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DISTRIBUTED ENERGY RESOURCES

Customer Input Counts

AmerenUE embarks on on *Project Power On* initiative in Missouri, which includes undergrounding troublesome and outage-prone overhead lines to improve reliability.

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During 2006, 723 Severe Weather Events were Recorded by the National Weather Service's office in St. Louis, Missouri, U.S. This was more than any other National Weather Service office in the United States. There were also 102 tornadoes in Missouri during 2006, which set a new record. For AmerenUE (St. Louis), this volatile weather resulted in outage events for its Missouri electric customers that were unprecedented in its century-long history.

BAD WEATHER ON PARADE

In fact, in the four years beginning in 2004, AmerenUE and its 1.2 million electric customers endured a litany of continually record-breaking severe weather events — record-breaking from the aspect of the number of customers out of service, the number of substations and distribution circuits out concurrently, and the number of outside resources (contractors, mutual assistance partners and electric cooperatives) called to assist in restoration efforts. This culminated in the second half of 2006 and early 2007, when back-to-back summer storms on July

19 and July 21 left a total 645,000 customers out of service, and back-to-back ice storms on Nov. 30 and Jan. 13 (the first severe ice events in 30 years) left 290,000 and 350,000 customers out, respectively.

Most of these events triggered investigations by the Missouri Public Service Commission that together carried dozens of recommendations in their wake. Customer-satisfaction ratings reached their lowest levels in years. The outcry was fueled by persistent negative press and pressure from elected officials at all levels of government. In hindsight, AmerenUE's rate-case submittal, filed just before the July 2006 storm (its first rate-increase proposal in 20 years), came at an unfortunate time and didn't help matters.

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**DEVELOPMENTS IN THE POWER-
DELIVERY INDUSTRY?**

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NO, NOT RIGHT NOW

WHAT MISSOURI CUSTOMERS WANT

Along the way, AmerenUE conducted focus groups involving more than 500 people across every imaginable cross section of its customer base. The intent was to get back in touch with what its customers consider important and what they want from their local utility. In addition, the company reached out to a wide range of elected and appointed officials and community leaders. The two major issues that emerged from these discussions were a customer demand for improved service reliability and a renewed focus on environmental stewardship.

There was a time in recent history when AmerenUE management believed the low cost of service was most important to Missouri customers, and the company responded with a consistent strategy of providing just that. For many years, AmerenUE's electric rates have remained among the lowest in the nation among major metropolitan areas. However, AmerenUE's focus group discussions have shown that today, especially in light of the Midwest's recent weather volatility, the major factor driving customer satisfaction is reliable electric service.

With this realization has come a fundamental shift in AmerenUE's energy-delivery strategy, one recognizing that previously conventional practices in distribution system maintenance, vegetation management and reliability engineering would never be sufficient again. It was on this premise that *Project Power On* was conceptualized and ultimately announced to Missouri customers.

POWER ON'S UNDERGROUND PROGRAM

- Improving overall service reliability
- Proactively upgrading the power-delivery system to stand up against future severe weather
- Enhancing the environmental performance of Missouri's fossil-fueled generating stations.

Project Power On is comprised of four basic elements, including a \$300 million commitment to the application of under-grounding solutions to a number of reliability problems throughout the Missouri service territory. [The other three initiatives are detailed in the sidebar above.]

From a traditional perspective, the \$300 million undergrounding program represents a dramatic departure from convention, both for AmerenUE and most of the electric utility industry. It is the single-largest distribution project ever undertaken in AmerenUE's history, and it is intended, above all else, to underground some of its most troublesome and outage-prone overhead power lines. There is no model in the industry today for a project of this nature and scale, but AmerenUE envisions it should be able to build 750 to 1000 individual projects of various sizes and to convert up to 200 miles (322 km) of its poorest-performing overhead circuitry — particularly those shown to be most susceptible to damage by trees during severe weather.

APPORTIONING THE INVESTMENT

One of the earliest decisions made was how to apportion the \$300 million investment across the Missouri service territory. For accountability reasons, it was important that capital investments be made in as many different areas of the state as possible.

After investigating several options, AmerenUE decided to apportion the investment across its service territory according to customer population. At first, the hope was that there would be beneficial work to do in each of the 57 Missouri counties AmerenUE is tariffed to serve, but this was finally deemed impractical, especially in counties with very small customer numbers. Funding allocations were bubbled up instead (based on customer population) to each of AmerenUE's nine Missouri construction divisions. In the end, a higher percentage of the undergrounding program investment was slated for the St. Louis metropolitan area and immediate surrounding counties. This makes sense, as this was the epicenter for most of the severe weather events of the past five years.

