IBM Software Group

CenterPoint Energy drives smart grid analytics through the power of GIS

Business Challenge
Like the rest of the electric transmission and distribution industry, CenterPoint Energy needs to deliver power more efficiently and reliably in the face of growing consumer expectations, environmental concerns and increasing costs. The company also sees the opportunity to leverage its digital asset infrastructure data for smarter power delivery.

Solution
Subject to approval by its regulators, CenterPoint Energy plans to leverage a mix of leading-edge communication technologies, smart meters and existing GIS-based digital asset infrastructure to create one of the industry's first intelligent utility networks. This mix of advanced technologies, which utilizes a service-oriented architecture (SOA) foundation, will enable near real-time data access and

When it comes to the electricity that powers homes, schools, businesses and hospitals, most people have little more than a fuzzy idea of what's involved to get it there. This ambiguity disappears when it comes to their expectations, however. They expect power to be there when they need it, and if it's not, they want the problem fixed as fast as possible—period. In the greater Houston area, it's the responsibility of CenterPoint Energy (CNP) to meet this customer expectation.

CNP, a Texas company that supplies electricity and gas to approximately 3 million customers, owns and maintains a grid of power lines that connect electric generators to users. CNP has deployed smart grid technology on a limited basis in Houston, initially installing 10,000 smart electric meters and 500 smart natural gas meters.

Following this successful project, the company received approval from the Public Utility Commission of Texas (PUC) and $200M in US ARRA Stimulus grant funding to complete installation of 2.2 million smart meters. CNP will also further strengthen the reliability and self-healing properties of the grid by installing more than 550 sensors and automated switches that will help protect against system disturbances such as natural disasters.

predictive analytics for a new level of grid reliability, fewer outages and faster response.

Key Benefits

- *Reduction in the frequency and duration of power outages through proactive management and automated response*
- *Overall increase in meter reading and grid management efficiency*
- *Near real-time electric-use data provided by smart meters to the utility and to the consumer*
- *Extended asset life for distribution and substation equipment through remote monitoring and diagnostics*

Potential Market Benefits

- *Greater electric reliability—reduction in the frequency and duration of power outages through proactive management, maintenance and automated response*
- *Faster response to problems through improved alerting, tracking, scheduling and routing field personnel*
- *Potential for retail energy providers to increase new time-of-use rate structures and additional services*
- *Increase in customers' ability to manage their own demand for power, which may encourage greater energy conservation*

CenterPoint Energy's business challenges

CNP faces multiple business challenges converging from a number of different origins. Electric restructuring in Texas in 2002 led to the creation of new competition: a set of retail electric providers that sell power and services directly to customers and pay CNP for the use of its power lines.

In addition to increased local competition, a changing regulatory environment—both at the state and federal level—has intensified the need for CNP's infrastructure to become more durable. The Northeast blackout in 2003 and severe hurricane seasons in 2004 and 2005 spurred CNP to look for ways to "harden" the grid by making it better able to resist outages and fluctuations in power quality. This initiative is consistent with the US Department of Energy's "Grid 2030" plan, a clear mandate to bring many of the defining attributes of the information superhighway—such as resiliency and intelligence—to the nation's electrical grid.

Finally, regulators are encouraging changes on the demand side, most notably giving electricity consumers the means to change their consumption patterns based on near real-time usage data, transparency and time-of-day pricing—all of which will allow the consumer to be an interactive participant in the electric market.

CNP also realized that only a fundamental change in its business and operational structure would provide viable, long-term durability. What makes this story stand apart, however, is that CNP opted for revolution over evolution by resolving to comprehensively change the way it operates. Looking beyond short-term strategies, the company saw its challenge as an opportunity to provide much-needed leadership for an industry in flux. IBM was the ideal organization to help CNP articulate and realize its vision of a next generation power grid.

