Case Study

Smart grid journey at Austin Energy, Texas, USA

Abstract

In 2003, Austin Energy based in Texas, US, began a long journey to explore and deploy the technologies enabling the Smart Grids of the future. The first part of Austin Energy's programme, called Smart Grid 1.0, to be concluded at the end of 2009, focuses on the utility side of the grid, going from the central power plant through the transmission and distribution systems and all the way to the meter and back. In total, the project covered the installation of 410,000 meters, 86,000 thermostats, 2,500 sensors, 1,700 computers and 1,000 network elements. Enterprise system architecture redesign and back-office integration were key to successfully orchestrate all the pieces of the project. Before the project was wrapped up, in December 2008, Austin Energy launched the second phase of the journey towards intelligent grid: Smart Grid 2.0, developed in conjunction with the Pecan Street Project. Smart Grid 2.0 focuses on the grid beyond the meter and into the premise (e.g. home, office, store, mall, and buildings) with integration back to the utility grid. The project is concerned with managing and leveraging distributed generation (e.g. solar, micro wind), storage, electric vehicles, and smart appliances on the customer side of the meter.

Case study fact sheet

• *Full name of the company:*	*Austin Energy*
• *Location (HQ / main branches):*	*Austin, TX (USA)*
• *Main business activity:*	*Electricity company*
• *Year of foundation:*	*1893*
• *Number of employees:*	*1,700*
• *Turnover in last financial year:*	*$1.3 billion (2009)*
• *Primary customers:*	*388,000 residential customers* *43,000 businesses*
• *Most significant geographic market:*	*Austin, TX and surrounding areas*
• *Main e-business applications studied:*	*Smart Grid, Smart Metering*
• *Case contact person(s):*	*Andres Carvallo* *Chief Information Officer* *Austin Energy*

Background and objectives

Austin Energy is the United States' ninth largest community-owned electric utility. The company serves about 410,000 customers and a population of 1,000,000 in an area encompassing 650 square kilometres. As a publicly owned power company and a city department, Austin Energy returns profits to the community annually. Austin Energy powers the capital city of Texas through a diverse generation mix, including nuclear, coal, natural gas, and renewable energy for a total of 2,600 MW. Austin Energy's base electric rates have not increased since 1994 and are the lowest rates among major Texas cities and among the lowest across the US. The company aims to continuously improve its customer satisfaction. By 2020, Austin Energy plans to obtain 700 MW of energy efficiency and a share of 30% of renewable energy in its generation portfolio, of which 100 MW coming from solar.

In 2003, Austin Energy undertook a wide project to revolutionise its enterprise ICT architecture and prepare the company for the construction of a modern energy system - customer-driven, integrated, interactive, optimised, distributed, secure and self-healing[1]. The project, completed in August 2009 is known as Austin Energy Smart Grid 1.0. It was focused on installing about 5,000 digital devices and related ICT solutions going from the central power plant through the transmission and distribution systems and all the way to the meter and back. Even before it wrapped up, Austin Texas had started preparing phase two by launching the "Pecan Street Project" to develop a citywide smart grid.

The Pecan Street project, and consequently Austin Energy Smart Grid 2.0, focuses on the grid beyond the meter and into the premise (e.g. home, office, store, mall, and buildings) with integration back to the utility grid. The project is about managing and leveraging distributed generation (e.g. solar, micro wind), storage, electric vehicles, and smart appliances on the customer side of the meter. The Pecan Street Project is being driven by former Austin Mayor Brewster McCracken, and includes the City of Austin, Austin Energy, the University of Texas' Austin Technology Incubator, the Greater Austin Chamber of Commerce and the Environmental Defence Fund. This last participant is the group leader and has organised resources into twelve teams, with 150 people total, that are delivering recommendations for an Austin-specific smart grid system. Together they are defining what smart grid 2.0 should look like, not just for Austin Energy, but also for industry at large. The results of these working groups will be the basis for Austin Texas' upcoming action plan.

The project has also already garnered eleven corporate partnerships, including Applied Materials, Dell, GE Energy, IBM, Intel, Oracle, Cisco Systems, Microsoft, Freescale Semiconductor and GridPoint. The corporate partners are assisting the project team by providing for free staff resources and strategic guidance within their areas of expertise. Partners are also helping the project team identify technologies that can be pilot-tested on the local electrical grid once the initial phase of the project is completed.

Smart Grid 1.0 took Austin Energy six years to deploy and cost about $150 million, of which $10 million coming from the Department of Energy. The estimated investment for the new project is about $240 million, and Austin Energy has submitted 2 applications to the US Department of Energy to obtain matching funds for around $110 million.

