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WHO GETS THE POWER?

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By Dan Koenigshofer

As hospitals expand and upgrade facilities, facility executives should carefully review the capacity of the physical plant’s basic infrastructure. Power and cooling capacity in particular are critical to daily operations. A review of power and cooling systems should include a focus on emergency power planning.

Health care organizations that do not have 100 percent emergency power should have clear procedures in place for the emergency power system. A carefully crafted operational plan for the emerg-
of systems, identifying key components and providing a means of troubleshooting them.

Next, do a detailed load analysis to measure actual loads on each automatic transfer switch. This allows for development of a breakdown of the emergency power system load.

Third, create an air handler zoning plan. Determine which areas are served by which air handling units. This information may have changed over the years. Facilities staff may think they are shutting off a non-critical area, only to find that an air handling unit serves a vital space for patient care. The plan should also document the electrical load of each air handling unit. At the North Carolina hospital, nearly half of the emergency power load, not including cooling, was the air handling units.

A written protocol for operation of an emergency power system, along with the one-line diagram and better labeling of panels and distribution switchgear, will make it easier for staff to run the system under all normal circumstances. Clear labeling is important in emergency situations. Use meaningful nomenclature that indicates floor, substation and physical location within the electrical system, including emergency power system branch and panel, and voltage. Be sure panel labels match the one-line diagram.

**Cooling Triage Plan**

The next step is the most challenging. To prepare a cooling triage plan, hospital management and engineers should work together to determine a sequence of priority for the air-handling unit shutdown. A color-coded sequence may prove helpful. For example, red air handling units would go off and stay off under emergency power, or may not even be connected to the emergency power system. Yellow air handling units would fall in the category of “maybe,” depending on load and circumstances. Green air handling units would receive emergency power and chilled water at all times.

To accomplish the cooling triage plan, various control strategies should be considered. For example, a combination of the following control sequences might accomplish emergency cooling objectives: Raise space setpoints, raise leaving supply air temperature, modulate or close chilled water valves, close outside air dampers, slow air handling units via VFD and completely shut off selected air handling units.

In North Carolina, the hospital’s facility director and consulting engineers began by considering the impact of allowing temperatures in administrative areas to rise significantly. This would reduce the total cooling load by only about 10 percent. In the August outage, the system had the capability of providing only 750 tons of the 2,500-ton load (30 percent). In reviewing options for the control sequence, the team opted to completely shut off selected air handling units. In all other scenarios, the outside air intake would quickly result in unacceptable temperature and humidity conditions with no chilled water available. It was also deemed necessary to maintain the operation of all exhaust fans, necessitating intake of outside air.

In addition, the hospital decided that, at least in the beginning, the system would be implemented manually by the building automation system (BAS) operator. Shutting off air handling units effectively closes a space for occupancy. Many variables make it imperative to have human intervention, including time of day, case load and type, scheduled surgeries and outpatient procedures, how long the utility thinks the outage will last, and weather. Another reason the shutdown sequence was not programmed was concern that, if an automated shutdown sequence started, there would be no way to modify it to take into account seasonal variations, for example. With a written, but manual, shutdown sequence, the operator can get input from other sources and alter the sequence. If the operator is unable to get any input, there is a written standard operating procedure to follow.

While exact loads depend greatly on the time of day, day of the week, and outside weather, estimates show that the facility can run without cooling for approximately 30 minutes. After that time, the first 750-ton chiller would be started manually. If the outage persists for a total of 60 to 90 minutes in the summer, a second chiller would be needed. To start the second chiller, some or all of the air handling units would have to be shut down. After the second chiller is started, there would be 1,500 tons available to the high-priority “green” air handling units. The maximum load on the “green” air handling units is 851 tons. During a prolonged outage, a BAS operator would be able to turn the middle-priority “yellow” air handling units back on one at a time while keeping a close watch on the total emergency power system load.

By carefully assessing an emergency power system and developing a priority list for department operation, facilities staff and engineers can develop a clear plan to allocate available cooling in the event of a prolonged power outage. Ultimately, if decisions regarding the cooling triage prove too difficult in terms of which facilities and operations will receive emergency power and which facilities won’t, that’s a sign that more comprehensive emergency power upgrades may be in order.

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A few other tips may be helpful in preparing for smooth operation of an emergency power system. Be sure that there is sufficient lighting on emergency power in the emergency power system room and around the gear to allow for maintenance and inspection for troubleshooting.

Also, if the main BAS unit is located in engineering offices not supplied by emergency power, it will be difficult to control operations from the BAS. Verify which devices will restart when normal power resumes, and which items will have to be restarted manually. Be sure that all of the HVAC control devices and mechanisms are on emergency power.

Test the in-rush current when starting the chiller and other large motors — in some cases, the in-rush may be too great and will exceed available emergency power system capacity. Part load start will be essential.

Finally, be sure that the emergency power system operational plan, including the triage component, is documented in detail and kept in an accessible location that several people (not just the facility executive) know about.

The figure below shows the distribution of the emergency power system over the three stages of outage. Many refinements of this sequence could be implemented at the cost of simplicity and reliability. The first might be to close the chilled water valves on the air handling units that are shut down, further shunting chilled water to the high-priority air handling units. This would result in quicker cooling of the coils on the high-priority air handling units and no “waste” of chilled water through air handling units that are shut off. Of course, the load on the cooling coils would be negligible with fans off.

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