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GREEN GROWTH

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PM #40063056

OPERATION **CRITICAL**

Sunnybrook increases resiliency with emergency power generating plant renewal project

By Philip Chow & Michael McRitchie

Emergency power systems are a lifeline for healthcare facilities. These plants provide an independent source of electricity to support vital systems on loss of normal power supply — a more likely occurrence today, given the increase in extreme weather events. It's no wonder then that facility managers are concerned when this all-important electrical equipment needs to be upgraded. They're faced with the challenge of replacing the critical infrastructure while minimizing service disruptions and maintaining an operational means of backup power. This is what Sunnybrook Health Sciences Centre faced when it undertook a project to replace its existing emergency power generating plant in its entirety.

CENTRAL POWERHOUSE

Sunnybrook is a full-service, 1,100 patient bed hospital in mid-town Toronto. With an aggregate campus area of approximately 3 million square feet, it is the largest regional trauma centre and maternity hospital in the country, boasting 1.2 million patient visits each year.

The hospital relies on its central utility plant to distribute emergency (backup) power, and heating and cooling services across its campus. Sunnybrook's emergency power network is divided into two stand-alone systems: a 4,160 volt (V) generation/distribution system, which provides power to approximately 20 electrical substations throughout the campus, and a 600 V generation/distribution system, which provides power to the hospital's central utility plant and, in turn, powers ancillary systems that serve the 4,160 V system. With existing infrastructure dating back to the '70s and approaching end of life conditions, Sunnybrook recognized the urgent need to replace its existing diesel generator plant.

OVERCOMING OBSTACLES

The infrastructure renewal project was constrained to building within the footprint of the existing central utility plant; constructing new space was not an option. Key design criteria included replacing obsolete equipment, increasing available capacity of emergency power systems and providing opportunities for reducing annual operating costs.

▲ LEFT TO RIGHT: Interior view of Sunnybrook's existing generator plant. Four new 2 MW - 4,160 V and one new 750 kW - 600 V diesel generators were installed. The existing generator plant was dismantled in two phases and the new plant constructed in two phases.

▲ LEFT TO RIGHT: New 4,160 V distribution switchgear for the emergency power distribution system was installed. Exterior of new generating plant near completion.

Creating a construction phasing and sequence plan that facilitated infrastructure renewal and implementation of design requirements, while maintaining reliable emergency power to the hospital was a significant challenge. After performing a detailed site review, it was determined that an upgrade project could be completed in two phases. During the first phase, a portion of the existing generator paralleling switchgear could be removed to facilitate the removal of three existing generators and associated infrastructure. This would clear up physical space in the existing plant and allow for half of the existing building to undergo structural upgrades and general trades work to accommodate larger replacement generators. In Phase 2, the remaining three existing generators and paralleling switchgear would be replaced. This would free up the other half of the existing building to undergo structural modifications to ready the space for larger replacement generators.

To maintain a reliable emergency power supply to critical processes throughout the campus, a number of temporary provisions and enabling works would be required. As the existing generator capacity would be diminished with the removal of generators under the first phase of the project, a temporary portable generator would be needed to supplement generating capacity, and existing 4.16 kilovolt (kV) campus distribution circuits would have to be temporarily powered from the portable generator. This would result in the need to provide temporary 4.16 kV switchgear complete with automatic transfer functionality, provisions to receive incoming utility power and power from the portable generator, and provisions to feed distribution circuits that would be affected by phased construction. Additionally, since the incoming fuel oil supply to the generator plant would be upgraded, the portion of the existing generator plant (which remained operational under the first phase of the project) would require a temporary fuel oil supply while the main fuel oil system was upgraded. To facilitate construction, a temporary fuel supply line, complete with its own independent valving arrangement, would run from Sunnybrook's independent heating oil supply.

PLAN OF ACTION

After creating a project concept that enabled constructability and established design goals, the next challenge was implementing the design. Since the majority of the new equipment associated with the emergency power system would have interrelated functions, it was determined that one supplier would provide the major equipment and assume responsibility for coordinating with associated sub-suppliers.

Detailed engineered drawings and specifications were prepared for an equipment package that consisted of four 2 megawatt (MW) - 4.16 kV generators, one 750 kW - 600 V generator, paralleling and synchronization controls, 4.16 kV automatic transfer and distribution switchgear, a diesel emissions reduction system (DERS) for each generator and a new load management system. The engineered drawings and specifications were posted publically as part of a request for proposal (RFP) for the equipment supply package. The RFP process was instrumental in giving Sunnybrook's plant operations and corporate planning groups direct input into the generator supplier selection process and ensured competitive pricing that conformed to the hospital's quality, reliability and serviceability requirements. The equipment package was awarded to Toromont CAT.

