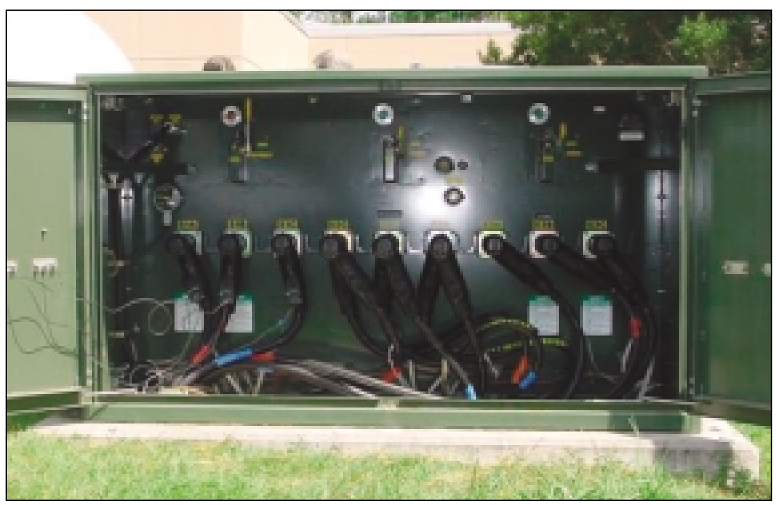
University of West Florida Increases System reliability While Preserving Campus Aesthetics

by Bruce Meyer, Distribution Protection Engineer
and Harold Lynn Dell, P.E., Principal Electrical Engineer & Senior Vice-President, Schmidt Dell Associates, Inc.
and Michael L. McClellan, Principal, Haddon-McClellan Associates, Inc.

Walking across the campus of the University of West Florida before the turn of the millennium, you wouldn't notice the hidden underground distribution system that powered the lights and educational equipment for this premier school. The cabling and switchgear for powering the university were hidden in manholes beneath the surface of the campus, to preserve the aesthetics of the attractive grounds.

The entire system had been somewhat updated over the years, but it was in need of modernization. The university utilizes a 12,460V underground distribution system. Before the modernization project, the system was composed of G&W Ram switches and 1/0 cables. It was configured into a radial system with a single feeder supplied by Gulf Power Company. The campus itself was supplied by a loop with parallel feeders, both being powered by the same main switchgear and single Gulf Power feeder. But this system was aging, safety concerns and faults were becoming more common, coupled with the increased demands for the power consumption of modern equipment. A fault on one tap would take down the entire campus. Fused overcurrent protection meant that every time a fault was interrupted a fuse had to be replaced somewhere in the sprawling system. In order to repair faults, change fuses, perform maintenance or just conduct routine switching, an operator would need to climb down into a manhole and work in a confined subterranean environment. This was dirty, dangerous and time-consuming.

The purpose of the modernization was to improve reliability and safety, simplify operation and increase the capacity of the underground distribution system. All the subterranean switches were eliminated, and replaced with 21 above ground pad-mounted switches. The project included all new backbone feeders to the network, as well as replacing all the campus distribution feeders. Separate switchgear was provided for each radial feed transformer, meaning that a fault on the taps would not be isolated by the added protection. A second feed was strung from Gulf Power off a separate, different feeder, which resulted in a second supply for the campus. This gave the university a true dual source system such that a fault on one source could be quickly isolated, and the campus fed from the alternate. All underground cabling throughout the system was increased to 4/0 copper wire, doubling the current capacity, although there remained some overhead cabling from the previous system. The result was that the reliability was considerably improved.



VFI pad-mounted switchgear greatly improves reliability

The switchgear chosen by the University of West Florida for the project was Cooper Power Systems' VFI pad-mounted gear. The university had some existing pad-mounted SF6 switches from another manufacturer, but those switches had experienced problems with maintaining pressure (a SF6 switch can only be operated if the pressure is within specified limits). There were also additional concerns with some of the toxic by-products of the SF6 and possible future environmental regulations.