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[1] A self-healing network uses real-time information from embedded sensors and automated controls to anticipate, detect, and respond to system problems, automatically avoiding or mitigatigatig power outages, power quality problems, and service disruptions. For more information on smart grid concept see section 3.4.3

e-Business activities

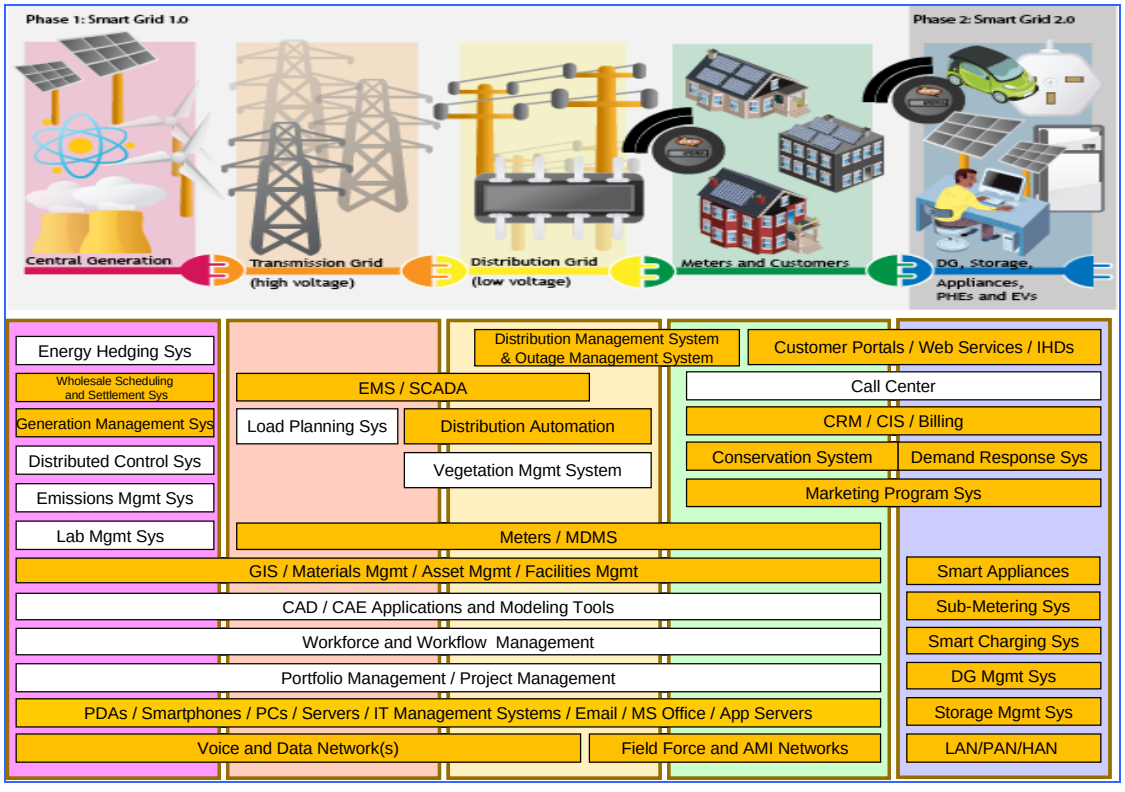
Starting in 2003, Austin Energy undertook a complete modernisation project of all its IT applications, migrating all of its software to become Java-based. As part of Smart Grid 1.0, Austin Energy began a long process of deploying a series of new technologies and applications, including the rollout of smart meters to its entire household and business clients (completed in August 2009).

The activities were led by the redesign of ICT enterprise architecture and a major step was the deployment of smart meters and the related automated metering infrastructure (with a two-way communication network). In total the project covered the installation of about 500,000 devices including 410,000 meters, 86,000 thermostats, 2,500 sensors, 1,700 computers and 1,000 network elements.

The deployment of a new meter data management system started in December 2008. This feeds into the outage management system, customer information system, distribution planning system, energy efficiency management system and asset management system. All this is accompanied by the rollout of a distribution management system (DMS) and integrates all the elements into a supervisory data acquisition and control system (SCADA) and energy management system. Lastly, the rollout of the new billing system, enabling demand response programmes and new billing rates - e.g. Time of Usage (TOU), net metering, prepayment –, started in May 2009 and will be completed by 2011.

The applications areas depicted in yellow in Exhibit 5-7 are those affected by Smart Grid 1.0 and the ones that are expected to be affected by the 2.0 project.

