Coming
Opportunity and Risk

Since its public launch in December 2008, most conversations about the Pecan Street Project have focused on the opportunities presented by leading the country's energy evolution: the opportunity to reduce carbon; the opportunity to jumpstart widespread renewable generation; the opportunity to start companies, create spinoffs, create jobs.

Indeed, the opportunities are enormous. Most countries and cities realize that change is coming to the energy world, whether the cause is a response to global warming, global economics or simply the evolution of technology. Even before the stimulus program injected billions of dollars into the American clean energy industry, significant private investment had already begun flowing. Globally, the race toward a new energy future is underway.

Because of Austin's history in the technology industry – specifically the significant collaborative effort from which computing-research giants MCC and SEMATECH emerged in the 1980s, kicking off a generation of semiconductor growth in Austin's "Silicon Hills" – the Pecan Street Project team immediately recognized the feasibility and potential payoff of Austin playing a leadership role.

"The environmental benefits of leading in clean energy are enormous," said Pecan Street Project founding partner Isaac Barchas of UT's Austin Technology Incubator. "But to be honest, what got everyone so excited about this project early on was that it could be an even bigger economic payoff for Austin. At a time when Austin's technology industries were clearly suffering, charting a path toward new economic opportunity was our primary driver."

But while the opportunities are great, the risk of inaction might be even greater.

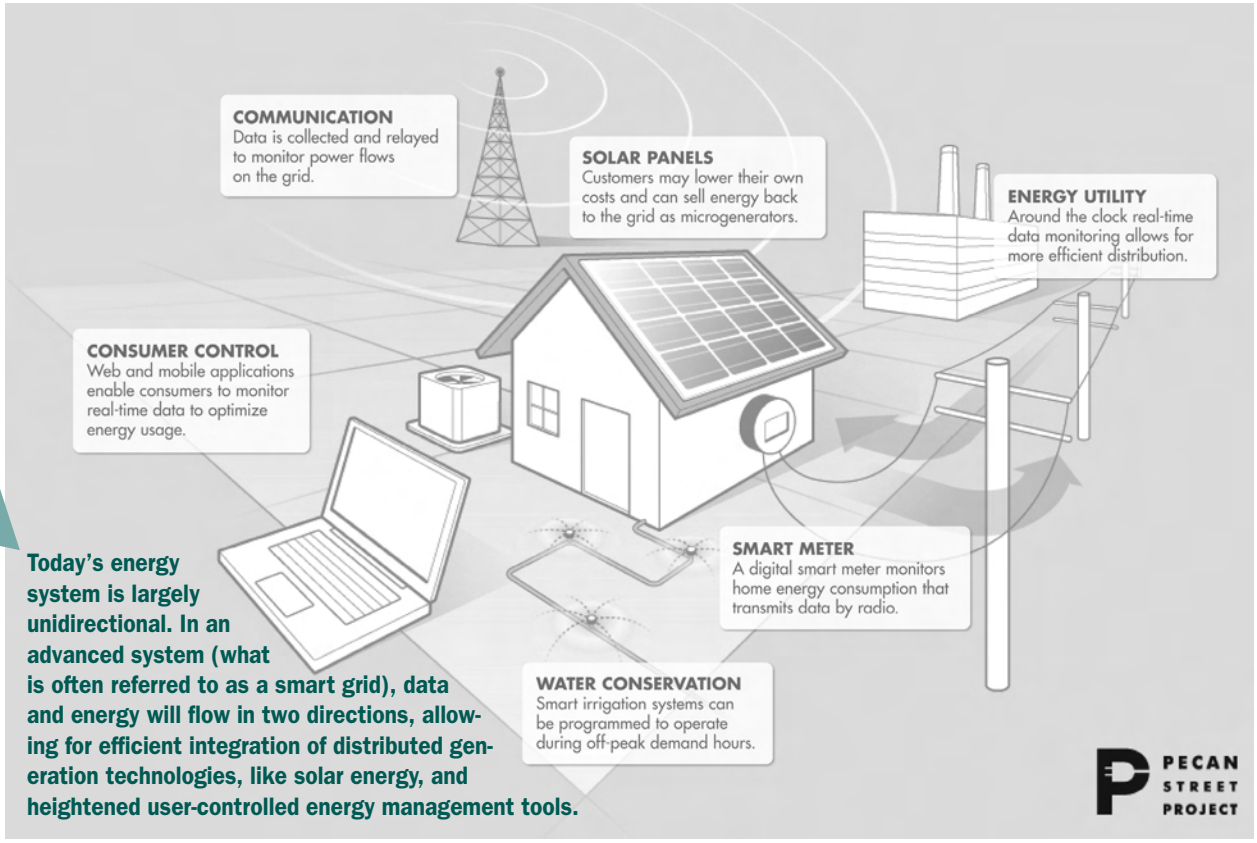
"Change is coming in the electricity world," said Pecan Street Project founding partner Jim Marston of Environmental Defense Fund (EDF). "Soon, the cost of installing solar will be less

Are we prepared for the future?

Two of the most likely features of a new energy distribution system are heightened user-controlled power management and increased distributed generation. How well prepared is our energy system for these new features? Austin is ahead of many cities, but it is not yet where it needs to be to implement many of the more advanced concepts.

Today's system enables customers to adjust their consumption by modifying their behavior – they can program thermostats, automate lighting or use the delay feature on major appliances. But they remain blind to the "energy return" on such behavior. When energy usage is reduced, customers don't see the cost benefits until their electricity bill arrives. And many important behavior changes – such as running the dishwasher or washing machine during off-peak periods – help Austin Energy manage peak demand but do not provide the user any cost benefit because electricity costs the same all day. So, some of the pieces of tomorrow's active management energy system are being implemented, but there's really no such thing as market-driven user-managed power. Not yet, anyway.

In addition, significant challenges emerge when a large amount of distributed generation, such as rooftop solar, is introduced into the current system. Today, a home or business owner can install solar to supplement his property's energy purchases and he is reimbursed by Austin Energy for any excess power that is "pushed" back to the utility's grid. But the system's current pricing structure and two-way capability is, by Austin Energy's own account, temporary and not scalable. As solar generation and "smart appliances" become more prevalent, the utility's business model, hardware and data management systems will have to be modified to take full advantage of new technology and to make such investments worthwhile for the broader consumer base.



Today's energy system is largely unidirectional. In an advanced system (what is often referred to as a smart grid), data and energy will flow in two directions, allowing for efficient integration of distributed generation technologies, like solar energy, and heightened user-controlled energy management tools.

Founding Partners

than the energy savings it will create, and customers will rightfully demand that their excess power be purchased by the utility. A market of smart appliances will mature, and customers will demand that their utility is compatible. Carbon legislation is coming, and the environmental cost of fossil fuel electricity will finally be included in rates. And even if all of this weren't coming, we all know that energy prices are going to go up. The energy market is a very powerful thing, and it is going to be very, very different 20 years from now than it is today."

Ironically, the transition to cleaner energy could have a devastating impact if Austin is not prepared.

"Our city budget is closely tied to a utility whose revenue is a direct result of how much energy it sells," said Pecan Street Project founding member Roger Duncan, former general manager of Austin Energy. "That business model is aging out, and if Austin isn't prepared for a future that promotes and rewards more efficient energy use, we're going to suffer financially far sooner than we'll suffer environmentally."

So, talking about the potential and opportunity voiced by the Pecan Street Project is valid. But opportunity is only half the story, and some involved in the project might argue it's not even the more challenging or important half.

The commitment made by the City of Austin, Austin Energy, EDF, UT and the Greater Austin Chamber of Commerce to address this issue proactively – in effect turning a great challenge into a great opportunity – reflects a prudent and thoughtful civic responsibility to preserve Austin's quality of life and provided the Pecan Street Project a far more urgent sense of purpose. That commitment must not end with the delivery of recommendations in this report.

