

## Case Study

# Johnson County Rural Electric Membership Corporation RUGGEDCOM multi-solution network at rural electric co-op enables productivity gains, lays the foundation for future distributed data applications.

**Johnson County REMC**  
A Touchstone Energy® Cooperative

## Wireless Connections

**Customer:** Johnson County Rural Electric Membership Corporation (REMC). Founded in 1935, its service area includes over 1,500 miles of distribution line in Johnson County and portions of Morgan, Shelby and Brown counties in Indiana.

**Challenge:** Find a single scalable utility grade data backhaul network solution that would support current and future applications, boosting efficiencies and reducing costs.

**Solution:** A multi-system approach that included Siemens RUGGEDCOM WIN WiMAX technology for SCADA and field force access, RUGGEDCOM RX1500 switch/routers to route traffic from the high-speed fiber ring, and RUGGEDCOM RS900G gigabit switches for edge data collection.

**Results:** Johnson County REMC laid the groundwork for a more reliable, resilient and cost-effective operation for improved customer service and eliminated recurring wireless service fees.

With its northern end a growing bedroom community to Indianapolis, and its southern end a stretch of breadbasket farmland, Johnson County, Indiana, has seen its share of changes over the years. So has Johnson County Rural Electric Membership Corporation (REMC), which was founded in 1935 when local, investor-owned utilities regarded this agricultural area as unprofitable to serve.

Today this cooperative electric utility serves more than 23,000 residential and commercial/industrial members with 25,000 meters and over 1,500 miles of distribution line in Johnson County and portions of Morgan, Shelby and Brown counties. As a member-owned utility, Johnson County REMC remains dedicated to providing its member-owners with reliable and affordable electric service today and into the future.

That pledge of reliability and affordability to its membership means that Johnson County REMC upgrades its capabilities when new technology can provide operational efficiencies and cost savings as well as improved reliability and resiliency. These goals drove the utility's recent project with Siemens RUGGEDCOM, the leading provider of utility-grade networking solutions designed for mission critical applications in harsh environments.

For decades, Johnson County REMC utilized a proprietary SCADA system that relied on a licensed 900 MHz radio network to monitor conditions on its extensive distribution system. The legacy radio network, which provided limited throughput of 9600 bits per second, didn't provide the speed or Quality of Service (QoS) attributes that could support current and future applications needed to improve service and cut costs.

**Challenge: Find a single scalable utility grade data backhaul network solution that would support current and future applications, boosting efficiencies and reducing costs.**

"The 900 MHz radio network for our SCADA system simply was not adequate to do all the things we wanted to do," said Chuck Bailey, special projects engineer for Johnson County REMC.

By 2010, Johnson County REMC saw the need to move from a proprietary wireless network for data backhaul to a standards-based TCP/IP environment to improve its technology options and cut costs by adopting advanced applications.

Johnson County REMC envisioned a communications infrastructure that provided greater reliability, increased throughput, and the ability to communicate with legacy devices, among other requirements. With better performance, a broadband wireless network promised to improve the efficiency of its SCADA system and mobile workforce. It would also provide additional bandwidth for enhanced functionality, and eliminate recurring, monthly fees for cellular service for linemen's laptops equipped with air cards. A new, scalable network could also support a transition from a legacy automated meter reading (AMR) system to advanced metering infrastructure (AMI), resulting in an upgrade to outage location and power quality insights while enabling new services for members. And a new network could also support situational awareness of the co-op's sprawling distribution network with video surveillance and distribution automation (DA) applications. So, clearly there were several compelling reasons for exploring a new communication solution.



To facilitate the growth and efficiency objectives Johnson County REMC had for upgrading its SCADA solution and field force access, several requirements were identified. The utility required a move from proprietary protocols to secure, standards-based TCP/IP communications while still supporting DNP3 communications between remote terminal units (RTUs), intelligent electronic devices (IEDs) and the SCADA master station (i.e., control center).

Additionally, Johnson County REMC required a solution that provided higher data speeds combined with QoS attributes, such as traffic shaping and data prioritization, to ensure each application received the required throughput within acceptable latency parameters. Finally, the entire infrastructure had to be utility-grade: comprehensive EMI immunity certified to IEEE 1613 and IEC 61850 standards and the ability to operate in extreme temperature conditions.

To begin, the co-op needed wireless broadband expertise to review its options and find a scalable solution to move its technology into the 21st century. Johnson County REMC hired Wireless Connections, a Siemens-certified Wireless Solution Provider, to guide its review.

"Our responsibility to our customers is to design a system or help them select a system that functions as planned," said Mike Cowan, president of Wireless Connections. "We assure that by providing detailed radio modeling – coverage maps, interference modeling and other due diligence – prior to the customer purchasing anything. Our goal is to ensure that the client understands a system's capabilities and costs before they buy it."