TYPE OF WORK INCLUDED

At the core of the undergrounding program is the conversion of overhead lines. Medium-voltage circuits are being targeted from the three-phase 34-kV line traversing rough terrain down to the single-phase 2400-V line running through residential subdivision rear lots. If overhead secondary (below 600 V) is on the pole, it also is converted. The underground facilities are installed following the same guidelines currently in place for new line extensions: medium-voltage cable routes along front lot lines and all padmount equipment accessible by boom truck from a paved or otherwise "improved" surface

from a paved or otherwise improved surface.

Funds are also set aside for the replacement of poor performing direct-buried underground residential distribution (URD) cable. Today, thousands of miles of direct-buried solid-dielectric cable operate below 15 kV in Missouri, half of which was installed to serve residential subdivisions in the 1970s and 1980s. Most of this is single-phase high-molecular-weight-polyethylene or cross-linked-polyethylene cable with exposed concentric neutrals. Replacements of these laterals with ethylene-propylene-rubber cable in conduit (the current standard) are justified based on excessive failures and substantiated cases of neutral corrosion, which in turn can result in stray-voltage conditions and other operational problems.

Rounding out *Project Power On's* suite of undergrounding solutions is the looping of single-sourced URD cable laterals. In many parts of the state, there exist legacy URD laterals that, unlike new installations today, aren't fed from two sources with a "normal open" in the middle. These improvement projects involve the installation of new cable sections in conduit in order to "loop" previously unlooped URD laterals. The reliability proposition associated with this type of solution is one of reduced outage duration as opposed to reduced outage frequency.

PROJECT JUSTIFICATION CRITERIA

It's anticipated that the undergrounding program will allow for the conversion of up to 200 miles of medium-voltage overhead circuitry. However, AmerenUE has more than 27,000 miles (43,452 km) of such circuitry in Missouri. As a result, the utility is employing a heavily targeted approach to identify and prioritize the work to be performed. And while there are many considerations that go into the decision to build a particular conversion project, three of them stand out: cost, the performance of the section being converted and the number of customers benefiting from the conversion.

As a means of getting the biggest reliability improvement possible for the investment, AmerenUE designed a metric called Cost per Annual Avoided Customer Interruption (CAACI) to help screen the hundreds of jobs initially under consideration. Those jobs that are most economical to build, convert circuit sections with poorest outage histories and electrically affect the most customers downstream of the nearest protective device will have CAACI values small enough to warrant the greatest consideration. To prioritize URD loop completion jobs, AmerenUE designed the Cost per Annual Avoided Customer Minute Out metric.

TURNKEY PROGRAM EXECUTION



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The magnitude of the underground program's investment prohibits accomplishing anything but a small portion of the work with internal resources. Using the company's strategic sourcing process, AmerenUE competitively bid the program as a turnkey operation, outsourcing every conceivable discipline: design, engineering, real estate, public relations, customer communication, warehousing, material delivery, construction and property restoration.

Contracts were signed in early November 2007 with three primary partners: J.F. Electric Inc. (Edwardsville, Illinois, U.S.), Henkels & McCoy Inc. (Blue Bell, Pennsylvania, U.S.) and PAR Electrical Contractors Inc. (Kansas City, Missouri). PAR is responsible for project controls and pre-construction services, which includes everything except construction and property restoration. The construction and restoration disciplines are split between J.F. Electric and Henkels & McCoy.

Altogether, AmerenUE's partners and their subcontractors have grown to nearly 400 full-time equivalents in the program's first 11 months. Overall management of the program and the contractors involved is the responsibility of a small department at AmerenUE (15 full-time equivalents) called Reliability Improvement.

CONVERSION OF OVERHEAD SERVICES

In order to have the biggest possible impact on reliability, AmerenUE has chosen to concentrate efforts on the conversion of overhead spans of wire (from pole to pole) and not the individual services to customer premises. There is a private investment involved for the Missouri customer in the conversion of overhead service wires to a home or building. AmerenUE did not want to force customers to make this investment nor did it want to have a customer's reluctance to do so stand in the way of the rest of the conversion project.