Project History and Timeline

Throughout the spring of 2008, Brewster McCracken, then a member of the Austin City Council, hosted regular breakfast meetings with Isaac Barchas, the director of UT's Austin Technology Incubator, and Joel Serface, then-director of UT's Clean Energy Incubator, to talk about ways to better align the City's and UT's economic development efforts. The collaboration had resulted in the City's participation in ATI's Wireless Technology Incubator in 2005 and the creation of the ATI Bioscience Incubator in 2007. This model has served Austin well for a generation – since a broad coalition of stakeholders, including the University, the business community and elected officials joined forces to build Austin's semiconductor industry.

Eventually, the conversations turned to the clean energy industry. "If the coming changes in energy generation and distribution were as undeniable as they seemed," McCracken said, "we figured that Austin could be a catalyst like we were with semiconductors."

So one spring morning in 2008, over coffee at Austin Java, the three colleagues decided to invite others into the discussion and see what would transpire.

And the Pecan Street Project was born.

The project's initial partners – the City, Austin Energy, UT and the Greater Austin Cham-

Corporate Partners

Pecan Street Project Timeline

Spring 2008	City of Austin and UT's Austin Technology Incubator begin discussing a clean energy economic development collaboration.
Summer 2008	Informal workgroups develop rough parameters for the project and recruit local experts, including Environmental Defense Fund (EDF).
September 2008	EDF officially joins the effort, rounding out the Founding Partners with the City of Austin, Austin Energy, the University of Texas and the Greater Austin Chamber of Commerce.
Fall 2008	EDF recruits corporate partners to provide staff and expertise.
December 2008	Pecan Street Project and its founding and corporate partners are announced at a Clean Energy Venture Summit press conference.
January 2009	Project volunteers gather for the first work session at SEMATECH, break into workgroups and begin their research and deliberations.
Spring 2009	Research and deliberation continue, remotely and at two more Austin work sessions.
July 2009	Workgroups submit internal reports and the founding partners begin formulating recommendations.
August 2009	Founding partners create Pecan Street Project, Inc., a non-profit organization, to pursue the project's mission beyond the release of the recommendations.
August 2009	Pecan Street Project, Inc. coordinates the submission of an application for Department of Energy stimulus funding for a smart grid demonstration project at Austin's Mueller community.
November 2009	The Department of Energy awards the Pecan Street Project, Inc. $10.4 million for the smart grid demonstration project at Mueller.
January 2010	Pecan Street Project, Inc. hires Brewster McCracken as executive director.
January 2010	Pecan Street Project, Inc. receives a $297,000 Department of Commerce economic development grant through the Capital Area Council of Governments (CAPCOG) to fund a portion of the organization's operating expenses.
March 2010	Recommendations resulting from research and deliberations of workgroups are released to the public.

ber of Commerce Chamber – enlisted Environmental Defense Fund (EDF) to manage an exploratory effort to examine two basic questions: "How can the Austin community accelerate the evolution of its energy delivery system?" And "Can we do it in a way that creates new economic opportunities for Central Texas?"

EDF, in turn, recruited a host of corporate partners – from smart grid pioneers and renewable energy leaders to software and hardware companies – to help work through the issues that would be addressed. Each partner agreed to provide employees who could commit to the project's workload and timeline. By the time the full group held its first work session at SEMATECH in January 2009, nearly a dozen companies had joined.

The team's core objectives were to inventory the best options for reforming the energy distribution system, identify and address the technology, economic and policy challenges to implementing those options, and offer Austin Energy as a test lab for entrepreneurs and corporations whose technology will power the new system.

What followed were nine months of research and analysis, conference calls, video conferences and group meetings in Austin. Each team submitted interim reports to EDF in May 2009, and following feedback and direction from the founding partners, each team submitted final internal reports in July.

In late summer, representatives from the founding partners and other team members convened to consolidate the various reports and develop a range of recommendations for the City, Austin Energy and the many community interests and leaders whose participation will dictate the success of the Pecan Street Project's original vision.

This collaborative research and visioning exercise, conducted through 2009 and resulting in

Pecan Street Project Working Groups

Early in the process, participants were divided into several working groups (teams) that would study and report back on specific areas of focus:

1. **Distributed Generation/Renewable Energy**
2. **Low-Tech/Low Emission Options**
3. **Energy Efficiency, Demand Response and Load Measurement and Control**
4. **Networked Storage and Transportation**
5. **Water Conservation**
6. **Operations and Systems Integration**
7. **New Utility Business Model**
8. **Customer Interfaces and Impacts and Behavioral Economics**
9. **Legislative and Regulatory Requirements**
10. **Economic Development and Technology Commercialization**
11. **Workforce Training**

The Pecan Street Project: What's in a name?

If corralling expert opinions about what the energy system of the future should look like sounds challenging, try finding agreement on a name for the project. The partners were trying to name an idea whose scope wouldn't be defined until they finished Phase One.

The first round of corporate-sounding candidates was ruled out because each name seemed to predict where the project would end up (PowerNet, FutureGrid, etc.). So the preliminary working group decided to pick an undeniably familiar but not-yet overused local Austin icon. Pecan Street emerged early because of its symbolic link between Austin's economic past and future.

Located in the heart of the city, Pecan Street and Congress Avenue were (and still are) the city's primary downtown commercial arteries. Pecan Street was eventually renamed 6th Street, which is now synonymous with Austin's self-proclaimed title of "Live Music Capital of the World." After 150 years, Pecan Street remains at the core of the city's identity. Because this project began as an economic development effort, it seemed appropriate to keep "Pecan Street" at the heart of what could drive the next 150 years of Austin's economy.

this report of recommendations to the Austin community, became known as Phase One of the Pecan Street Project.

During this process, it became apparent to team members that the work of the Pecan Street Project should continue beyond the release of its recommendations. In August 2009, members of the founding partners joined together to create a separate non-profit corporation called Pecan Street Project, Inc., with a board consisting of representatives from EDF, UT, the Greater Austin Chamber of Commerce, Austin Energy and the City of Austin. The organization coordinated the successful application for $10.4 million of Department of Energy stimulus funding for one of the first Pecan Street Project recommendations – a smart grid demonstration project at the Mueller community. On January 1, 2010, the new organization hired an executive director, Brewster McCracken.

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Project Guiding Principles

The over-arching vision of the Pecan Street Project is to re-imagine Austin's energy distribution system in a way that can support and accelerate the installation and management of smarter and cleaner electricity services. This includes the integration of clean distributed generation, storage, demand response, energy efficiency, new pricing/rate models and other technical and economic issues.

From the very beginning of the group's deliberations, the scope, process and priorities of the project established Pecan Street Project as one of the country's most far-reaching and comprehensive collaborations. In addition to the remarkable breadth of expertise of the participants, the project adhered to a number of unique guiding principles that set it apart from other "smart grid" projects across the country.

Guiding Principles

1. Environmental Protection
2. Replicability
3. Economic Development
4. Economic Stability of the City and Austin Energy
5. Interdependency of Renewable Energy and Efficiency
6. Scope of Community Integration
7. Collaborative Process

1. Environmental Protection

Implicit in the objectives of most smart grid projects is an assumption that success will result in environmental benefits: wiser use of electricity and increased reliance on renewable energy will reduce our dependence on fossil fuel electricity. But very early in this process, a firm commitment was made to demonstrate tangible and measureable improvements in water use and quality, carbon impact and air quality. The Pecan Street Project team did not want to realize environmental benefits incidentally; environmental protection was a core objective. This commitment is evident in the group's solicitation of EDF to lead the project. Not only has EDF distinguished itself nationally by forming significant partnerships with leading corporations to achieve environmental benefits, it is among the most productive environmental advocacy organizations in the country. And with more than 30 staff in its Austin office, it is intimately familiar with the Texas energy and environmental landscape. The prioritization of environmental resources and EDF's leadership role are key differences between the Pecan Street Project effort and many of the "smart grid" projects underway in other cities.

2. Replicability

The Pecan Street Project team envisioned a process by which the recommendations and strategic direction that resulted from the project would be shared with other communities and utilities. Many of the suggestions that will prove successful in Austin may be unique to this region, climate and customer base. But to the extent possible, what Austin learns here should be made available to others. As a result, the project has been designed with an "open source" approach. Because replicability is a key objective of the project, the teams were directed to explore suggestions and recommendations that could be adopted by other energy providers, whether publicly or privately owned.

