THE MAGAZINE OF 7x24 EXCHANGE INTERNATIONAL

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FALL 08

MINIMIZING ENERGY COSTS IN DATA CENTERS: ENERGY MANAGEMENT BY DESIGN

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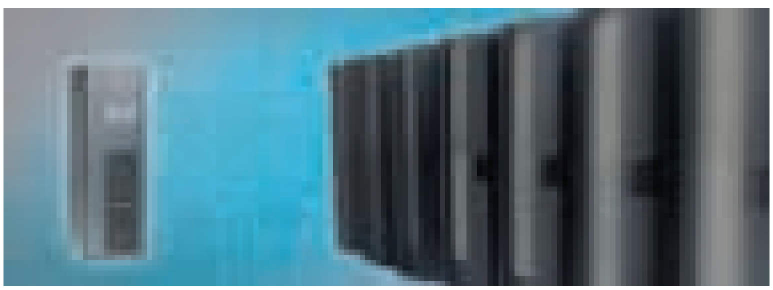

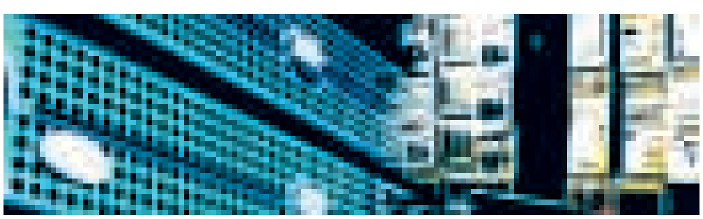

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Chairman's Letter

Robert J. Cassiliano

I hope everyone enjoyed a terrific summer!

Focus in the mission critical industry has shifted dramatically toward energy-efficient operation. Our 2008 7x24 Exchange Spring Conference featured 12 presentations on Green topics. On July 8, 2008, members of our Board of Directors Bill Leedecke (President), Russ Mykytyn (Vendor Representative) and I attended the National Data Center Energy Efficiency Strategy Workshop, sponsored by Microsoft, in Redmond, Washington, for the Department of Energy (DOE) and the Environmental Protection Agency (EPA). At this event 7x24 Exchange was introduced as an industry leader and we were asked to speak about observed trends, activities and achievements, and key areas for collaboration. We also produced a point paper with additional detail for distribution to meeting attendees. Highlights of this workshop will be presented at our Fall Conference.

As for the 2008 7x24 Exchange Fall Conference being held at the JW Marriott Palm Desert in Palm Springs, CA November 16 - 19, 2008, the Board of Directors continues to add new features based on feedback we have received from conference participants. The following content has been added:

- Exchange Tables on specific topics at all breakfasts and Monday's lunch
- A virtual tour of a Comcast facility on Tuesday morning
- An End-User Interactive Exchange Luncheon on Tuesday
- A Vendor Knowledge Exchange on Tuesday afternoon

The changes to the conference are designed to provide additional value to participants and their companies by focusing on what attendees and members tell us is important to them. The Board of Directors encourages your feedback on these changes.

I look forward to seeing you at our Fall Conference in Palm Desert, California!

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Minimizing Energy Costs in Data Centers: ENERGY MANAGEMENT BY DESIGN

Barry J. Needle

The challenge for today's facility and data center managers is to reduce operating costs by minimizing energy consumption while maximizing power reliability, IT application performance, and availability.

Lately, in an effort to understand and improve IT energy efficiency, the industry has adopted the Power Usage Effectiveness (PUE) and Data Center Infrastructure Efficiency (DCiE) metrics supported by The Green Grid organization[1]. These metrics, derived via facility and IT equipment power ratios, facilitate more informed methods of reducing the total cost of operating data centers while managing increased service demands. Functions such as data center commissioning and system modification testing schemes address how much risk is prudent in the quest to save energy, a benefit found in the information revealed by the power ratios. Furthermore, the PUE and DCiE metrics allow individual operators to measure the effectiveness of efficiency improvement programs by comparing the efficiency of their own facilities to those of like organizations.