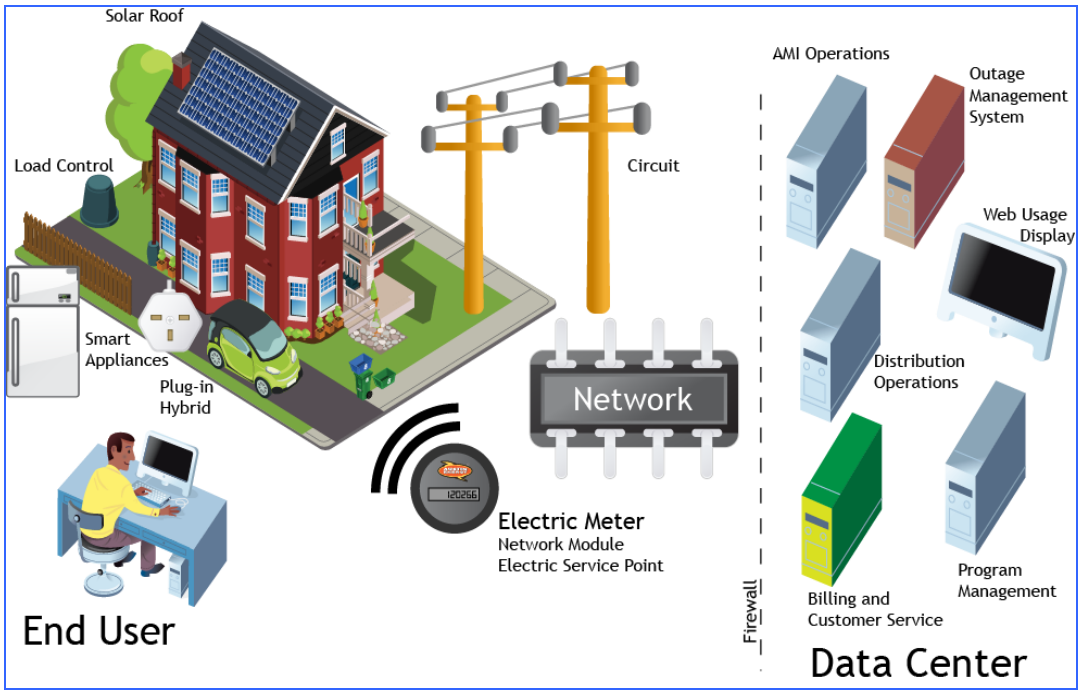
Exhibit 5-1: Austin Energy Systems affected by Smart Grid projects



Source: Austin Energy, June 2009

The new Austin Energy IT infrastructure is being designed to accommodate exponentially larger quantities of data. Currently, Austin Energy needs to handle 20 Terabytes of data per year. When meter readings will be carried out every 15 minutes for the entire network this figure will reach 100 Terabytes, while when the readings will be carried out every 5 minutes the data will reach a capacity of 400 Terabytes. This represents a serious challenge to be addressed also from a storage perspective. The challenge will be even more complex with the rollout of additional intelligent devices into the customer premises, as planned by the Pecan project and Smart Grid 2.0 (refer to Exhibit 5-8).

Exhibit 5-2: Austin Energy vision of the Smart Premise (Home)



Source: Austin Energy, June 2009

As part of its efforts in going into the customers' premises, the Pecan Street Project will start by leveraging a newly built area, the Mueller development. This is a 3,000-squared meters development in which every new building is green built (either certified through LEED or Austin Energy's nationally recognised Green Building programme). In partnership with Mueller residents and stakeholders, Austin Energy will test smart grid 2.0 by creating a microgrid initially linking 1,000 residential meters, 75 commercial meters, and plug-in electric vehicle charging sites during the five-year project period. The development will integrate smart meters, energy control gateways, advanced billing software, and smart thermostats. The project team will use this technology platform to demonstrate grid integration of distributed clean energy generation, smart water systems, distributed storage, smart appliances and plug-in electric vehicles. The project will also compare different delivery and business models, including dynamic pricing, demand response, decoupled pricing linked with net metering, and rooftop solar leasing. The project will also test different storage technologies, including potentially thermal storage, battery technologies (e.g., lithium ion, lithium iron magnesium phosphate, metal air, and lead acid), and possibly ultracapacitor and fuel cell systems.

The project will collect data and analyse these results against control groups and distribution feeder systems in other locations in the City of Austin to quantify how the integration of these technologies impacts customer electric bills and usage, utility finances, environmental outcomes and electric system performance.

The goal of the demonstration project will be to transform how energy is generated, delivered, and managed so that customers on that part of the system would be carbon neutral – and to do this in a way that creates green collar jobs, efficiently and cost effectively expands use of clean energy, and provides consumers with greater control over their electric bill and environmental impact while saving them money on their electric bill.

Impacts

Austin Energy's objectives of energy efficiency as well as of further development of green energy will not be achieved without the creation of the smart grid described in the previous sections.