3. Economic Development

If Austin's energy system evolves using non-Austin talent, with equipment and services from non-Austin companies and spurs economic development in other parts of the country, this effort will only have been partially successful. The genesis of the project was an economic development brainstorm session, and the involvement of the Greater Austin Chamber of Commerce and UT's Austin Technology Incubator has ensured that the creation of new companies and jobs in Austin remain a core focus of the project.

The current energy system – reliant on centralized generation outside Austin – has been very good business for communities located far from Austin. One of the advantages of spurring the acceleration toward a cleaner, modernized system is the potential of keeping more energy investment dollars within our own community, spurring company and job creation.

As one Pecan Street Project participant put it, "Every time we empty a railroad car of Wyoming coal at a Texas power plant, we fill it up with our money and send it back for another load. It would be nice to keep our energy dollars here where they can drive our economy, not Wyoming's."

4. Economic Stability of the City and Austin Energy

Austin Energy's leadership team knows that the utility must plan now in order to survive in tomorrow's energy market. Yet because the City relies on Austin Energy as a revenue resource as well as an electricity provider, the changes it implements must take into account very real political consequences.

Thus, one of the assumptions of this project – from day one – was that the financial stability of Austin Energy must be preserved or revised. Threaten Austin Energy's revenue stream and the project could wither on the vine. That's a reality the project team was willing to accept, but it's one that makes Austin Energy's "reinvention" as challenging as that of any investor-owned utility.

Why EDF?

In June 2008, after the City of Austin, Austin Energy, the University of Texas and the Greater Austin Chamber of Commerce had developed the basic parameters of the project, the group concluded that it wanted to add another founding partner that could bring energy industry expertise, had unquestionable environmental credentials, understood how to tackle large, complex technical and policy challenges and had earned credibility with the business community.

Brewster McCracken approached Jim Marston, the regional director of the Texas office of Environmental Defense Fund (EDF), the day before Marston left town for EDF's annual planning retreat and made him an offer.

"I told him that we were about to embark on a year long project to revolutionize America's energy delivery system and that we needed his help," McCracken said. "I asked for staff resources. I asked for his national connections. I asked for EDF's political capital. And I told him that we had no money to pay him."

"I said I'd have to check with my team," Marston said, "but that, lucky for him, we wouldn't take his money if he had any."

EDF was in. And to date, nearly a dozen EDF staff members from Austin, New York, Washington and California have logged more than 2,000 hours steering the first phase of the project.

5. Interdependency of Renewable Energy and Efficiency

Throughout 2009, several smart grid projects across the country received significant media attention, and most of these projects include what have become the cornerstones of such initiatives: installation of smart meters, enhanced end-user energy management, renewable energy and storage.

But while many of these projects are specific about utility-side technology deployment (smart meters, etc.), most are vague about renewable energy and energy efficiency.

The Pecan Street Project is different. Smart meters and a smart system aren't the goal. They're necessary ingredients of a system that is more reliable, cleaner, more affordable and more sustainable. Smart meters without smarter energy consumption (efficiency) will not be enough. The Pecan Street Project takes Austin Energy's already-completed system-wide smart meter deployment and goes a giant step further. It asks the question, "What motivates a utility that charges by the kilowatt-hour to encourage customers to use less energy or produce it themselves on their roof?"

6. Scope of Community Integration

The word "integration" can be used with varying levels of specificity and complexity. In some cases, it is used simply to describe a very tactical operation – the connection of two things so that they work together, just as solar panels need to be physically integrated into a residential or commercial electrical network in order to work correctly.

But "integration" became a much more significant theme of the Pecan Street Project. Just as the project is an "integration" of the principles stated here (Environmental Protection, Replicability, Economic Development and the Economic Stability of the City and Austin Energy), the vision of the energy system that resulted from this project is one that integrates the many pieces of our community that use, generate, store and manage energy. The community CAN BE the system if its various parts are thoughtfully integrated.

Today's energy system is largely unidirectional and point-to-point. Electrons start at one distinct location and end up at a socket, with little interaction along the way. But the Pecan Street Project set out to design what some have come to call an "Energy Internet." Just as the Internet connected commerce, banking, entertainment, digital media, voicemail systems, and all the other systems that generate or consume information, tomorrow's energy system should connect – or integrate – all of the systems and community assets that will consume or generate electricity.

The buildings and homes where energy is consumed, for instance, will eventually be micro-generators, so how well they are designed and how they connect and interface with the system is of critical importance.

The development of plug-in electric vehicles, similarly, will enable the transportation and energy systems to be linked again as they were in the early days of electric streetcars. Electric

vehicles will further enable the use of car batteries as distributed mobile storage, dispatching their stored electricity back to the grid during peak demand periods. To be a real solution, however, our energy and transportation systems must evolve together.

The clearest example of the project's ambitious scope is its recommendation that Austin Energy and the Austin Water Utility be more closely integrated. [See Water Management Recommendations.] Water is not just a human necessity and vital natural resource, it is also a massive part of our energy system. Power plants are among the largest water users and the treatment and movement of water represents the City's single largest block of energy consumption. Reduce one and you reduce both. Ignore one and significant reduction of the other is a much steeper challenge. The two processes are so interdependent that it only makes sense that they be considered part of the same system.

Because of the City of Austin's involvement as both Pecan Street Project partner and utility owner, the possibility for integration extends still further: to land use regulation, new building codes, job training programs and coordinated marketing and outreach campaigns. All are symbiotic – enabled by and enhancing the value of "smart grid" technology, improvements to Austin Energy's infrastructure, deployment of distributed energy, advanced metering, changes to the energy rate structure, customer research and demonstration projects.

Clearly, aiming for a fully integrated energy system complicates things. It's not just a matter of installing smart meters and solar panels on several hundred thousand homes. It's much bigger than that. We don't suggest such integration will be easy, but the recommendations found through this report reflect its importance.

7. Collaborative Process

Managing the logistics of the meetings, reporting, review and feedback among groups was daunting. Imagine experts from across the country – many of whom are used to being the most experienced person in the room – working through the myriad issues surrounding this challenge. From the outside looking in (and perhaps even from the inside), the last year may have looked like organized chaos.

But what the process lacked in slickness, it more than made up for with thoroughness and a willingness to think in brand new ways. The effort began as a nearly boundless brainstorming process; the team didn't even know all the questions it was trying to answer until it began. The group was given an aggressive goal and its first charge was to figure out what it needed to figure out.

Over the last year, no fewer than 200 people – experts from the partner organizations, community advocates, corporate partners and others – invested thousands of labor hours addressing these issues. Of all the collaborative smart grid projects across the country, the Pecan Street Project is the only one to have so heavily relied upon such a broad spectrum of government, utility, academic, advocacy and corporate expertise.

At regular intervals, the public and customers were invited to participate. Team members held briefings with community leaders, elected officials and the business community. They

appeared at public forums to brief citizens about the project's scope and progress. In June, the project team held a facilitated public meeting before a standing-room-only crowd to brief the public and solicit feedback.

Austin Energy conducted focus groups with residential and commercial customers to help refine some of the ideas and suggestions and clarify some concerns emerging from the project's working groups. Because the project had just begun and the focus groups represented only a small segment of Austin Energy's customer base, the findings were more suggestive than prescriptive. But the project team used the findings to help steer its thinking about how various components of a redesigned utility would affect customers and how quickly (or slowly) customers would adopt new technology or service options.

The feedback from these groups was fairly consistent with historic research of energy customers:

- Concerned about the cost of energy, they are wary of changes that might increase their energy bill.
- They respond well to concepts that would allow them greater control of their energy use, but are wary about privacy, security, pricing and mandated energy limits or use restrictions.
- They support alternative energy, but support wanes if affordability or reliability is threatened.
- They support the idea of Austin pursuing clean energy, especially if it spurs local economic development. But again, this enthusiasm wanes if energy costs escalate.

