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WHITE PAPER / **SMART UTILITIES ENABLE SMART CITIES**

CREATING THE SMART CITIES OF THE FUTURE

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Electric utilities are part of the fabric of the communities they serve. No one knows city infrastructure better than the local electric utility. That puts them in a unique position to help develop smart cities that connect basic neighborhood infrastructure to synergistically improve operational excellence, revenue potential and sustainable lifestyles.

Would you like to live in a smart city? We believe electric utilities can enable the technologies needed to make smart cities a reality. But there is still a lot of discussion about just what a smart city is.

Simply put, we believe a smart city is defined as *connecting the basic infrastructure of diverse neighborhoods and communities to drive operational excellence, revenue potential and sustainable customer lifestyles.*

This definition is developed from a utility perspective because we believe electric utilities can and should become indispensable partners in making smart cities a reality.

The smart electric utility — the next-generation (NxG) utility — must be at the center of the smart city. Utilities are in a better position to benefit from this wave than big technology companies. The window is open, but utilities have to move now or their competitors will beat them to the punch.

Electric and gas utilities already have certain inherent advantages in enabling smart cities. High-capacity broadband is a fundamental part of a smart city. While utilities are developing new private networks and advanced technologies to meet the demands of more distributed energy resources, they position themselves for smart city opportunities.

Why should utilities consider moving to help develop smart cities? Consider these trends.

First, we see a declining number of big, central-station generating plants being built and put into service. Many larger baseload plants are now being developed by third-party independent power producers who then participate in regular competitive power auctions held by the regional transmission operators.

Under Federal Energy Regulatory Commission (FERC) Order 1000, big transmission line build-outs have moved into the competitive arena, and fewer regulated utilities are going to be taking on these mega-projects.

Finally, as more distributed energy resources come online, utilities face the challenge of maintaining grid resiliency and stability while meeting the demands of customers who may increasingly pursue energy independence by installing solar, wind or on-site energy systems.

As a result of these trends, utilities need to answer the question, "What will drive shareholder value in the future?" Traditional rate-base return on investment for "steel in the ground," under the current regulatory model, will have to change. We think shareholder value can be derived from electric utilities becoming the center of smart cities.

The first element of our definition is **operational excellence**. There are many smart city projects currently underway, focusing on a specific application, such as transportation/streetcars, parking sensors, electric vehicle (EV) charging stations, street lighting and high-speed internet access. All of these projects need to be supported by smart utility infrastructure that promotes operational excellence.

Utilities already incorporate advanced technologies for mapping, meter reading and SCADA systems. In order to benefit from these existing systems for smart city applications, the next step should involve a review of these systems across multiple utilities' infrastructures. This would allow for the aggregation of data and the sharing of system maintenance and forecasting.

As this overarching systems review is performed, special attention should be given to security standards. We are arguably one cybersecurity event away from a major legislative and regulatory mandate to upgrade resiliency and security standards, so smart city planning efforts should be informed and shaped by advances in system and device security practices.

In addition to focusing on security, smart city data architecture will need to focus on common standards and communications protocols. If each device and system vendor uses proprietary protocols, smart cities will be forced to use products from a single vendor, as opposed to selecting the best-in-class product for each application.

What kind of a data architecture will this create? We think it will consist of a combination of Local Area Networks with takeout points connecting to a larger fiber and microwave point-to-point backhaul network. Utilities already have much of this communications backhaul in place, so they are natural leaders to extend these systems into neighborhoods and communities.

Revenue potential is the next element of our definition.

The model for how utilities earn on their investments will inevitably change. We know that utilities will need to work with regulators and elected officials to keep regulated utilities as healthy, relevant parts of the communities they serve. New rate structures and the ability to pursue new sources of infrastructure-related revenue will be fundamental. Some of those sources of revenue are, as yet, unknown. Utilities are well positioned to build out the necessary smart city infrastructure, but they need to move quickly to beat big competitors to this market.

Finally, the smart city must promote **sustainable lifestyles**.

Sustainability is defined as "a set of environmental, economic and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality or availability of natural, economic or social resources." [1] Consumers today are increasingly interested in the concept of living in harmony with the environment and each other. They want to sustain themselves financially through work that they find satisfying and that benefits the society at large.

Utilities have a great opportunity to support sustainable lifestyles. They can gather and disseminate data that turns information into action, such as sensors that assist with analyzing and controlling traffic patterns. They can develop charging networks for electric vehicles that can help balance the system. They can even deploy devices like moisture sensors to control irrigation of green spaces. The possibilities are limitless. The main challenge is that our legacy buildings and urban areas are not easily updated for today's smart city applications. Planning and designing a greenfield smart city would be less complex. We have the technology today to make it far more economical to build smart cities, rather than conventional cities. If we were starting from the ground up, the benefits would outweigh the costs.

So why are electric utilities the most logical candidates for smart cities? Aren't they part of the legacy past, when you simply built another central-station generating plant if load growth demanded it? The answer is they are already part of the fabric of the communities they serve. No one knows city infrastructure better than the local electric utility. They have the relationships with the customers. They have an ongoing focus on safety and reliability. They own the rights-of-way, have the franchise agreements and know where the lines are buried. They have the equipment and crews necessary to deploy, operate and maintain smart city technologies.

We suggest starting with demonstration projects called "innovation neighborhoods" to test what is possible. Futurist and city master planner David Sandel is promoting the concept of innovation neighborhoods in his hometown of St. Louis and beyond. Sandel's vision is to start with a small multi-block innovation neighborhood and test new ideas and vendor concepts, making adjustments before scaling up to larger neighborhoods. His vision, as many others around the country are starting to agree, will show that smart cities are coming, and they can be "best" enabled by smart electric utilities.

It is prudent to start small, but we must not lose the drive to think big. Participate in pilot projects and work with public-sector agencies and departments to plan and develop innovation neighborhoods. By keeping the focus on easy-to-understand issues like operational excellence, revenue generation and sustainability, smart utilities and smart cities will find more common ground. But someone must lead, and smart electric utilities have the potential to be a driving force for smart cities.

[1] ASCE *Civil Engineering magazine*, August 2011, pg. 10.

BIOGRAPHIES

MIKE BEEHLER, PE, is a vice president with Burns & McDonnell in the firm's Transmission & Distribution Group. After working as a transmission engineer and project manager for two investor-owned utilities, Mike led the company's initial development of critical infrastructure protection. He has initiated the application of sustainable principles to T&D design, preceding the development of the Envision program by the Institute for Sustainable Infrastructure. Mike has written and presented extensively on the subjects of reliability-centered maintenance, program management and the smart grid. Subsequently, Burns & McDonnell has become the industry leader in major program management and developed several world-class grid modernization labs. More recently, Mike has written, presented and consulted on industry megatrends, transactive energy and the integrated grid.

MEGHAN CALABRO, PE, is an electrical engineer and assistant department manager in the Burns & McDonnell Transmission & Distribution Group. She has planned, designed and overseen installation of Enterprise Meter Data Management projects, along other smart system improvements that are yielding valuable data for utility distribution system operations. For example, she has served as a senior consultant for the KCP&L SmartGrid Demonstration Project, a $58 million Department of Energy-funded pilot that has affected 14,000 customers in the urban core of Kansas City, Missouri. Meghan participates in a number of working groups within the T&D industry, focusing on distribution grid management and incorporating emerging standards such as IEC 61850 and IEC 61968-9.

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