Communications Design and Feasibility Study helps Electric Cooperative to Further its Smart Grid Goals

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Lead-in
Coweta-Fayette EMC (CFEMC), a Georgia-based non-profit energy cooperative, is reaping the benefits of its initial Smart Grid investments and eager to meet new automation objectives. The utility’s Smart Grid vision is to leverage technology to make its systems as efficient as possible, ultimately benefiting its members by maintaining low rates and reducing outage durations. However, before it could move forward with that vision, it needed to establish a more sound, reliable and cost-effective communications infrastructure.

CFEMC experienced tremendous growth since its founding in 1945 and it is ready for grid modernization. The EMC currently serves more than 74,000 primarily residential members across an eight-county, 800-square-mile service area located approximately 40 miles south of Atlanta. It operates 30 substations, 83 distribution feeders, and more than 6,100 miles of line. Following a diligent search, the utility chose the services of Siemens Communications Consulting to model and simulate different communication network options and recommend the optimal path forward using their Smart Grid Communications Assessment Tool (SG-CAT).

Successful foundation
CFEMC first began exploring Smart Grid technology in 2004 when it implemented a loop scheme distribution automation system. The system allows faulted circuit zones to be automatically isolated so that when faults or outages occur, the fewest number of customers are affected. Additional transfer schemes were installed throughout the service territory in subsequent years. The utility experienced a significant reduction in outage durations due in part to the fault isolation and automatic transfer schemes.

In 2009, an advanced metering infrastructure (AMI) was implemented to enable the remote reading of all meters. Automated meter reading made the utility much more efficient, and CFEMC now has the ability to ping meters after outages, isolate bad meters that aren’t registering energy usage, and conduct daily reads.

“We have seen a number of benefits from what we’ve done so far with our distribution automation and AMI systems, and we really want to expand on that.” – Chris Stephens, Vice President of Engineering, Coweta-Fayette EMC

“Siemens did more than just a path study. Their SG-CAT tool added the dimensions of performance prediction and cost modeling. SG-CAT simulated system behavior under different real life scenarios to make sure our telecom networks would perform as we needed, when we needed.” – Chris Stephens, Vice President of Engineering, Coweta-Fayette EMC

“Unlike other consultants and vendors, Siemens has a unique ability to translate our operational use cases into network requirements. If you get this step wrong, your whole communications strategy can fail.”

Strategy for growth
In order to take the Smart Grid strategy further, a more robust and sound communications system was required. Because the AMI communications in place were not sufficient to leverage for distribution automation, capabilities such as power factor optimization, loss reduction, and automating system restoration after faults would have to wait.
CFEMC had experienced limited success with the various communications media that it had utilized to that point. It needed to identify the optimal communications network technologies and architecture, and establish a solid communications infrastructure before moving forward.

The primary goals for the new solution were reliability and cost economy. In other words, CFEMC needed a telecom strategy that protected its operational and budgetary interests for distribution automation and other applications. The utility sought a solution that provided low latency, high reliability, and sufficient capacity for future use, while leveraging as much of the existing communications infrastructure as possible. Although CFEMC's engineers had personal experience with certain technologies, they needed guidance from others with knowledge of different telecom solutions, vendors, and technologies, as well as the data traffic requirements for grid-specific applications.

To make an educated determination, reduce risk, and minimize costs, CFEMC needed to understand the coverage considerations for each telecom option (e.g., interference, signal strength, TX power, link budgets, antenna heights, existing fiber locations); how well each option supports the operational needs of the applications (e.g. in terms of reliability, packet reception rate, latency, response time, congestion, demand on the existing network infrastructure); and the fully loaded costs of each option (capital costs, organizational impact, and recurring maintenance and operational costs).

“We wanted to be more aggressive in deploying Smart Grid technologies but realized that without reliable communications networks, we would not be successful.” – John Moore, Manager of Engineering, Coweta-Fayette EMC

Partner selection
CFEMC evaluated a range of consulting and engineering firms for more than half a year before selecting Siemens in April 2013. A number of differentiators set Siemens apart, including its objectivity, experience, reputation, knowledge, and powerful assessment tool. The cooperative chose Siemens for the following reasons:

Objectivity:
Siemens provided the objectivity that other vendors could not. CFEMC felt strongly that Siemens offered an objective and unbiased analysis and would provide an optimal network design – not the one with the highest price tag or the one that a vendor was trying to sell. Other consultants tended to lean toward particular vendors, frequencies, radios, etc., without knowing the utility’s objectives, goals, bandwidth requirements, or latency requirements. In contrast, Siemens was selling a service, not a product, which was important and appealing to CFEMC.

Experience:
Siemens brought a global view of grid-specific communications. Over the past two years alone, Siemens has interacted with more than 100 investor-owned utilities (IOUs), municipalities, and cooperatives on the topic of telecommunications. Siemens’ telecom engineers and consultants have driven standardization activities, authored patents, published literature, and sat on the board of directors at a variety of industry establishments, including the IEEE and Utilities Telecom Council (UTC).

Reputation:
Siemens has a reputation for being a proven leader in technological solutions for the utility environment – a reputation that spans 166 years. CFEMC’s CEO had previous experience with Siemens consultants and gave them rave reviews.