In addition to this preliminary opinion research, Austin Energy has conducted extensive public outreach surrounding its future generation planning process. That outreach effort has informed the work of the Pecan Street Project working groups.

Still, it is an understatement to say that this effort has only scratched the surface of public involvement. The project team is well aware that the significance of the project, its reliance on and impact on Austin Energy's customers and the lengthy implementation timeline all dictate that public involvement will be a critical part of this project's success.

Moving forward, the project's future success hinges on robust public involvement, and the list of issues on which public input will weigh heavily is extensive:

- Any alternative pricing models that Austin Energy considers must be tested with actual customers in pilot programs.
- Customer-centric management tools, such as web-based energy monitoring, must be fully modeled and tested with actual customers in actual homes or businesses.
- Changes in land use, zoning, public financing options, infrastructure projects or other modifications that intersect with City policy must be developed in cooperation with multiple stakeholder groups.

- Very careful consideration must be given to the impact that proposed changes would have on low-income customers.
- Proposals that will modify Austin Energy's expenditures or contribution to the city budget must be developed and vetted through a public process.

In short, the "public process" portion of the Pecan Street Project has only begun. Now that an initial list of recommendations has taken shape, it must truly become a community effort.

Evolving Austin Energy

One of the most profound underpinnings of this project has been the recognition by Austin Energy's leadership that the utility must evolve. It is a cautious recognition, but it is real and public.

Indeed, evolving Austin Energy's business model is the most fundamental recommendation offered by the Pecan Street Project – some team members called it the "elephant in Austin's living room." But understanding what the utility must change into requires understanding what it has been.

Like all utilities, Austin Energy is essentially a collection of tangible assets that deliver energy to residential and commercial customers.

But from an economic perspective, the practical definition of a utility – including Austin Energy – can be reduced to something much more general and basic. Whether it deals in electricity or water, whether the market is regulated or deregulated, the basic function of a utility is commodity delivery, and the basic business model ties revenue to the volume of the commodity sold.

As a result, some basic economic principles have driven the American energy utility industry for a century:

What's so special about Austin?

Given that the Pecan Street Project was initiated by a City Council member, the University of Texas, the local utility and the region's chamber of commerce – not exactly unbiased sources – it is not a surprise that some people may not quite buy into the idea that this city is as "uniquely qualified" to undertake this effort as its founders announced in December 2008. Certainly, the next several years will determine whether that claim was accurate, but Austin does have some intriguing characteristics that set it apart from other regions undertaking this complex change.

Austin Energy already runs the nation's largest green power program, which means that not only has it tapped into an interested market, but its leadership does not need to be convinced about clean energy. More interestingly, because Texas has its own grid (a claim that no other state can make), the small, location-specific system expansions that characterize a distributed energy system do not need approval from the Federal Energy Regulatory Commission – a process that can take several years.

The Austin City Council serves as the board of directors of Austin Energy. That means that major decisions that affect the utility and the city's building codes, land use policies and infrastructure investments can be much more streamlined than in other cities.

Austin's strong semiconductor and software sectors, its active clean technology business community and the Greater Austin Chamber of Commerce's robust clean energy recruiting program all demonstrate that the entrepreneurial community is ready to take advantage of a city-wide business and job creation effort in clean energy.

Finally, the University of Texas is not only home to the nation's largest open source supercomputer, but its Austin Technology Incubator and Clean Energy Incubator are major sources for technology research and commercialization.

- Increased consumption increases profit and is inherently good.
- Lowering the cost of generation and delivery increases profit.
- Any regulation, mandates or market forces that decrease consumption or increase the cost of generation or delivery are bad.

This basic economic model is the single greatest obstacle standing between Austin Energy and a modernized energy delivery system.

It's understandable that most discussions of our energy future focus on deployment of advanced technology. Not only is technology tangible, but gadgets look good on TV news and in complicated newspaper diagrams. Just as with iPhones or new car models, the public (and the media) love to glimpse the future through the "product marketing" lens. When it comes to renewable energy, the public can envision solar panels. People can grasp the idea of controlling their appliances via a web site. Many of these consumer energy products will come to fruition, so it's reasonable to tout their promise.

But the real catalyst of a truly new energy system isn't a cool new gadget. It is a business plan that will change a 100-year old reliance on commodity-centric economics – one that can succeed even as customers are motivated and empowered to use less energy. In other words, it doesn't matter how cool a gadget is if no one will buy it or if its use will threaten the entity that would integrate it into its system. But few of the smart grid experiments around the country are tackling this necessary shift in thinking.

If significant new resources (such as user-owned generation, user-to-grid or user-to-user energy transactions, heightened load shifting and demand response strategies and real-time user energy management) are to be integrated into the energy delivery system, fundamental components of the utility industry's business model have to be modified, improved or replaced altogether.

Austin Energy's history demonstrates that such shifts are feasible – logistically and politically. Its past accomplishments show that it is a willing and successful innovator.

Austin Energy's 2003 strategic plan verbalized its ongoing commitment to energy efficiency by making it the utility's number-one priority. It has aggressively led efforts to modernize the local grid and increase its reliance on cleaner energy sources. By mid 2009, the utility had installed smart meters through its entire service area. For the last seven years, its GreenChoice option has been the #1 green energy program in the country. Its aggressive solar rebate program greatly reduced homeowners' up-front investment to "go solar." And despite the kind of public pressure that is often felt by first-movers, the City Council approved the utility's plan to invest in a 30-megawatt solar installation in Webberville, a town near Austin.

Over the course of the last year, Austin Energy has engaged the public in a detailed and open conversation about its plans for future generation. It has held town hall meetings and community briefings outlining its goals, the paths it is considering and the results of the analyses it has conducted on the costs and benefits of several options.

Some of the options are significantly forward-thinking and quite ambitious. For example,

the utility's current plan is to increase renewable energy generation to 30% of all generation by 2020, resulting in a 17% carbon reduction compared to 2005 levels. It is considering a plan that would increase the renewable target to 36% by 2020, resulting in a 20% carbon reduction.

By most measures, the City and Austin Energy have proven their "energy innovation bona fides."

Such discussions, like the Webberville solar deployment decision, elicit concerns about both cost and necessity; concerns that are understandable but that Austin Energy's leadership believes should inform – not sidetrack – its commitment to a newer, cleaner, more efficient energy system.

Because it is city owned, Austin Energy has the ability and responsibility to do things differently than investor owned utilities. As an arm of city government, it is charged not only with delivering affordable and reliable power (like other utilities), but also with doing so in a way that furthers the City's vision for livability, environmental stewardship and equity. And the members of its leadership team are recognized nationally as leading advocates of increased investment in renewable energy, conservation and innovative demand response and load shifting strategies. Without question, the fact that Austin Energy and its leadership have a civic conscience makes the vision of the Pecan Street much more feasible.

The demise of the 'spinning meter' business model is inevitable. Everyone knows it's coming and most people now think it's coming pretty quickly. What has not emerged yet is its replacement. And until we know where the revenue streams will flow from and to, it doesn't really matter what brilliant technical plan we come up with. The business model is the linchpin.

— Roger Duncan
Former General Manager
Austin Energy

But to suggest that Austin Energy is free from the short-term financial pressure that investor-owned utilities face from shareholders would be inaccurate. Certainly, Austin Energy must respond to economic realities and the citizens it serves.

Remaking core infrastructure has often been at odds with political and economic expediency, and the same will be true in this case for Austin Energy. Austin Energy is the City of Austin's largest single source of revenue. It funds many city services and keeps tax rates low and the wheels of city government churning. The Pecan Street Project team is well aware that disrupting the flow of dollars from Austin Energy to the City's general revenue fund would disrupt the very foundation of city services.

The costs of reinventing the energy system will also not be trivial, nor will the pay-off be quick. Committing to those investments, even with a progressive utility and city, will therefore require significant political will. The fact that the city council serves as the utility's board of directors might streamline energy-related decisions and policies. But it also means that every issue that could potentially impact an Austin Energy customer also impacts the re-election of the utility's board members.