As a work-around to this, a secondary pedestal is being installed within 10 ft (3 m) of each service pole on a conversion job, usually in the rear of the lot involved. Secondary cables are brought in to the pedestal from the new padmount transformer in front of the lot. An additional cable is brought out of the pedestal and up the service pole (a "reverse riser") to feed whatever overhead services remain on it. This pedestal also becomes the utility "point of attachment" for whenever those services are placed underground in the future.

However, it did appear to make sense to provide an incentive for residential customers to participate in the undergrounding of overhead service wires at the same time AmerenUE is converting the rest of the subdivision. Consequently, AmerenUE pursued and obtained approval from the Missouri Public Service Commission for a "operational incentive" that provides \$750

from the Missouri Public Service Commission for a "promotional practice" that provides a \$750 rebate check to eligible residential customers who make the investment to convert their overhead service wires within six months of AmerenUE's completing the conversion in their area.

LISTEN, RESPOND AND DELIVER

A whirlwind of activity is underway at AmerenUE, even in addition to what's going on with *Project Power On*, intended to show Missouri customers that AmerenUE is committed to responding to what it is they've told the company is important to them. The motto above is reflective of an energy-delivery strategy that is focused on exceptional customer service and improved service reliability. It's fully intended that *Project Power On* will help deliver on this commitment.

OTHER PROJECT POWER ON INITIATIVES



Power plant scrubbers. AmerenUE is spending US\$500 million on the installation of scrubbers at its Sioux power plant. This capital project reinforces for Missouri customers the continued sense of AmerenUE's priority for environmental stewardship. Scrubbers are being installed for both of the plant's units, and should reduce mercury (Hg) and sulfur dioxide (SO₂) emissions to within 10% of current levels. Reductions in the airborne emissions of Hg and SO₂ have held the U.S. Environmental Protection Agency's interest for several years. The Sioux project makes the single-largest reduction possible in the company's Hg and SO₂ footprints, and the investment is being made several years ahead of when EPA regulations would have otherwise mandated.



Expanded vegetation management. AmerenUE is spending another \$150 million over the next three years on a vastly expanded tree-trimming program. St. Louis is one of most heavily tree-canopied metropolitan areas in the United States. It's been determined that 60% of all customer interruptions that occurred as a result of the recent storms were caused by uprooted trees or broken tree limbs. AmerenUE's vegetation management program had followed industry standards with respect to clearances and had varying self-imposed cycle lengths throughout its service territory. In 2004, AmerenUE reached an agreement with the Missouri Public Service Commission to reduce cycle lengths based on customer density to four years in urban areas and six years in rural areas.

Under Project Power On, budget appropriations for vegetation management have nearly doubled to \$50 million annually, allowing AmerenUE to:

- "Trim to the sky" and remove all overhang within utility easements on feeder backbones.
- Show more aggression in the removal of danger trees and trees directly beneath wires both on and off utility easements.
- Maintain trimming cycles on a consistent basis.
- Work more broadly with local townships, municipalities and customers on "Right Tree in Right Place" education.

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Circuit and pole inspections. The utility plans to spend another \$85 million over the next three years on a comprehensive circuit and pole inspection and repair program. All 900,000 structures in Missouri carrying energized distribution facilities 69 kV or below (save for dusk-to-dawn and streetlight poles) are visually inspected on a four-year cycle for problems that could cause future outages. Inspection data are recorded on hand-held devices and uploaded to a database, with all deficiencies and NESC violations sent to respective AmerenUE construction divisions for repairs. Prior to this, AmerenUE had a program that began in 1998 involving the 10-year cyclical inspections of roughly 200,000 Missouri structures carrying 34 kV and select 12-kV distribution facilities.

Under the current program, every third visual inspection of a wood pole also includes a full strength assessment of the structure (that is, every 12 years). The battery of tests includes a sounding test, a boring test and a ground-line excavation test. Based on the pole's remaining mechanical integrity, as determined using NESC and ANSI strength tables, it could be identified for replacement or C-truss-reinforcing. Any pole left in service receives an internal preservative treatment for extending its useful life.

Mark Nealon (MNealon@ameren.com) has worked for AmerenUE for 24 years and has experience in distribution planning, systems development, construction and operations. He is the manager of Reliability Improvement and is responsible for the execution of *Project Power On's* undergrounding program. He is a registered professional engineer in Missouri and Illinois

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