Know-how:
During the sit-down meeting, it was evident that the Siemens team had a wealth of experience, great knowledge of what CFEMC was trying to accomplish, and an understanding of the larger Smart Grid vision. They expressed a sincere desire to help the utility develop the right solution, and had the right blend of expertise and tools to deliver with excellence.
Toolset:
The deciding factor for CFEMC was Siemens' proprietary Smart Grid Communications Assessment Tool (SG-CAT). SG-CAT is telecom planning software for grid-specific applications. It goes beyond the capabilities of RF planning tools by adding the dimensions of performance prediction (e.g. congestion, capacity, response time, reliability) and cost modeling. SG-CAT allows Siemens engineers to model different communication technologies / designs and evaluate how each solution will perform in real-life scenarios by simulating the utility’s own topography and geography, over a period of time, and under various “what if” system operating and loading conditions.

In other words, SG-CAT can simulate traffic flows for SCADA, distribution automation, backbone, metering, and other grid-specific applications on a packet-by-packet basis, and evaluates how well different telecom network designs accommodate these traffic flows on the basis of coverage, operational performance, and cost.

The use of SG-CAT offered much greater potential for Smart Grid success than a traditional path/propagation study, or the approaches that other consultants and equipment vendors traditionally utilize.

“I didn’t want to be pushed in one direction. I wanted someone to look at what was the best solution for Coweta-Fayette, as if they were sitting in my shoes, and I felt like that’s what Siemens did.” – Chris Stephens, Vice President of Engineering, Coweta-Fayette EMC

Communications network assessment process
The SG-CAT study was conducted within eight weeks and concluded in June 2013. The effort required minimal time and resources from CFEMC. Siemens consultants began the engagement by spending a day with two technical services personnel and four engineering personnel to discuss the utility’s needs, constraints, preferences, and operational / business interests.

Subsequently, the EMC team members spent two days collecting information about the existing communications infrastructure, including the latitude, longitude, and heights of all existing towers and facilities. That data, exported to a file by CFEMC, served as inputs to the SG-CAT’s GIS model.

Using their knowledge and the SG-CAT, Siemens consultants simulated distribution automation system operations under various communication technologies and architectures to determine what the best course was for CFEMC. Using the tool’s advanced simulation and modeling capabilities, they evaluated 220 MHz and 900 MHz band technologies, microwave, WiMAX, AT&T and Verizon Wireless networks, fiber, leased lines, and various other options. Analyses of coverage, cost, and operational performance were conducted for each option. The SG-CAT delivered the insights of a pilot at a fraction of the time and cost. The tool was also able to diagnose performance and coverage problems within the existing infrastructure.

The CFEMC team members and Siemens met mid-way through the study to review their progress and initial findings, and then again once the study was concluded and the final recommendations of the various technologies were documented in a written telecommunications strategy report. The report included network design summaries, architectures, recommendations, data traffic models, simulation analysis results, RF path profiles, design maps, financial models, implementation plans, plus much more.

Several hours were spent reviewing the strategy report in person with the original project team. Each analysis scenario and recommendation was explained and discussed in great detail. The final recommendations and justifications were then presented with confidence by the VP of Engineering to the CEO.

Sound conclusions and powerful benefits
At the end of the day, the SG-CAT has helped CFEMC choose the right communications solution. The preferred strategy supports the utility’s strategic goals and addresses its budgetary, operational, and RF coverage concerns.
The first ten recloser locations will receive wireless routers by the end of 2013, and then over the following four to five years, as budgets permit, approximately 400-500 additional points will be deployed across the distribution system.

The ability to get full funding is expected to improve as the solution is deployed and the benefits are substantiated. Once a solid base communications system is in place, CFEMC will be ready to show progress on its Smart Grid objectives and implement new automation solutions.

Meanwhile, CFEMC is pleased with outcome of the study and the fact that very little was asked of the utility to give them a working solution. As a partner, Siemens met the utility’s expectations, analyzed what was asked of them, provided thorough services, and as a result provided a powerful set of benefits, including:

1. Instilled confidence in the direction chosen
2. Reduced risk and uncertainty
3. Maximized ROI for grid modernization initiatives
4. Improved reliability and security
5. Maximized use and lifetime of existing assets
6. Reduced hassle and time burden on CFEMC’s staff.

“Without the Siemens and their SG-CAT, we would not have been as confident with the solution selected. The study strongly corroborated some of our own findings and allowed us to explore alternatives.” – Chris Stephens, Vice President of Engineering, Coweta-Fayette EMC

**Snapshot: Coweta-Fayette EMC**

- Founded – 1945
- Type – Non-profit rural electric cooperative
- Headquarters – Palmetto, Georgia
- Counties served – Coweta, Fayette, and portions of Clayton, Fulton, Heard, Meriwether, Spaulding, and Troup
- Service area – 800 square miles
- Employees – 200
- Meters – 74,000
- T&D line operated – 6,113 miles
- Maximum demand – 433 MW
- Website – www.utility.org

**Smart Grid project timeline**

- 2004 – Distribution Automation loop scheme system implemented
- 2009 – AMI implemented
- 2013 – Communications design and feasibility study conducted by Siemens using their SG-CAT tool; findings presented to the CEO
- 2013 – Ten locations deployed by year-end
- 2014-2018 – 400-500 locations deployed as budgets permit