The challenge, in sum, is this: if a utility's revenue must be maintained and the utility's business model is based on the volume of energy sold, how can it justify changes that will require up-front investment and is explicitly intended to reduce the amount of energy it sells?

"The demise of the 'spinning meter' business model is inevitable," said former Austin

Energy general manager Roger Duncan. “Everyone knows it’s coming and most people now think it’s coming pretty quickly. What has not emerged yet is its replacement. And until we know where the revenue streams will flow from and to, it doesn’t really matter what brilliant technical plan we come up with. The business model is the linchpin.”

Over the course of this project, several Austin Energy-specific parameters emerged as critical components of the Pecan Street Project’s recommendations:

1. Energy efficiency measures should play a primary role in reducing demand.
2. Demand response measures should be maximized to manage and normalize demand.
3. User-controlled energy management should be significantly increased, which will require installation of compatible smart metering, home networking and energy-controllable appliances.
4. Reliance on distributed generation should increase significantly, which will require integration with user consumption controls and financial compensation for surplus energy.
5. Energy storage and the transportation sector should be integrated into the utility’s physical and financial infrastructure.
6. Reliance on fossil fuel electricity should be significantly reduced.
7. Water use/availability must be weighted more heavily in the utility’s planning.

Each of these has technical consequences. But all will also require fundamental changes within Austin Energy’s current revenue model.

The Pecan Street Project team recommendations, therefore, include aggressive testing by Austin Energy of the feasibility of truly new pricing structures that accelerate its shift from a volume-driven commodity provider to one that better integrates energy efficiency, smart grid technology and significant amounts of distributed generation.

For example, imagine Austin Energy not as a rate-charging commodity provider but as a fee-based service provider. Customers could sign up for a service plan for a fixed cost per month. For that fee, they get all the power they need, within a tested and predetermined range. In exchange for the predictable flat fee, they would agree to become energy partners – not just customers – with Austin Energy. They’d make their rooftops available to solar equipment owned by Austin Energy. They’d agree to reduced-cost appliance upgrades such as solar water heaters. They’d participate in Austin Energy’s demand response program, which might cycle off their air conditioners in 15-minute increments on the city’s hottest days. They’d agree to limit their peak use of non-essential appliances in favor of off-peak use. They would never be denied power when they need it. But they would agree that using energy at certain times – outside their service plan – would be “pay as you go,” just like tossing more garbage than will fit in your City-issued trash can is “pay as you throw.”

Such a service provider model is untested and unproven in the electricity industry, but early whispers from industry experts indicate that the idea has promise. It could be the “linchpin” that Roger Duncan is looking for. And if it’s not, its testing might lead to the solution that is.

Recommendations

No one knows exactly what tomorrow's energy system will look like – it is the riddle the Pecan Street Project has been trying to answer. But there are pieces that most experts agree will be part of the system we invent. Two of the most important pieces are heightened user-controlled power management and increased user-generated power. The days of being a "utility customer" will pass. We'll be co-generators and co-managers of energy. The utility's role as an "energy provider" will give way to a new role as an "energy manager." Such a shift will require a significant upgrade to hardware, software and billing systems, as well as the business model that has driven utilities for generations.

The electric delivery system has been upgraded and improved over the last 100 years – generation is cleaner, transmission is more reliable and the appliances we use are more efficient. Despite these improvements, though, the one-way system Thomas Edison invented has largely remained the same: we burn fuel in a remote location to generate electricity, send it over a series of wires to cities and towns, and customers are charged based on how much energy they use. Now as it was then, the primary focus of our electric system (and its revenue) is energy delivery, not energy management.

For the past year, the Pecan Street Project has focused on technical issues related to evolving Austin Energy from a commodity-only provider to a utility that more effectively integrates user-controlled energy management and distributed generation. What technology improvements must be made to sustain the kind of energy management function Austin Energy will play in the future? What will it cost, and who will pay for it? Will customers quickly accept the utility's role (and their own), or will they object? What policies must be enacted to ensure that the investments made in this new system provide the potential cost-savings and environmental benefits?

But this report also includes recommendations beyond Austin Energy's future role and business model – issues such as water management, job training, technology commercialization and advanced energy efficiency strategies, each of which will play an important role in an evolved energy system.

The project team's final recommendations were distilled into four major areas that reflect these economic, technical and policy questions.

1. Austin Energy-specific Recommendations, including:
    A. Renewable and Distributed Energy Deployment and Testing
    B. Smart Grid Testing and Pilots
    C. New Rate Structure
    D. New Business Model
2. Water Management Recommendations
3. Public Policy Recommendations (Beyond Austin Energy)
4. Economic Development and Job Training Recommendations

These recommendations stem not only from the opportunities presented by Austin's lead-

ership in clean energy, but also from a need to avoid the economic consequences of inaction, prepare a ready workforce to make Austin a clean tech leader, coordinate efforts with other communities and groups and educate Austinites about why and how these changes will occur.

These recommendations are not a do-or-die list of measures that must all be executed for Austin to succeed in the new energy economy. They are best-effort recommendations developed by dozens of experts in various fields and should not be interpreted, despite being strongly worded, as static "all or nothing" mandates to Austin Energy, the City of Austin or any other organization that would have to implement them. Nor are these recommendations all of the good ideas from the Pecan Street Project action teams. In fact, one of the difficulties in finalizing this list was the embarrassment of riches that resulted from months of brainstorming. What is included here reflects an effort by the Pecan Street Project to cull the best of hundreds of great recommendations from the action teams.

A number of "guidelines" informed the development of these recommendations:

Cost is crucial. Cost was of critical concern to each member of the project team. Some recommendations – particularly the ones related to pricing and rates – explicitly discuss cost benefit analysis. But the cost impact of *all* of these recommendations must be analyzed, especially as energy costs continue to change. However, cost comparisons need to consider total societal costs, including what economists call externalities.

Unanimity was not required. The breadth of recommendations reflects the breadth of stakeholders involved in this process. As a result, however, not every idea received the same level of urgency or enthusiasm from all project partners. So it is important to note that unanimity was not a requirement of inclusion.

Constant change will require constant review. The energy industry is changing rapidly, and we suspect changing circumstances will require modifications to the priorities and details of many of the recommendations.

The results should promote local job growth. An original driver of this effort was regional economic development. Participants understood that Austin Energy fossil fuel plants require the sending of local customers' money to other regions to buy fuel and that distributed power and energy efficiency keeps local money in the area. As such, these recommendations are intended to have a net positive effect on the local economy. It will be important – if the mission of the Pecan Street Project is to be realized – to regularly evaluate the progress of this effort and to evaluate how it has contributed to the regional business climate.

Finally, a desire for brevity limited the amount of "showing our work" the team could accommodate. In some cases, more context was required to fully explain a recommendation. In other cases, the recommendation was rather simple to describe. Brevity, however, should not be interpreted as simplicity. To that point, the Pecan Street Project is currently editing a more detailed and technical companion report that will delve deeper into many of these recommendations and provide more context, analysis and rationale.

1. Austin Energy Recommendations

A. Renewable Distributed Energy Deployment and Testing

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.

Among the objectives of the Pecan Street Project is the deployment of at least 300 megawatts of clean distributed energy throughout Austin Energy's service territory by 2020 and the establishment of Austin Energy's grid as a "test lab" for the many companies that will create the clean technology that the future system will require.

Such a commitment to renewable energy, we believe, is a sound one that will help Austin Energy diversify its generation mix, protect it from future carbon liabilities, give it more control over costs and spur a new market that will create jobs and drive down the future cost of renewable energy.

We recommend that Austin Energy begin to deploy at least 100 megawatts of distributed renewable energy that would be owned and financed by the utility. The remaining 200 megawatts would be achieved by encouraging and incentivizing distributed generation financed and owned by private residents or businesses.

This deployment would fall within the "renewable energy" target of Austin Energy's proposed generation plan. In other words, it would move the utility toward its goal, not increase its goal.

