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CASE STUDY

Medical Center

G&W Electric Turnkey Medical Center Solution Improves Energy Reliability, Streamlines Fault Response, Helps Ensure Safety of Patients & Staff

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G&W Electric's microgrid and distribution loop solution with powerful Padmount Switchgear, Hitachi Relays, and FLISR technology deploys best practices to keep critical loads energized on 32-building Medical Center complex.

Medical Center Challenges

Hospitals and other medical facilities are especially sensitive to power outages spanning any duration or magnitude—and require highly reliable and safe electrical systems. In a healthcare setting, sustained outages resulting in a black out, loss of power to HVAC, surgical or respiratory devices, and other essential equipment can have an immediate and detrimental impact on patient care. In addition to protecting patients and staff, the 260-bed Medical Center project posed numerous technical challenges.

The campus required more powerful electrical distribution control to utilize an existing main (whole-site) generator, which did not have full capacity to power all loads on the campus in the event of a utility loss of service. They needed the ability to swiftly switch over to generator power if utility power was lost.

At the same time, they needed the ability to isolate a fault on the 180-acre campus distribution loop, so that no buildings would lose power or cause an outage from the utility. Their maintenance crew needed 24/7 monitoring for faults or outages, with the ability to quickly restore power within seconds or minutes, not hours or days. Maintaining reliability of power to loads across the campus was essential to designing the right solution.

Solution: Microgrid Control with Open-Loop Fault Location Isolation & Service Restoration (FLISR)

G&W Electric provided a fully integrated 12470V microgrid and FLISR solution. The solution deploys best practices and technologies to monitor and control in real-time the switchgear, generator, and utility power source—and to quickly view reports if a load tap to a building trips. The project required multiple systems to be integrated seamlessly and a tight installation schedule ensuring uninterrupted power to the healthcare campus.

G&W Electric experts worked closely with the engineer of record to specify a more efficient solution to address the technical challenges at the Medical Center complex. In the past, the system had one loop for the utility feed and another for the generator. Parallel feeds were directed to each transformer, making it difficult to troubleshoot when a feed was lost.

The new streamlined single loop solution still provides resiliency by using FLISR to isolate faults and restore power to loads using the healthy source. Based on best practices, the system features lines between every switch to improve control and more quickly identify and isolate faults. The turnkey solution also includes a spare utility feed in case the Medical Center adds this connection in the future. The FLISR functionality is deployed as a system with the microgrid controller to function seamlessly.

G&W Electric leveraged the existing generator by communicating to the generator control using a centralized microgrid controller. The resulting microgrid eliminated the requirement for generators and transfer switches at every building. Now, all building transformers are only fed by the main distribution loop. The switchgear taps to these transformers are continually monitored by the microgrid controller. At about half the campus buildings, the Medical Center maintains smaller generators, which now serve as additional redundancy to the main generator. The entire distribution loop and therefore all buildings are quickly fed by the main generator in the event of a utility power outage.

The whole-site generator can feed about two-thirds of the voltage load of the campus, so the solution incorporates a load management system enabling the generator to power loads in order of highest to lowest priority. When the generator is dispatched, lowest priority loads are shed based on current power consumption based on generator capacity. As utility power is restored, the system ensures stability before transferring power back from the generator, reconnecting all loads, then shuts down the generator after a cooling period.

G&W Electric TNI Padmount Switchgear and Control

The new solution reduced switch requirements and eliminated the need to run two parallel medium voltage loops. Outdoor metal-clad switchgear was replaced with more reliable G&W Electric Padmount Switchgear.

The gas insulated padmount TNI switchgear includes load break switching and fault interrupting with visible break and integral ground position. High voltage connections are positioned on the opposite side of the switch operators to isolate and protect workers from high voltage terminations. Integral voltage sensors wired to the relay provide visibility at the centralized control to determine healthy power conditions.

The utility and generator interconnection switchgear includes a spare source way if ever required as well as two distribution feeds to the campus loop. Transitions between sources are open and the generator is prevented from connecting directly to the utility.