Initially, several options were explored, according to Bailey, but each fell short on key functionality that Johnson County REMC had determined would be critical for current or future applications. Fiber optic cable connected the utility's control center with its substations, but running fiber between substations and AMI collectors in the field wasn't seriously considered due to cost. Cellular connections between major system components was ruled out due to the recurring operational costs and the attendant loss of data custody as data flowed through a carrier's network operations center. Use of the unlicensed ISM (industrial, scientific and medical) bands in the 902-928 MHz frequency range was rejected due to its limited throughput and lack of Quality of Service (QoS) attributes.

"Near-term they needed a last-mile, wireless connection for mobile customer premise equipment (CPE), which in Johnson County REMC's case means a mobile workforce application," said Cowan. "We advised them that the RUGGEDCOM brand offered a utility-grade, point-to-multipoint wireless broadband solution that would fit their current and future needs."

Johnson County REMC and Siemens RUGGEDCOM products were "already acquainted", Bailey said. The electric co-op already used utility-grade, RUGGEDCOM RS900G compact gigabit switches at its control center servers and substations to enable communications between them. And nearby rural electric cooperatives had experienced positive results with RUGGEDCOM's technology for a variety of applications. So as the electric co-op proceeded to define and meet its challenges, it had confidence in RUGGEDCOM's technology.





RUGGEDCOM WIN 7200, 5200, and 5100

**Solution: A multi-solution network approach that included Siemens RUGGEDCOM WIN WiMAX technology for SCADA and field force access, RUGGEDCOM RX1500 switch/routers to route traffic from the high-speed fiber ring, and RUGGEDCOM RS900G gigabit switches for edge data collection.**

The solution recommended by Wireless Connections centered on RUGGEDCOM WIN WiMAX as the core communications transport connecting the utility's fiber network to Substation and DA assets. This included RUGGEDCOM WIN7200 base stations, WIN5100 mobile CPEs for field force automation, and WIN5200 fixed CPEs with integrated antennas for AMI and DA location communications. Additionally, the RUGGEDCOM RX1500 Multi-service Platform was chosen as the primary router connecting the fiber ring to field assets, and RUGGEDCOM RS900G compact gigabit switches were selected to provide local switching at substations and AMI data collection points.

The resulting design and associated RUGGEDCOM products provided a secure, utility-grade network with high throughput and QoS capabilities to support existing and anticipated applications. The RUGGEDCOM WIN WiMAX solution also eliminated the need for recurring monthly payments to a cellular carrier for air cards. "Utilities prefer to invest their resources in capital expenditures rather than operating expenses," Cowan pointed out.

To this point, utilities often measure payback on capital investments in terms of decades. The RUGGEDCOM WIN WiMAX solution significantly improved that cycle for Johnson County REMC. While most of the proposed architecture addressed fixed assets, the RUGGEDCOM WIN5100 CPEs were installed in each truck, to enable the utility's mobile workforce to carry tablets and receive work orders in the field. This design created virtual hotspots in the 3.65 GHz frequency band that could communicate with the WiMAX base stations at substations and a dozen other locations strategically positioned across the service territory. "On the mobile workforce investments we just made, we're looking at around a two-year payback," Bailey said. "In the electric utility business, that's fantastic."

**Results: Johnson County REMC laid the groundwork for a more reliable, resilient and cost-effective operation for improved customer service and eliminated recurring wireless service fees.**

In terms of value, however, the improvements to SCADA and field force automation eventually may be outweighed by the support the RUGGEDCOM WIN WiMAX solution (supported by RUGGEDCOM RX1500s and RS900Gs) will provide for future applications such as AMI and DA.

Obtaining AMI readings from 25,000 meters at the edge of a sprawling distribution system requires about 55 AMI gateways, which need to connect with the utility's head-end AMI software at the control center (via fiber connected through RUGGEDCOM RX1500) over the Siemens RUGGEDCOM base stations and CPEs (RUGGEDCOM WIN) with local, secure gigabit switching (RUGGEDCOM RS900G).



RUGGEDCOM RX1500 and RS900G

With all the data generated by multiple applications (SCADA, video surveillance, AMI, DA, and Field Force Automation) RUGGEDCOM WIN's ability to prioritize data channels and perform "traffic shaping" via Quality of Service (QoS) provides a major differentiator from other solutions. QoS provides Johnson County REMC with flexibility to design and monitor its data traffic carried by the RUGGEDCOM WIN WiMAX solution with the throughput and latency characteristics required for each application.

"It's changed our lives in many ways," Bailey said of the multi-faceted Siemens RUGGEDCOM solution that supports FFA, AMI and DA. "The more you know about what's going on in your distribution system without the delay of sending a field crew there, the better decisions you can make, and the more co-op members you can restore service for in a given time. That's the value of situational awareness."

"If a breaker operates, for instance, the speed and volume of data backhaul also means getting fault current data right away," Bailey added. "We plug that into our engineering analysis model and that allows us to tell a lineman where to look, within a few poles, for where on-site work is needed."

With the scalable data capacity enabled by the RUGGEDCOM WIN WiMAX solution, other applications are not just possible, but already being exploited.

"When the RS900G switches were installed in our substations, our safety/security team wanted high-definition video surveillance installed," Bailey recalled. "And the new broadband data network made that possible."

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