Specific deployment and pilot program recommendations include:

#1: Deploy 20 MW of New Distributed Renewable Resources

By 2012, Austin should deploy at least 20 new megawatts of renewable energy through a mixture of distributed energy technologies. Through its normal procurement process, Austin Energy should issue an RFP by the end of 2010 calling for the 20-megawatt target, and allow applicants to propose various distributed technologies and deployment strategies (solar co-ops, ground mounted solar, solar above parking lots and solar on school roofs, but not residential rooftop solar) to compete on cost.

#2: Quantify the "True" Value of Distributed Generation

The true value of distributed energy has not yet been quantified. Austin Energy's 2005 Value of Solar study quantified many cost saving features of expanding solar energy, such as fuel savings, decreased line losses and less need for transmission and distribution lines. But other potential cost savings have not yet been quantified, such as the impact that more solar or other distributed generation would have on criteria pollutants (and their cost impacts), potential local job creation, economic development and increased tax revenue. The City, Austin Energy, UT, the Greater Austin Chamber of Commerce and others should work together

to quantify these potential benefits and merge them with Austin Energy's Value of Solar findings. With a more accurate and exhaustive analysis of the true cost benefits of distributed energy, the City and Austin Energy will be better equipped to make cost comparisons between distributed generation and conventional centralized generation options in the future.

#3: Deploy Additional 80 MW of Distributed Renewable Resources

After the City has deployed the 20 new megawatts of distributed generation (#1) and developed a True Value of Distributed Generation (#2), Austin Energy should begin deploying distributed renewable energy until the 100-megawatt target is reached.

#4: Launch Distributed Renewable Energy Pilots

Over the next five years, Austin Energy should conduct some specific pilots that quantify the efficacy, cost and potential generation of additional local renewable energy sources. There are several promising renewable energy options that could contribute to modifications to Austin's energy system. Co-op solar agreements could allow several residents or businesses to pool their finances to invest in off-site solar generating facilities. Many of Austin's "big-box" retailers could contribute significant amounts of solar energy to the system if their roofs were fully utilized. Today's geothermal heat pumps move 3 to 5 times as much energy between buildings and the ground than they consume while doing so and have been proven capable of producing large reductions in energy use and peak demand for the heating and cooling of buildings. Recommended pilots include:

- Up to 2 megawatts of co-op solar (fractional ownership of off-site solar generation),
- Solar shades at the Austin-Bergstrom Airport parking facilities,
- Quantifying the potential of micro-wind generation on downtown high rise buildings,
- Quantifying the potential of local combined heat and power generation using micro-turbines with waste heat,
- Quantifying the potential of geothermal heat pumps for residential and commercial properties,
- Big-box rooftop solar owned by landlord/developer, and
- Fayette Power Plant co-firing with bio-mass.

#5: Expand Demand Response Program

Austin Energy already has admirable efficiency and demand response programs. In fact, together they account for enough energy savings to have negated the need for one new power plant. Austin Energy should aggressively expand its demand response program to minimize one characteristic of wind and solar that tends to greatly devalue these resources in the electric planning process. One of the disadvantages of renewable energy (particularly wind and solar) is that without storage, it is not always immediately dispatchable. Some have claimed

that the costs of renewable energy should include either storage or "back-up" dispatchable power like a natural gas peaking unit, both of which inflate the actual cost of renewable generation. One way to reduce this concern is to dramatically increase the utility's ability to manage its load during peak periods – in essence, using demand response to "back up" wind and solar energy. Such demand response programs could include new partnerships with large industrial customers or commercial building tenants. It could also include an expansion of residential HVAC residential demand response programs to include appliances such as swimming pool pumps or technologies that instantly dim voltage for lighting as much as 30% based on ambient light levels, without meaningful loss of utility.

#6: Test Energy Storage

The University of Texas is already conducting world-class research in energy storage; it should be expanded and more deliberately coordinated with Austin Energy, the Greater Austin Chamber of Commerce and Austin's energy storage start-ups. Such an effort should focus on understanding how energy storage truly interacts with variable generation sources, such as renewables, or loads, such as plug-in electric vehicles (PEVs), in a practical setting. The effects of energy storage integration within the distribution grid's control and planning should also be explored. In particular, a pilot that compares decentralized community storage (approximately 50,000 kilowatt hours) and centralized larger scale storage (approximately two megawatt hours) and quantifies the performance, costs and benefits of a fully integrated storage system should be a first priority. Key measurements of the pilot should include monitoring of load leveling, peak shaving and power purity benefits verse costs. If possible, such a pilot should be jointly managed by the University of Texas and Austin Energy.

B. Smart Grid Testing and Pilots

#7: Launch Smart Grid Demonstration Project

Austin should launch a residential and commercial smart grid demonstration project that will quantify the performance, costs and benefits of a fully integrated energy system. This recommendation has already been articulated and acted upon by the Pecan Street Project, Inc. in its successful application for stimulus funding for a smart grid demonstration project at the Mueller Community. Key features of the project should include an upgraded AMI infrastructure with higher-bandwidth and lower latency (required to enable the system to go beyond just moving meter data to enabling new energy applications), full two-way communications to the customer premise via a smart meter or other device, and real-time monitoring of energy use to enable consumer engagement.

Austin's Mueller community / Photo courtesy of Catellus

#8: Design and Test User Interface

Research suggests that personal behavior habits will be as strong a predictor of the smart grid's success as the deployment of advanced technology. Austin Energy should team with product design experts and the University of Texas to design and test the user interface customers will use to manage their energy. Significant behavioral questions exist:

- How will users interface with the system (web-based, countertop appliance or another interface)?
- What kinds and how much information will users want?
- What kinds of information will motivate users to make better energy choices?
- How involved do users want to be in managing their energy?
- Should management tools be "pre-loaded" with default settings or will customers want complete control over the systems "out of the box?"

This effort should establish an open-source clearinghouse of energy behavior research that can guide the utility's technology deployment and marketing decisions. This would require several "test" interfaces and in-depth consumer behavior research expertise.

#9: Build Demonstration House and Business

Austin Energy should have a demonstration house designed and built to showcase consumer interface options, renewable energy features, advanced power architecture for simpler and efficient system integration, and energy management components of a modified energy system. These demos would not only allow for on-site testing and measurement of future technologies, but also could serve as powerful public education and outreach opportunities. This is another opportunity for coordination with the University of Texas – its School of Architecture has been developing test houses and is a valuable resource on building energy usage and its interaction with the smart grid. These could be designed as part of the demonstration project at Mueller or as a separate effort.

#10: Promote Plug-In Electric Vehicle Penetration

Austin Energy should promote the early penetration of plug-in electric vehicles (PEVs) in the region as a new revenue source, a way to reduce carbon and smog emissions and a new source of dispatchable load. In addition to its existing partnership with auto manufacturers, Austin Energy should analyze whether to promote public charging stations and establish a time-of-use rate tied to smart plugs and the smart grid to require off-peak charging. Rates for charging during peak hours should require a premium rate that reflects the much higher cost of energy used at peak times.

In addition, by 2014, Austin Energy should develop a PEV Power Discharge (vehicle-to-grid) strategy, including partnerships with several large employers to incentivize PEV connectivity in their employee parking facilities and a rate structure for residential and public PEV charging stations.

#11: Establish Open Source On-Grid Testing Program

Austin Energy, the University of Texas and the Austin Technology Incubator should establish and promote a program to allow testing of emerging technologies and services on Austin Energy's grid. This will require the development of a protocol for what criteria technologies must meet to be tested, benchmarks for measuring each technology, and MOUs about the openness of any on-grid testing. To spur local job creation and growth, the Pecan Street Project recommends that the program should give priority to companies headquartered in or with significant presence in Austin, but be open to best-of-breed companies regardless of where they are located.

C. New Rate Structure

Austin Energy should change its rate design to prepare for future changes in the electricity market and lay the foundation for dynamic pricing and increased deployment of energy efficiency and distributed generation.

Specific rate design recommendations include:

#12: Unbundle Rates

By 2012, as an interim step, Austin Energy should deploy a new unbundled rate structure that provides customers separate transmission and distribution charges, as well as separating out other costs from generation.

