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Case Study

Green Mountain Power improves grid reliability, resiliency, and manageability

Leveraging Siemens Professional Services and network solution suite

Green Mountain Power Case Study-At-Glance

Customer: Green Mountain Power is the largest power distribution utility in Vermont, serving most of its population of two-thirds of a million people and covering most of the state's 9,600 square miles.

Challenge: Green Mountain Power sought to identify a trusted network advisor whose portfolio, expertise, and reputation could guide the transformation of their data communication platform.

Solution: Siemens Professional Services designed a new core network and a redundant, sub-ring topology for substation SCADA data, and the RUGGEDCOM wireline portfolio provided flexible, IP-based routers and switches to meet the utility's specific needs.

Results: The complete RUGGEDCOM solution provided a high-capacity network with data paths and control center redundancy for improved substation SCADA, resulting in improved reliability and resiliency of power service to Green Mountain Power customers.

Green Mountain Power (GMP) is the largest power distribution utility in Vermont, a mountainous state bordering Canada with hard winters, sweltering summers, and widespread consumer adoption of solar and other forms of alternative energy which GMP produces in conjunction with the state. These environmental and operational challenges are relatively common, but GMP has earned a reputation among its peers for taking a proactive, technically progressive approach on behalf of its customers.

Until recently, GMP had relied on serial communications connected over radio modems that used leased telephone lines for SCADA monitoring and control of its substations – an antiquated technological approach to its substation monitoring and control needs. Over time, this approach had become unstable, inefficient and costly to maintain.

The GMP team determined that judicious investments in upgrading its SCADA monitoring and control of substations and related communication networks would lay a cost-effective foundation for a smarter, more reliable and resilient grid. These investments would meet today's challenges, while also supporting the utility's ability to meet anticipated or even unforeseen future challenges.

The improvements in SCADA monitoring and the related communications networks would also drive efficiencies in asset management, shifting it from a time-based to a condition-based approach. The fundamental goal of these upgrades was to enable more sustainable and efficient power delivery to customers, which aligned with the utility's core mission.

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GMP, like similar distribution utilities of modest size, had limited staff resources to meet such over-arching challenges. Thus it needed a trusted advisor for a multi-year transformation of its data communication platform and associated networks. That meant finding a solution provider with expertise in network design, a broad and flexible product portfolio, and a reputation for innovation and market longevity.

Challenge: Green Mountain Power sought to identify a trusted network advisor whose expertise, portfolio, and reputation could help guide the transformation of their data communication platform.

For efficiency and security sake, the utility wanted to own and manage the entire data network that monitors and controls its distribution system, from the control center down to the substation along with other assets in the field, including hydropower. The platform that would support these improvements needed to be flexible and scalable to support future functionalities.

"We didn't have control over our own communications infrastructure," said Dave de Grasse, Senior SCADA Engineer at GMP. "If something went down, we could only hope that whoever provided our service could find the problem and fix it. Many times, however, we found that the problems were actually caused by the telecom carrier, but they didn't realize it. That was the hard part. We were at the mercy of another company and we couldn't control our own destiny."

"We wanted someone to help us actually design the network, that met our needs" de Grasse added. "We looked at multiple vendors. And that's when we sat down with Siemens Professional Services and came up with a network design."

As Green Mountain Power discovered, Siemens Professional Services not only had the needed expertise in network design, but RUGGEDCOM offered a broad, flexible portfolio of solutions that matched the utility's specific needs.

Solution: Siemens Professional Services designed a new core network and a redundant, sub-ring topology for substation SCADA data, and the RUGGEDCOM wireline portfolio provided flexible, IP-based routers and switches to meet the utility's specific needs.

GMP sought guidance from Siemens Professional Services, which designed an overall solution with several key parts. First, Professional Services recommended and designed a new 10-gigabit/second core network between the utility's main control center in Rutland, Vermont, and a backup control center in Colchester. To improve network manageability and provide redundancy of data paths, Professional Services recommended that the utility build gig sub-rings connecting scores of substations. And within each substation, the utility created local area networks that could utilize both legacy RTUs (remote terminal units) and newer IEDs (intelligent electronic devices) for full, reliable SCADA monitoring and control.

The new communication network relies on RUGGEDCOM solutions that best suit specific needs. Some examples include:

- Handling the high data traffic of GMP's 10-gig core network at each of its two control centers with the RUGGEDCOM RX5000, a high port density Ethernet routing and switching platform with cybersecurity features.

- Supporting gigabit speeds in the sub-rings linking GMP's substations and enabling redundant data paths for 100 percent reliability with the RUGGEDCOM RSG2488, a 28-port, gigabit, layer 2 switch with hot-swappable, dual redundant power supplies and modest footprint.