Even if an ROI analysis of already completed projects is not publicly available, it is worth to mention that all the activities were carried out with no impact on customers' rates, which have not risen for the last 15 years.

Overall, it is still too early to quantify benefits sought after by such a broad implementation. Major results are expected in terms of reduced need for construction of additional generation and transmission capacity, reduction of operating costs, service improvement, realisation of demand response programmes, building automation. A more comprehensive list of expected results, benefiting both customers and the utility are summarised in Exhibit 5-9.

Exhibit 5-3: Expected benefits of Austin Energy Smart Grid 2.0 Project

Benefits for Austin Energy	Benefits for customers
▪ Reduced need for additional generation and transmission capacity ▪ Reduced operating costs ▪ Improved outage management - ability to quickly determine if power is off or on ▪ Reduced number of delayed and estimated bills ▪ Reduced energy theft ▪ Improved load profiler ▪ Improved distribution load management and planning ▪ Greater historical load and usage data available for better load forecasting ▪ Better asset management and maintenance (effectiveness and cost reduction) ▪ Time-of-use, prepaid, and flat bill pricing programmes ▪ Support any market price-responsive tariff requirements	▪ Faster notification and restoration times from outages ▪ Better understanding and management of bills through usage information via a Web portal ▪ Ability to participate in energy efficiency and demand response programmes ▪ Reduced inconvenience by no longer needing to unlock gates and tie up dogs for meter reads ▪ Improvements in timeliness and accuracy of billing with fewer estimated bills ▪ Remote service turn-on and shut-off (e.g. of air conditioning) ▪ Access to real-time meter reads through a call to customer service or via data on a home energy display or Web portal ▪ Manage appliances via Web portal ▪ Ability to participate in alternative tariff options

Lessons learned

Austin Energy plans to share lessons learned with other cities around the nation and the world. The collection of different technologies, business models and practices can be mixed and matched by other municipalities to create their own smart grid. It is this open-ended policy that has helped Austin garner some of the top professionals in the country.

During Smart Grid 1.0 Austin Energy quickly learned that one of the most difficult challenges to overcome is the resistance stubbornness to change processes and culture. Changing a culture affects skills, jobs and lives. It requires time, commitment and people's willingness to change. It is not something that can be "mandated".

For this reason the participation of customers in the second part of the journey to smart grids into the premise will be voluntary. As Austin Energy already controls 22% of its customers' thermostats, for example by regulating them during peak hours, the company feels it already has a pretty good sense of what its customers want and need. However, it is prudent in asserting that it would be able to manage 100% of its clients' thermostats.

Austin Energy has come to the conclusion that utilities alone are not enough to elaborate the answer to the future Smart Grid, as a consortium of experts from various market segments are crucial, not only for best practices, but also to contain costs and spread risks. Utilities need to take on the role of orchestrators to harmonise all the tasks needed to make the Smart Grids of the future a reality.

Finally, Austin Energy highlights that the redesign of enterprise system architecture and back-office integration were key to successfully orchestrate all the pieces of the project.

References

Research for this case study was conducted by Roberta Bigliani and Gaia Gallotti (IDC Energy Insights), on behalf of the Sectoral e-Business Watch. Sources and references used include desk research plus:

- Interviews with:
  - Andres Carvallo, Austin Energy (Texas, USA), Chief Information Officer
- Websites:
  - www.austinenergy.com
  - www.muelleraustin.com
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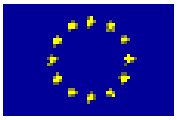
  - www.ciomaster.com
- Other references:
  - Austin Energy Company Profile
  - "Balancing vision & today" article by Andres Carvallo, Intelligent Utilities magazine, January-February 2009, Energy Central
  - "Turning Information into Power: The Smart Grid and Network Operations, Andres Carvallo, CIO of Austin Energy in Austin, TX, on the Pecan Street Project" - Oracle Utilities Live Webcast, June 11th 2009

About this document

This case study was initially published as part of a comprehensive Sectoral e-Business Watch study report “ICT and e-business impact in the energy supply industry” (2009). The European Commission, Enterprise & Industry Directorate General, launched the Sectoral e-Business Watch (SeBW) in late 2001 to monitor, study and assess the implications of ICT for enterprises and sectors. The results support policy formulation, notably in the fields of industrial and innovation policy. All study reports and further resources such as data on ICT adoption in enterprises are available online at the SeBW website (www.ebusiness-watch.org).

For further information, please contact



European Commission
Enterprise & Industry Directorate-General
D4 "ICT for competitiveness and innovation"
e-Mail: entr-innov-ict-ebiz@ec.europa.eu

Sectoral e-Business Watch
c/o empirica GmbH
Oxfordstr. 2, 53111 Bonn, Germany
e-Mail: info@ebusiness-watch.org