#13: Design New Solar Program

By 2012, Austin Energy should deploy a net meter rate for NEW solar customers equal to wholesale peak rate, and announce a plan to phase existing solar customers from retail rates to the wholesale peak rate. This will require several interim steps, such as conducting the analysis necessary to establish the wholesale peak rate and implementing changes to the billing system. Because solar prices have decreased and federal subsidies for solar have increased, the Austin Energy solar subsidy is less necessary and can be reduced.

#14: Move to Dynamic Pricing

By 2014, Austin Energy should have designed, tested and implemented a dynamic pricing rate structure. The Pecan Street Project team believes real-time pricing is preferable. Coupled with smart grid technology, dynamic pricing can provide customers price signals to reduce consumption and to shift load to lower-cost and lower-emitting resources. Before implementing a new pricing structure, Austin Energy should fully examine the potential impacts of rate changes on low-income customers and consider modifications to existing policies, such as strengthening its "lifeline rates" to protect to these customers against unintended bill impacts. In addition, real-time pricing should only be implemented after advanced energy management technology is installed, customers understand how to use it,

and the impacts on Austin Energy's revenue are understood. If real-time pricing proves to be technologically impractical or cost-prohibitive, time-of-use pricing (peak, shoulder, and off-peak rates) should be implemented instead.

D. New Business Model

Austin Energy should move to an alternative business model that better accommodates markedly more end-use efficiency and significant amounts of new distributed generation. This is a fundamental shift, yet it will be of paramount importance if the utility is to thrive in a future electricity market that will have many new technologies, more customer control and carbon constraints.

#15: Expand Energy Services

By 2014, Austin Energy should expand its "services" business by more aggressively marketing its capabilities in the sales and services of efficiency, distributed generation and communication services.

#16: Develop New Revenue Model Options

Between now and 2015, Austin Energy should design and test one or more new service models that increase Austin Energy's role as a products and services company and protects the utility from the possibility of reduced consumption. These tests should quantify the bottom line potential of the new business model and identify risks to the utility and customers.

Specifically, the Pecan Street Project recommends the exploration of a "Flat-Rate" business model that provides customers access to energy at a set monthly fee in exchange for participation in new efficiency and energy management programs. Customers would enter into a partnership with the utility that would include pre-determined time of use parameters, the installation of energy management equipment, ultra-efficient and programmable appliances, efficiency upgrades, and a utility option to use the customer's roof for distributed generation. The flat rate could be based on a per-square-foot basis and include additional charges for heavy-consumption but non-critical appliances, such as swimming pool pumps or plasma TVs. At least initially, participation should be voluntary. Usage outside the parameters of the agreement would be priced separately, much like "excess minutes" are charged to customers who go over their cell phone usage plans. Those who choose not participate in the Flat-Rate partnership program would be subject to rates that reflect the utilities costs without the cost-savings efforts.

In the short term (by 2014), additional analysis is needed to confirm the Pecan Street Project hypothesis that the cost savings from such a program, along with new revenue streams from new products and services, will offset the reduced revenue that will result from much greater efficiency and more distributed generation.

If after analysis a Flat-Rate model proves impractical, Austin Energy should implement an alternative business model that relies less on revenue from kilowatt sales and more on the

sale, maintenance, integration and upgrading of energy products and services. An analysis of the potential revenue from such a focus should be conducted concurrent to the Flat-Rate testing so that an alternative can be articulated when the Flat-Rate testing is completed.

#17: Encourage a Third Party Electric Services Market

Regardless of which long-term business model is adopted, Austin Energy and the University of Texas should explore an alternative Third Party electric services market through which businesses can participate in Austin Energy's business model. In colloquial terms, this could be comparable to the App Store that Apple has designed for mobile applications. Austin Energy would establish standards and help manage the market, but outside companies would be able to provide plug-and-play add-on services that would help customers better manage their energy usage. In addition to improving energy management across the city, this could be a new source of revenue for Austin Energy.

2. Water Management Recommendations

Austin should integrate water planning into its energy management strategy and apply elements of the smart grid to its water utility. Water treatment and transport accounts for much of the City's electricity consumption and results in large amounts of carbon dioxide emissions. In addition, improved management of city-wide energy usage will be impossible without the integration of water treatment and movement into Austin Energy's planning. As such, the City should apply many of the "smart grid" principles being deployed for the energy system to its management of the water utility. Water-related recommendations include:

#18: Price Water to Spur Conservation and Load Shifting

It is the Pecan Street Project team's hypothesis that the Austin Water Utility's existing blocked rates do not provide a strong enough conservation incentive. By 2012, the Austin Water Utility should fully evaluate the potential conservation impact of more aggressive block pricing and a "Summer Rate Schedule" that incentivizes shifting consumption away from peak consumption days.

#19: Install and Test Smart Water Meters

By 2014, after completing an economic analysis, the Austin Water Utility should introduce smart meter concepts into the water system with the installation of smart water meters and the integration of real-time water use reporting and pricing for high-water use customers.

#20: Provide More Usage Information to Water Customers

By 2012, the Austin Water Utility should test and then implement new features that would increase robustness of information delivered in utility bills. For example, utility bills should

include information so customers can easily understand their relative usage, such as a 10 Neighbor Water Use Average.

#21: Cross-Train City Water and Energy Auditors

To increase city worker efficiency, the City should cross-train electric and water utility efficiency audit staff and include water and energy analyses at each efficiency audit.

#22: Reduce Landscape Water Use

The City should change the building code to limit the amount of water-intensive landscape/turf areas within new residential and commercial developments. Austin should look to other regions (such as Scottsdale, Arizona; Oviedo, Florida; Clark County, Nevada; and San Antonio) that have already made such changes.

#23: Establish City Water Use Targets

The City should set a goal for yearly and peak-day water use and commit to reach the goal by 2015.

3. Public Policy Recommendations (Beyond Austin Energy)

The Austin region should actively and aggressively pursue policy changes, public outreach campaigns and customer marketing efforts to accelerate the changes envisioned by the Pecan Street Project team.

The Austin area stands to benefit from the fact that the City of Austin and Austin Energy are so closely tied. Because of this unique relationship, many of the changes that the utility will need (but cannot implement itself) can be acted on by the same group of local leaders. The Pecan Street Project objectives not only include the deployment of new technology and cleaner generation, but also more efficient use and management of electricity – whatever fuel is used to create it. As such, the City of Austin should create and deploy a "Pecan Street Project Platform" of City policies and projects that will accelerate the project's vision.

In addition to specific policies recommended listed in previous sections, the Pecan Street Project urges the Austin City Council, to enact the following policies and programs, some of which are "ready to go," and others that will require additional analysis and study.

#24: Require Solar-Ready Construction

Revise the building code to require "Solar Ready" specifications, such as orientation and unobstructed solar access, for new homes built after 2012. Initial cost is the primary consumer obstacle to installing roof-top solar, and customized installation constitutes up to half of the cost of these systems.

#25: Require Lighting Controls

Revise the building code to require the installation of lighting controls in new homes and commercial buildings built after 2012. Lighting controls can reduce electricity consumption and provide net savings to customers.

#26: Adopt Performance-Based Codes

Move from the current, technology-based building codes to performance-based building codes based on ACEEE standards to provide builders, residents and businesses flexibility and to encourage innovation in building efficiencies. The first step is to quantify the potential cost and benefit of performance-based building codes, versus opposed to technology-based codes.

#27: Encourage Solar and Other Efficient Water Heating

Solar water heaters and other efficient water heaters can provide energy efficiency at roughly no net cost to consumers, and water heating technology is one area the Pecan Street Project believes is ready for Performance-Based coding. Though solar water heaters provide one of the most efficient sources of hot water, other technologies, such as heat pumps, efficient tankless systems and "smart" water heaters, can have the same impact on energy consumption. Recognizing this diversity, the Pecan Street Project recommends a building code requiring the installation of new water heaters based on stringent energy efficiency criteria rather than technology-specific criteria. Based on data from American Council for an Energy-Efficient Economy (ACEEE), the Council should establish an annual water heater consumption standard of 2,350 kWh of electricity or 160 Therms of natural gas.