Green Mountain Power Core Backbone Design
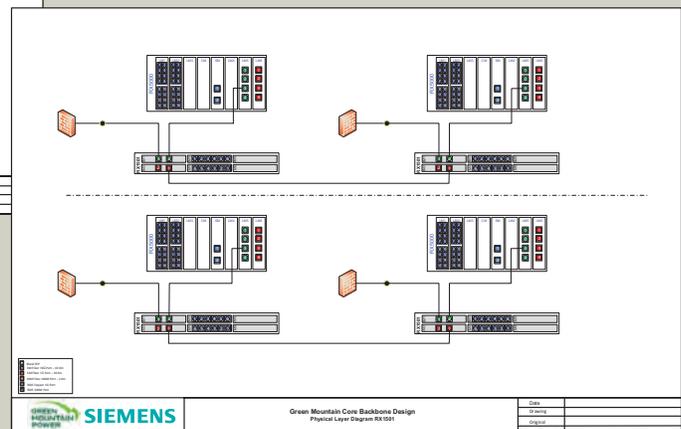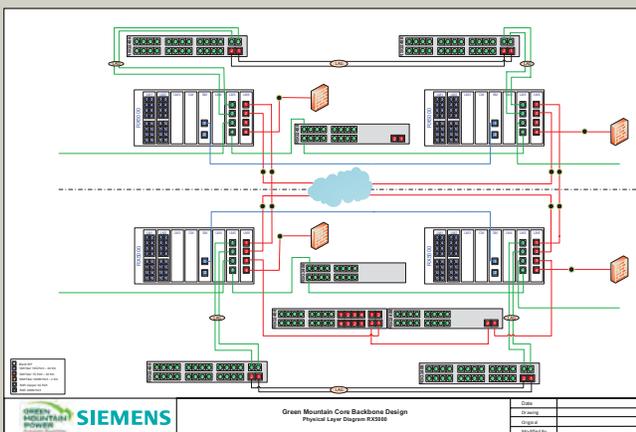
- Providing a cost-effective "foundation" for GMP's SCADA improvements, while accommodating a mix of communication options from copper to fiber with the RUGGEDCOM RX1500 modular Layer 2/Layer 3 switch/router.

Initially, Green Mountain Power simply wanted a robust switch and router for transitioning from serial to IP-based communications in some of its network links, before a new network design could be implemented. RUGGEDCOM's RX1500 family of Layer 2/Layer 3 switches and routers was an established and proven solution at a time when other vendors were simply making claims about their equipment's future capabilities.

"We had tests done by an independent party to ensure the RX1500 met all our specifications," de Grasse added. "And it certainly did. We boiled it down to two or three brands at that point. The others just didn't meet the standards we needed in the field. They said they could meet those standards, but they didn't have an actual product on the market yet. We needed to begin implementing, so we went with the best choice we could and we made the right choice."

In all cases, Green Mountain Power relied on the robust design of the utility-grade RUGGEDCOM solutions, built to withstand the high electromagnetic interference common in distribution substations, as well as the wide temperature swings common in power utility field applications. All RUGGEDCOM devices have an operating temperature range of -40 to 185 degrees Fahrenheit (-40 to +85 Celsius), which meets the challenge presented by Vermont's dynamic climate.

"We needed solutions that could survive the Vermont environment, with cold winters and hot summers, without us having to constantly replace equipment," de Grasse said. "We went with the RUGGEDCOM devices because they had the specifications we needed. The environmental robustness [of RUGGEDCOM switches and routers] was key."

The utility also installed RUGGEDCOM NMS (Network Management Software) to centrally configure, manage and monitor its RUGGEDCOM devices and the data networks they serve.

"RUGGEDCOM NMS enables me to see when anything changes at a substation, if I have a node out, a power supply failure or if there's a fiber break and data is converging in another direction," de Grasse said. "You can immediately see the state of the network on a map and the NMS sends alerts to our technician group if an event occurs. It helps us manage the network with only two dedicated SCADA personnel."

Throughout the implementation of these solutions, GMP relied on Siemens Professional Services for training and trouble-shooting.

"Siemens Professional Services helped us all along and ensured that we understood what we were doing, why, and how to press forward." – de Grasse

"In fact, Professional Services trained our technicians on the use of the devices, on configuring them and on how the devices actually work. They did really well at structuring the classes to enable everyone to come up to speed. And they're really quick to respond if we have problems" said de Grasse.

Results: The complete RUGGEDCOM solution provided a high-capacity network with data paths and control center redundancy for improved substation SCADA, resulting in improved reliability and resiliency of power service to Green Mountain Power customers.

Finding a trusted advisor for network design, with a portfolio of technology solutions, has proven empowering for GMP and its staff. The utility owns its communication network, from sensors to service dispatch. And a "cool synergy" is taking place, according to de Grasse, as RUGGEDCOM and GMP exchange ideas.

"We've seen changes in RUGGEDCOM solutions because of that interaction," de Grasse said. "That's reassuring to me – RUGGEDCOM is adapting its solutions and products to fit our requirements."

"For the first time we feel that we have control over our own destiny and we're not at the mercy of someone else," de Grasse continued. "Now I can see when a relay is trending towards failure. I could never see that before. That's a huge advantage. And I can dispatch people with greater accuracy and in a timely manner."

Remote management of device settings is another major step in operational efficiency, according to de Grasse. Tasks that in the past required sending a service technician to a substation in the field – too often on a stormy winter night – can be accomplished from a central location cutting truck rolls significantly.

The utility's next steps include upgrading the SCADA capabilities at yet more substations, implementing the RUGGEDCOM CROSSBOW cybersecurity solution and, eventually, distribution automation that supports Fault Detection, Isolation and Recovery (FDIR).

"That's the future," de Grasse said. "We're moving in that direction. The communications network we're creating now will get us there pretty quickly. We've got the high-speed communications now, and that's the foundation for automated restoration. The only way that smart grid is going to work is with a robust and secure communication network."

"Our engineers can now see the status of protective relays by looking at an event record, use that to confirm correct operation of a device and also to adjust and improve the device's settings," de Grasse said. "It has really allowed us to get to these devices much more easily, more quickly and consistently."

The greatest improvement for GMP, of course, is the ability to reduce outages for its customers, particularly the large commercial or industrial customers for whom outages are costly and not just inconvenient.

"We've got large manufacturing facilities that depend on us," de Grasse observed. "Transmission lines in Vermont are pretty short and our distribution substations are close to transmission points, so it's not hard for us to cause voltage fluctuations on the transmission line if we don't clear faults quickly."

"Now, with this new system, we can clear faults faster, so we don't affect power quality to our large manufacturers, whose plants are vulnerable to any kind of voltage fluctuations" de Grasse added. "That's a big benefit. For the average residential or commercial customer, we've reduced our outage times quite a bit."