Drawing upon expertise and technology from nearly every part of IBM, CNP established a roadmap for building an Intelligent Utility Network, or IUN. Traditional grid management systems provide only the most basic information on operational status and have no way to gather information from—or deliver information to—the homes and businesses they serve. As such, they enable only a limited "top-down" view, with essentially no rapid view from the "bottom up." Today, field crews must be on site to identify the location and cause of power outages. In the future, technology will pinpoint the outage location. The core premise of IUN is that by improving the transparency of the entire grid—to the meter and beyond—energy delivery companies like CNP will have a

Solution Components

Software

- IBM WebSphere® Message Broker *Servers*
- IBM BladeCenter® Services
- IBM Global Business Services
- IBM Global Services Strategic Outsourcing
- IBM Global Technology Services
- IBM Research

IBM Business Partners

- ESRI, Itron, Inc., eMeter, Corinex and Arteche

Smarter power

As part of its pioneering deployment of an intelligent utility network, CenterPoint Energy will be putting in place an SOA framework that will better enable a wave of innovations, including a first-of-a-kind outage detection capability that features self-healing within the grid and fully automated dispatching.

granular, real-time view of grid conditions. This will vastly improve the ability to leverage information, make the grid more reliable and operations more efficient.

While the broad goals embodied by IUN are not new, their realization has been held back by technological barriers, the most fundamental being the lack of a viable communications infrastructure that spans the distance from a utility's backend systems to its customers' meters. While utilities may be able to detect a problem using their current systems, they are often unable to ascertain the nature of the problem until crews arrive on-site. It is because of this gap that utilities like CNP are forced to rely on physical visits by field staff to diagnose and fix problems, as well as to activate or deactivate service and read meters.

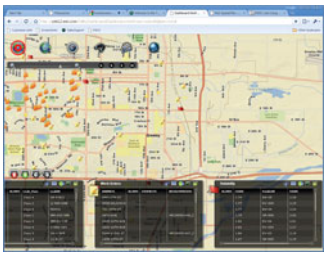
The solution

Designed in collaboration with IBM, CNP's proposed IUN solution will address these issues through the innovative application of leading-edge technologies—including broadband over power line (BPL)—and work with IBM Research to develop first-of-the-kind failure detection capabilities that go beyond what was previously thought possible. The fact that BPL, which sends a broadband signal over distribution wires (utilizing solutions from IBM Business Partners Corinex and Arteche), leverages CNP's existing assets is just one benefit. Even more promising is how the company's future BPL infrastructure, when deployed by IBM Global Technology Services, will provide a single conduit for a wide range of grid-related activities, with advanced meter services, the use of the meter as a sensor on the grid (with its own address), and the deployment of home area network monitoring and control, representing prime examples.

Using meters from IBM Business Partner Itron that have two-way communications capability, CNP has successfully tested automated meter reading as well as more advanced capabilities such as remote connection and disconnection of service, both of which promise to reduce the incidence of costly "truck rolls" to the customer's premises. Meter data management software from IBM Business Partner eMeter (running on IBM BladeCenter® servers and managed by IBM Global Services Strategic Outsourcing) will control the flow of meter data to and from CNP's backend systems. The fact that these meters have the built-in capability to wirelessly send and receive data, with everything from individual appliances to thermostats within customers' homes and businesses, opens up a range of new service opportunities down the road.

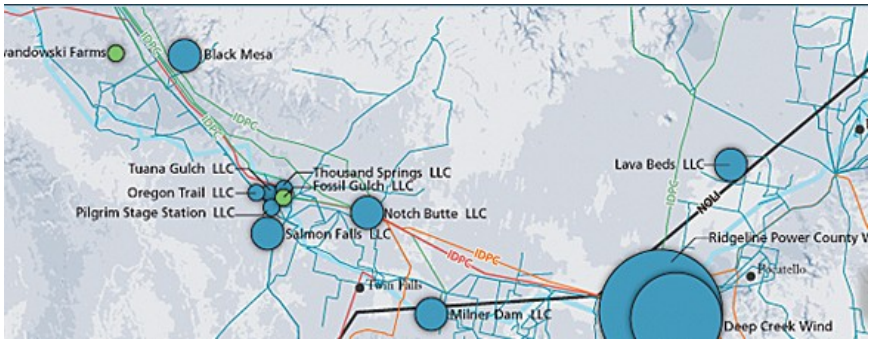
Real Savings

CNP has implemented a comprehensive enterprise ESRI-based asset-management database that includes links to its financial, customer supply chain, environmental and asset management systems. CNP's decision making, communication of assets and collaboration processes have all benefited, In an early project, an underground location tool GIS application saved CNP $1 million in the first year it was implemented.