#28: Create Construction Efficiency Incentives

Promote efficient and renewable construction by providing developers who include on-site distributed generation or advanced energy efficiency (at least 10% above existing city building codes standards) with incentives such as new rules that give permit seekers priority consideration (line-cutting privileges) or reduced permitting fees.

#29: Modify Municipal Lighting

Install automatic lighting sensors and controls in all municipal buildings by 2018.

#30: Spur Multi-Family PEV Construction

Beginning in 2011, require new multi-home residential projects above 25 units to provide PEV charging infrastructure for at least 33% of the off-street parking spaces.

#31: Enact Solar Financing Legislation

Develop rules and a funding plan to implement HB 1937 (PACE) to allow homeowners to avoid the high initial capital costs of renewable energy by paying the cost of solar installation through their property tax bill.

#32: Launch Smart Strip Partnership

In an effort to reduce "vampire load" created by idle consumer electronics, Austin Energy should launch a partnership with cable providers and electronic retailers to spur adoption of residential smart power strips. Austin Energy should look for incentives that do not require utility-funded subsidies or are funded by the providers or the retailers.

#33: Design and Launch Regional Purchasing Partnership

When it comes to purchasing power, size matters. The customers of Austin Energy, San Antonio's CPS, Bluebonnet Electric Coop and Pedernales Coop are among the largest collection of public power customers in the country. That size would translate into significant cost savings if distributed generation and other utility infrastructure improvements are coordinated. Several private entities in Austin and San Antonio have already engaged in renewable energy partnerships, and Austin should lead in organizing a formal partnership with other regional public power providers.

4. Economic Development and Job Training Recommendations

The potential economic activity that would result from advances in energy delivery drove the founding of the Pecan Street Project and much of its deliberations. Several ideas arose that will help the region spark a new energy market and attract companies, investment and jobs in this developing industry.

#34: Expand Start-Up and Incubation Support

Building on the incubation capacity at UT's Austin Technology Incubator, Pecan Street Project partners and other regional organizations should coordinate and formalize additional incubation support for the companies focused on Pecan Street Project technologies and services.

#35: Develop Local Preference Criteria for Smart Grid Procurement

The Pecan Street Project partners should work with the Austin Energy and the City of Austin procurement offices to develop policies that encourage local and regional companies to participate in Pecan Street Project related projects, including the smart grid demonstration project at Mueller. Certainly, the demonstration project at Mueller has the most immediate potential to spur millions of dollars of economic activity. Yet even outside the scope of that

project, the recommendations in this report could result in significant economic activity, and the City and Austin Energy should maximize the portion of that activity that directly benefits local companies.

#36: Coordinate Marketing and Incentive Efforts

Pecan Street Project partners should lead a coordinated "incentive and marketing" effort to promote Austin – and the rest of Texas – to renewable and clean technology companies. Texas has significant competitive advantages when competing for smart grid or renewable energy companies or investments. One *disadvantage* that has been identified by many local experts, however, is the lack of a well-coordinated effort to bundle known incentives, create new incentives and actively promote Texas or Austin to the rest of the world. Given the close working relationship between the City, Austin Energy, the University of Texas, the Greater Austin Chamber of Commerce and others, the Pecan Street Project partners should lead an effort to create a unified incentive and marketing campaign to support clean tech recruitment.

#37: Pursue New Energy Consortium

One of the original long-term goals of the Pecan Street Project team was the establishment of an ongoing research consortium focused on the technology, policy and intellectual property that will guide the evolution of the energy system. Pecan Street Project partners should actively pursue the creation of such an entity that represents – and pulls talent from – industry, academia and government.

#38: Develop Standardized Green Job Training Curricula

The region should tap the resources of the Texas Workforce Commission, the University of Texas, Austin Community College, and other regional universities, colleges and job training agencies to develop standardized job-training curricula for design, installation and maintenance of renewable energy technology deployment.

#39: Consolidate and Coordinate Green Job Efforts

Various existing green job training efforts should be combined into one, more cohesive, coordinated Central Texas job training effort that serves as a clearinghouse for regional green job information and can contribute to regional "standardization" efforts, such as the green job education and training curricula mentioned above. The effort could be led and managed by any one of the many regional entities that are currently managing an individual effort.

Conclusion
Moving Forward

When the City, Austin Energy, UT, the Chamber and EDF joined together in December 2008 to announce the Pecan Street Project, each participant realized that this first effort would only be part of a long-term project. The energy system wasn't created in a year, after all. No one expected it to be redesigned in a year.

Now that the group's initial recommendations have been delivered to the community, the project must grow and adjust to push forward the group's vision. This change will occur through community input, economic factors, changes in the energy market and advances in technology. But the next phase of the Pecan Street Project has already begun.

Following its creation in August 2009, the first action of the new Pecan Street Project, Inc. organization was the coordination of a successful application for Department of Energy stimulus funding for a demonstration project at Austin's Mueller community. The proposal requested $10.4 million in funding to supplement more than $20 million in pledged matches from participating applicants. In November 2009, the Department of Energy granted the award, in essence launching the first recommended demonstration pilot of the Pecan Street Project.

In addition to administering the Demonstration Project at Mueller, Pecan Street Project, Inc. will continue to promote the original vision of the Pecan Street Project and the recommendations articulated in this report and will serve as a professional manager of pilot projects, education campaigns and other related efforts.

But Pecan Street Project, Inc. is only one part of what needs to happen now. Beyond the demonstration project at Mueller and the technical and utility modifications that Pecan Street Project Inc. will spearhead, there is a less-tangible priority that emerged from the team's work.

The vision of the Pecan Street Project must become hardwired into the planning DNA of this community – just as technology was hardwired into the community's vision a generation ago. And the responsibility to make that happen will fall on the shoulders of more people than those who launched this project and brought it this far.

For example, the implementation of these technical improvements will require a significant job training effort. Many community entities (Austin Community College, the Chamber and the Texas Workforce Commission, to name just three) are already working to develop the workforce that will design, install and maintain this technology. But the coordination among ALL regional job training agencies must become much more deliberate and streamlined.

The University of Texas' potential as a clean energy catalyst has merely been tapped. To be sure, UT's commitment was strong – more than two-dozen experts and professors have par-

ticipated in this project. But given UT's expertise in technology commercialization, architecture, smart grids, modeling and entrepreneurism, most Pecan Street Project team members agree that closer integration of UT's experts and the ongoing project would be very valuable.

And there are other stakeholders that must be integrated into this effort now that these initial recommendations have been offered. Of course, the Mayor and City Council must be part of any successful effort – not only because of their leadership of Austin Energy, but because many of the project's recommendations deal specifically with land use and building code modifications the City Council will have to lead. Experts from more than a dozen corporate partners have participated already, but the local entrepreneur and investor community – and many others – must be more deeply engaged.

Most importantly, this project's momentum must be preserved if it is to become truly embedded in the community. Beyond its great location, the demonstration project at Mueller stands to immediately take advantage of the momentum that the Pecan Street Project created last year. And there must be more than Mueller.

In short, if the Pecan Street Project mission is left to a non-profit organization and a few dedicated individuals within Austin Energy or City Hall, it will make only incremental progress. The scope of this effort is dramatically larger than any one organization, department, expert or leader can execute.

All of this points to a responsibility on the part of the founding partners and Pecan Street Project, Inc. to not only renew their commitment to the project mission, but also to double their efforts as its ambassadors and invite new talent into the process. This project has begun a collaborative effort that could pay remarkable economic and environmental dividends for decades to come. To help ensure that happens, though, it needs evangelists, a deliberate and aggressive education and community outreach strategy and continued participation from experts. And it will need them all for the foreseeable future.

The work conducted over the last year under the broad umbrella of the Pecan Street Project is the result of many volunteer hours from many volunteer experts. The staff and board of the Pecan Street Project, Inc. guided the process and issued this report. But neither would have been successful without such commitment from so many people.

Many thanks to the Pecan Street Project, Inc. staff and board members, the staff from each of the founding partners, the employees of the project's corporate partners and the other professionals who contributed to this effort.

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