The officials were apprehensive at first about bringing the switches above ground due to a desire to carefully preserve the appearance of the campus, but were quite happy with the resulting low profile VFI equipment. Craig Turner, Senior Utility Supervisor at the University of Western Florida commented, "The ease of operation and the overall quality are excellent. It helps us out immensely with the isolation points. With the switchgear being above ground, the safety factor is ten-fold what it used to be." The VFI switchgear was supplied in a configuration of two sources and two taps. The separate sources and taps were isolated by another source switch which allowed the internal bus to be tied together or isolated, allowing both taps to be supplied by either source with a simple front-mounted switch.

The supplied equipment is longer lasting, more reliable, and much safer than the previous vault-mounted switches, not just because it is now above ground, but because it is completely deadfront, utilizing vacuum interruption, and providing electronic overcurrent protection. Deadfront switchgear means that all live buswork and switching is contained within a solidly grounded tank. The front-and rear-mounted deadfront connectors are made inaccessible to the public by using enclosures and padlock mounted doors. The VFI also features vacuum switching and interruption with Cooper's VSAM vacuum bottles utilizing axial magnetic field interruption. The axial magnetic field has the advanced properties of spreading the interruption arc across the whole surface of the vacuum bottle contact, preventing any excessive wear from fault interruptions that may occur. This greatly extends the life of the vacuum bottles such that they will easily outlast the switchgear without any need for maintenance. The VFI taps operate with low energy flux shift trippers to switch the vacuum bottles and TPG electronic overcurrent protection controls. The TPG controls provide more precise, consistent protection without the need for replacing fuses, and make available ground fault protection. They also allow for growth of the system, since increasing the minimum trip requires only changing a simple dip switch setting on the control. Powered by internal CT's, the control requires no external power or cables, making for an easy installation and upkeep. The new switchgear has provided a great boost to the reliability, safety, maintainability, and longevity of the system.

Sophisticated metering is included as part of the modernization. The Cooper VFI switchgear with the TPG control allows for SCADA to be connected to the switches. Target indications from the VFI gear send information to a remote terminal unit, or RTU, giving information about any fault interruptions that have occurred. Voltage transformers (one on each side of the internal switch) were installed in the switch providing 120 volts to the remote metering system. The current transformers are provided on the primary cables inside of the switch compartment. The combination of the voltage and current transformers provides complete power measurement along with fault troubleshooting communicated back to a central processing area by fiber optic cabling. Fault indicators mounted to the outside of the VFI switchgear allow bright identification of faulted phases without even opening the gear enclosure. This allows campus officials to identify faults both from the central SCADA center and also to identify faulted phases at the sight of occurrence. Not only has reliability been greatly improved, but faults may also be identified and repaired more quickly and easily.

The low profile equipment is aesthetically pleasing in this campus setting

Presently, when strolling through the campus of the University of West Florida, most who come there still may not notice the looped underground distribution system providing the area with energy and light. Even if it is seen, the low profile of the VFI switchgear is pleasing to the eye, fitting in pleasantly with the natural surroundings of the campus. But very few will probably stop to consider that the lights now stay on longer without interruption. THE LINE

Utility Group Urges Review Of Total Power Supply System

Distribution Vision 2010 LLC (DV2010™), exists to implement new technologies to improve reliability of the distribution system. Collaborative relationships with industry leaders and academia in a variety of disciplines have been established to design, develop and apply new equipment methodology and operating practices specifically for distribution system reliability.

The group is urging a review of the total electrical supply system including generation, transmission and distribution. They are concerned discussions surrounding the blackout of 2003 are too focused on inefficiencies with the nation's transmission lines and threaten to jeopardize the effectiveness of total supply improvement.

DV2010 believes the blackout delivered a serious warning that a thorough review of electrical generation, transmission and distribution systems is urgently required. The investigation should consider the synergistic roles transmission and distribution systems play in a reliable power delivery system. Transmission lines are required to move large amounts of power from generating stations to large substations. Distribution lines distribute this power from these substations to industrial, commercial and residential users.

Much of the initial discussions about what caused the blackout have been centered on the grid's transmission capabilities. The consortium believes any serious attempt to improve reliability must also include upgrading the aging distribution system.

Utilities have successfully used a number of products, including reclosers, fuses, relays, arresters, capacitors and automation to limit the impact of an outage to a minimum number of customers. For most utilities, however, spending to improve the distribution lines has been limited due to capital constraints.

For more information on power system reliability visit www.cooperpower.com/reliability