The TNI switchgear at the Medical Center include factory-built controls utilizing Hitachi relays. G&W is relay agnostic but chose to utilize Hitachi in this case for the following reasons: Hitachi Relay are equipped with sufficient inputs to complete all required functions and communicate to central control. The Hitachi Relays simplify the control by using one relay for the 6-way switch. This provides a higher level of reliability by eliminating electrical connections that would typically be needed for multiple relays. The single relay is also able to provide holistic switch bus-fault and differential protection. The relays chosen for this project are built on the standard IEC 61850 architecture and are ideally suited for peer-to-peer communication.

Fault Location isolation and Service Restoration (FLISR)

One of the most reliable methods to improve power availability and to comply with regulatory and safety standards for uptime is to quickly determine a fault's location, isolate it and automatically restore power to healthy feeders. G&W Electric integrated FLISR technology into the Medical Center's microgrid distribution loop automation scheme. G&W Electric has been installing FLISR systems for more than two decades. Benefits include enhanced operational efficiency and reduced duration of power outages from hours to seconds.

FLISR technology on the campus loop is powered by the central control software and switchgear relays sending IEC 61850 Generic Object Oriented Substation Event (GOOSE) messages between each other to identify and isolate faults using switches upstream and downstream, and to restore power by closing the loop head end and normally open points. Using IEC 61850 protocol and GOOSE messaging ensured redundant communication paths. The protocol uses fast and reliable mechanisms to group any format of data *(i.e., status, value)* into a unique data set and transmit it across communication networks within 4 milliseconds.

Microgrid Control and Software & Human Machine Interface (HMI)

A server computer loaded and configured with a central monitoring and control software was configured by G&W Electric as a part of the turnkey project. The software contains the system control configuration, including a configurable priority matrix, shedding scheme, and Human Machine Interface (HMI) customized to meet monitoring and fault restoration at the Medical Center complex. DNP3 communication protocol is used to monitor and control the switchgear from the central controller.

All switchgear points were mapped, tested, and documented in the monitoring and control server by G&W Electric at the factory to minimize commissioning time, cost, and errors. System operating modes selectable from the central control include automatic and manual modes, as well as a password protected command to simulate a loss of utility during preventative maintenance tests. TNI padmount Switchgear communicate with each other and the central control using a fiber optic ring installed by the contractor. G&W Electric utilized managed Ethernet switches from iS5 Communications to direct communication traffic and secure the network from intrusion.

Factory Acceptance Testing (FAT)

G&W Electric's dedicated in-house experts performed pre-shipment testing on all components and the complete solution of the Medical Center solution. The switchgear was arranged in the factory as it would be in the field. FAT testing used relay test sets and injected current and voltages to verify the solution would meet the expectations of the healthcare complex.

Project stakeholders attended factory testing to gain valuable hands-on experience prior to field installation. A FAT plan detailed the events, sequences, and functionality that would be tested. Testing of the Medical Center microgrid control in a controlled environment significantly minimized downtime during commissioning, while providing a high level of confidence the solution would work as designed.

G&W Electric provided training prior to and during full system tests to ensure employees were prepared to operate the system efficiently and safely. Field testing during commissioning confirmed full functionality with specified loads being transferred to the generator and back to the utility. Medical Center maintenance personnel continue to perform tests and receive training from G&W Electric at regularly scheduled intervals.

Proof of Concept

Microgrid and centralized control concepts are becoming more prevalent in medical complexes, universities, and multi-building corporate campuses. The Medical Center microgrid solution resulted in greater reliability, maintenance cost savings, and fewer fault-related outages. In the six years since installation, the G&W Electric solution for the Medical Center has performed reliably and successfully to overcome at least one reported loss of utility power event. The system quickly isolated the utility loss, shed all loads, started the generator, then reconnected loads based on pre-determined priorities for rapid recovery and power restoration.

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GWCS34-2024