Following selection of the equipment package, construction of the new generating plant and equipment

SOCIAL MEDIA COLUMN
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Your social media starting point

By Steven Chester

Perhaps you've finally decided that "now's the time" to get started on social, or maybe you're cringing at the thought of logging in to your Twitter account that hasn't been touched in months.

If this is the place you're in, it's time to reassess what your social media goals are and get yourself to your social media starting point. Your goals could be just one or all of the below. In the case of the latter, take the time to rank the order of importance of each.

- Building your brand: Are you looking to develop new relationships? Then it's time to listen to what others are saying, craft messages designed to inform, entertain and captivate your audience.
- Increasing website traffic: Have great content to share? Craft some meaningful messages to drive traffic to your content pages.
- Customer support and outreach: Your customer demographic is changing, and so are their communication needs. You'll need a space to answer questions and gather feedback for your company.
- Sales leads: Yes, you can sell on social. In fact, if you're not doing it, your competitor more than likely has the jump on you. LinkedIn, for example, is an incredible way to gather contacts and expand your reach through secondary connections.

Next up, we'll talk about outreach. Hint: You're nowhere near ready to craft that first post.

Steven Chester is the Digital Media Director of MediaEdge Communications. With 15 years' experience in cross-platform communications, Steven helps companies expand their reach through social media and other digital initiatives. To contact him directly, email gosocial@mediaedge.ca or call 416.512.8686 x224.

installation was tendered to a group of pre-qualified contractors. Given the substantial scope of electrical work associated with the project, the successful electrical contractor would assume the role of the prime contractor and be responsible for coordinating other trades on the project, as well as procuring and installing the pre-selected equipment package. The project was awarded to Ontario Electrical Construction Co. Ltd.

The preliminary enabling works were completed, and the temporary switchgear and rental generator were installed in Phase 1. With Sunnybrook's critical loads supported by temporary infrastructure, half of the existing generator plant was decommissioned and existing equipment removed from the site. The existing floor slab was removed and a new one poured, complete with structurally reinforced bases for the new generator sets. The building's structure was reinforced and structural steel installed for an air intake plenum expansion and exhaust plenum expansion.

While construction was progressing on-site, major equipment items were being manufactured and undergoing rigorous factory acceptance testing procedures. The entire emergency power system lineup (generators, switchgear and control panels) was shipped to an off-site testing facility and assembled to undergo integrated system testing, which included testing automatic transfer functions, paralleling and system controls with portable load banks. This process helped identify operational issues before the equipment was shipped to the site. Once installed on-site, it was subjected to additional pre-service evaluation to test the site-specific installation. Final functional testing was successfully performed with Sunnybrook's critical loads and the first phase of the installation was placed into service. The process was repeated for Phase 2 of the project.

INNOVATIVE APPLICATIONS

Undertaking infrastructure renewal allowed for a number of innovative features to be included with the equipment upgrades.

Each of the new diesel generators is equipped with a diesel emissions reduction system (DERS). This has reduced emissions from the standard U.S. Environmental Protection Agency Tier 2 levels to the more stringent Tier 4 regulations, lowering pollutants levels, such as nitrogen oxide, by as much as 95 per cent. DERS modules consist of a particulate filter, selective catalytic reduction system, sound attenuation system (deleting the requirement for a separate muffler) and a dosing system, whereby an external supply of urea, water and compressed air is injected into the exhaust stream to catalyze the nitrous oxide emissions.

The new 4.16 kV switchgear and automatic transfer controls are equipped with closed-transition transfer logic, enabling the distribution system to momentarily parallel utility power with generator power. This mode of operation is important in reducing disruption to hospital operations during weekly generator tests (a requirement for healthcare facilities noted in CSA standards C282, Emergency Electrical Power Supply for Buildings, and Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities).

By incorporating both of these innovative design features into the project, Sunnybrook has the capability to utilize its standby generators to offset electrical demand load from the utility grid during peak conditions and reduce its global adjustment costs (a utility charge that is levied to large facilities in Ontario, with a peak electrical demand load in excess of 5 MW during peak electrical demand conditions). Closed-transition transfer controls allow Sunnybrook to transfer hospital loads to generator power seamlessly, and emissions reduction technology enable Sunnybrook to power hospital loads from generator power during non-emergency conditions. By displacing hospital loads for approximately 60 hours or more during summer months, Sunnybrook's plant operations group anticipates a significant reduction in utility costs. ■

Philip Chow, P.Eng., is a senior project manager at H.H. Angus & Associates Ltd. He specializes in electrical solutions for critical applications and was the lead electrical engineer on Sunnybrook's generator plant renewal project. Michael McRitchie is director of plant operations, maintenance, security and biomedical engineering at Sunnybrook Health Sciences Centre. They can be reached at Philip.Chow@hhangus.com and Michael.McRitchie@sunnybrook.ca, respectively.