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Redefining
the role of electrical engineers

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QUALIFIED ELECTRICAL ENGINEERS CAN PLAY A KEY ROLE IN WORKING WITH OWNERS TO UPGRADE EXISTING CRITICAL FACILITIES AND TO BUILD NEW MODULAR FACILITIES THAT ARE MORE EFFICIENT, COST-EFFECTIVE, AND, AT THE SAME TIME, MEET THE OWNER'S RELIABILITY REQUIREMENTS.

The successful engineer is on top of all of the emerging technologies and practices. System scalability, modularity, and system efficiency are terms that have been around for years, but as energy use in data centers has become a larger part of the bottom line, CEOs and CFOs are demanding more efficient critical environments. Next-generation data centers with very low power utilization effectiveness (PUE) have been the trend. Power costs are not going to decrease, and the expectation of doing more with less will continue. This is good news for electrical engineers as we can play an integral role in designing these systems.

> "The design and operation of critical environments is in continual flux. This economic downturn will require us to sharpen our pencils and be innovative."

Reliability and redundancy

The electrical engineer needs to be in lockstep with the owner to ensure there is a good understanding of the owner's reliability requirements and IT operations. If there is geo-redundancy within the critical environment and a desire for low PUE, less redundancy within the electrical components may be advisable. Fewer redundant components will lead to higher loading percentages and higher system efficiency. The entire data center does not have to meet a certain Tier or redundancy level. The UPS, for instance, could be designed at N+1 and the generator system could be designed at N.

A UPS can have a significant reduction in efficiency when it is loaded to less than 50%. A Tier 4 electrical distribution system that has 2(N+1) redundancy in the UPS will typically be loaded to less than 33% under normal operating conditions.

Recent advances in UPS technology have provided additional options for the critical environments electrical engineer. These efficient UPSs offer "eco-mode" operation where the UPS operates offline while the input power quality (voltage and frequency) is within certain predetermined parameters. If the input power drifts outside good power quality limits, the UPS switches back to online operation. All of this occurs well within the Information Technology Industry curve. Some of these systems offer up to 99% efficiency, represent-

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ing a delta of approximately 6% to 7% over standard UPS efficiency.

Monitoring a mission critical environment

Monitoring and controls within a mission critical environment are essential. With more attention being placed on energy efficiency and the ability to verify PUE, a comprehensive control strategy is important. Metering, including power quality, should be deployed in the electrical distribution system. A comprehensive control and monitoring interface can also be leveraged in the U.S. Green Building Council LEED process for certification.

Rack level monitoring with Zero U power distribution units (PDUs) can help ensure that data center operators will populate the racks in the most efficient manner, using all the amps available within branches of power without overloading any component. In an N+1 or 2N system, overloading beyond prescribed percentages of system rating can cause cascading failure. Rack level monitoring can be integrated into a system-wide monitoring and control system.

Professional certification and training

In addition to a professional engineering license, LEED certification and registration as a communication distribution designer (RCDD) are desirable credentials. Certification as a LEED AP, as well as experience with the LEED certification process, illustrates additional know-how in sustainable design. The RCDD certification illustrates significant knowledge of good data system design practices in critical environments.

An increased number of owners and general contractors realize the importance of coordination in 3D-CAD, especially for critical environments. Data centers and other critical environments use large mechanical and electrical systems. Collaboration between the MEP systems is essential. Identifying and resolving conflicts between the systems will save significant time and money during construction.

The 2008 National Electrical Code (NEC) includes a new section for critical environments. Critical Operations Power Systems (COPS) are generally installed in vital infrastructure facilities that, if destroyed or incapacitated, will disrupt national security, the economy, or public safety; and where enhanced infrastructure for continuity of operation is deemed necessary by government authorities. COPS are those systems so classified by municipal, state, federal, or other codes, by any government agency having jurisdiction or by facility engineering documentation establishing the necessity for such a system.

Knowledge of this electrical code is essential. Discussions with the local authority to determine if a critical project is considered a COPS facility must be completed at the very beginning of the project. Significant additional requirements in the design and operation of the facility are necessary if the critical facility must comply with this section of the NEC. Some of these requirements include 72 hours of fuel, a portable as well as permanent generator connection, UL 1008 transfer switches, full load testing, and many other items.

Several organizations and societies offer valuable information for engineers involved in critical environments. These organizations include, but are not limited to, 7x24, AFCOM, and BICSI.

Changing environment

The design and operation of critical environments is in continual flux. This economic downturn will require us to sharpen our pencils and be innovative. Increased knowledge of the relevant data center topologies and the latest technologies is essential. In addition to the PE license, credentials like the RCDD, LEED AP, and their associated continuing education can provide the edge required in this competitive environment. Staying active in professional organizations and groups that specialize in the design and operation of critical environments is highly recommended.

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Lane is president at Lane Coburn & Assocs., Seattle, and a member of several professional organizations, including BICSI, NFPA, 7x24 Exchange, Illuminating Engineering Society, and the Washington State Society of Healthcare Engineers. He is a member of Consulting-Specifying Engineer's editorial advisory board.