Utilities will use GIS as a method for organizing data collected from sensors and smart meters and communicating status information to the utility and its customers.

The Grid Can't Be Smart without GIS



Geographic information system (GIS) technology is widely recognized for its strong role in managing traditional electric power transmission and distribution and telecommunications networks. For CNP, GIS by IBM Business Partner ESRI already provides a comprehensive inventory of the electrical distribution network components and their spatial locations. An array of applications for managing assets, automating tasks, and serving customers comprise but a few of CNP's enterprise GIS applications that cover all aspects of the company's operations. With CNP's sophisticated communication network superimposed on the electric network, asset data management with GIS becomes utterly critical.

According to CNP's GIS manager, Cindi Salas, "GIS technology plays a key role in the automation strategy in that it will provide the initial infrastructure data that will fuel the automated analytics."

Today, most electricity utility systems are passive and unaware of problems in the field. Other than information about main supply substations, these systems have little information on their status. Spatial technologies offer the breakthrough needed for utilities to operate much more effectively and interactively. CNP will use ESRI GIS technology as a method for organizing data collected from sensors and smart meters and communicating status information to the utility and its customers.

A Flexible Architecture for Power

One of the key insights in the CNP project was that simply having a communication infrastructure wasn't enough when it came to supporting its future service requirements. Instead, CNP needed an architecture with the inherent flexibility to support a growing number of services and thus fully leverage its communication backbone. To that end, IBM Global Business Services will be designing a service-oriented architecture (SOA)-based service delivery framework (SAFE) that employs IBM WebSphere

The IBM Solution Architecture for Energy and Utilities Framework (SAFE) *is an innovative, powerful software platform, uniquely positioned to provide network visibility and control, process automation and business collaboration for solutions across the energy value chain.*

Message Broker as an enterprise service bus to enable different services to share grid data in real time.

Integrated within the IBM SAFE framework, ESRI's GIS software provides the tools, applications, workflows, analytics and information-integration capabilities CNP needs to manage its intelligent utility network. Using this framework as a foundation, the IBM-CNP team will be able to redesign and automate many of the core processes used to manage the grid. The most revolutionary improvement will be in the area of fault detection. Using data gathered from first-of-a kind analytical techniques developed by IBM Global Business Services and IBM Research, CNP will be able to not only detect problems, but also to diagnose faults and their precise location so it can send the right crew with the right equipment to fix the problem.

Complementing this quantum increase in grid transparency are process automation efforts designed to drastically cut the duration of outages and to mitigate their effects on customers. Automation will not only let the company operate more efficiently, but will also provide the basis for a self-healing capability within the grid. The proposed solution, when approved by the company's regulators, will detect outages the moment they happen—enabling the system to reroute grid traffic around the problem automatically to minimize its impact.

As a storm-prone city situated on the Gulf Coast—and the home to a large base of energy-hungry businesses—Houston is the ideal testing ground for one of the world's first true IUN solutions. Don Cortez, Division VP, Operations Technology, and a driving force behind the IUN project, sees CNP's work with IBM as strengthening the foundations of its business and providing leadership for other transmission and distribution service providers around the world. "We're working to implement all those things that people dream about in a newly deregulated energy market—all very new ideas," says Cortez. "With its unparalleled track record in translating technology innovation to sustainable market success, we saw IBM as the right kind of partner to help us succeed."

International Business Machines Corporation
Route 100
Somers, NY 10589 U.S.A.

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