At the core of all actions to improve energy efficiency, reliability and availability is the answer to the question of cause and effect. Any change to the operation of a data center will have an effect on the amount of power the IT equipment uses, the quality and stability of the power distribution system and the health of the computing facilities output. Moreover, since every data center is unique in design and operation, the actions taken to manage energy will be most effective if formulated specifically for each data center site.

The Data Center Powering Crisis

Data center IT equipment and the supporting power and cooling infrastructure are up to 40 times more energy intensive than a typical office building. From an energy usage perspective, a data center is more like a dense, power-packed industrial facility brimming with power-drawing equipment.

According to a recent EPA report[2], the power demand of the data centers in the U.S. is significant and growing.

- The energy consumption of servers (including cooling and auxiliary infrastructure) in U.S. data centers has doubled in the past five years and is expected to almost double again in the next five years [2011] to more than 100 billion kilowatt-hours (kWh), costing more than $7.4 billion annually (2005 dollars)
- "The peak load on the power grid from these servers and data centers is currently estimated to be approximately 7 gigawatts (GW), equivalent to the output of about 15 baseload power plants. If current trends continue, this demand would rise to 12 GW by 2011, which would require an additional 10 power plants."
- Data centers consumed about 60 billion kWh in 2006, roughly 1.5 percent of total U.S. electricity consumption.

It's no mystery to data center operators that most of the energy pushed to servers ends up as heat. The cost to power and cool racks of installed servers is quite significant and is forecasted to become even greater in relation to new server spending. Figure 1 graphically shows the increasing proportion of power and cooling relative to server spending worldwide, that for each dollar spent on a new server in 2005, forty-eight cents was spent on power and cooling. This is more than twice the ratio in 2000. In 2010, it is projected that this ratio will rise to $1:0.71

Unfortunately, expenses do not end with powering and cooling servers. There is

Projected CO2 Emissions Associated with the Electricity Use of U. S. Servers and Data Centers (MMT -CO2/Year), All Scenarios, 2007 to 2011

Scenario	2007	2008	2009	2010	2011	2007-2011 Total	% of current efficiency trends scenario
Historical Trends	44.4	51.2	59.2	69.2	78.7	302.8	111%
Current Efficiency Trends	42.8	47.9	53.6	60.5	67.9	272.8	100%
Improved Operation	34.8	39	43.5	48.4	53.1	219	80%
Best Practice	30.2	30	29.8	29.7	30.1	149.8	55%
State-of-the-Art	28.1	25.7	23.5	21.4	21.2	119.9	44%

- EPA, 2007

potentially an extreme price to pay for no power as well: idle servers. Unintended downtime is costly, at an average price of a million dollars an hour. That's what IT system downtime costs American business, according to a keynote address by the META group (now Gartner, Inc.) given six years ago — and the cost has yet to come down.

It should be noted that the forecasted power demand cited previously does not reflect unmitigated historical growth extrapolations. During the last several years, the industry's attention to the growing crisis of unbridled energy demand has fostered many of the ideas currently generating the positive effects of energy-efficiency trends. According to the EPA report, however, there remains significant potential for further improvement in reducing future energy demands and realizing notable environmentally "green" effects. Three energy efficiency scenarios were developed to explore the impact of new technological approaches that could be deployed without unacceptable risk to data center performance, reliability and availability.

Dubbed "improved operation", "best practice" and "state-of-the-art," the envisioned improvements in energy efficiency would be significant resulting in a potential dramatic reversal of energy demand trends. The accompanying reduction in the total carbon footprint (green house gas emissions) from the operation of IT facilities is noteworthy given the greater than 21% contribution[3] to total greenhouse gas emissions from power plants. The annual savings in 2011 ranging from approximately 23 to 74 billion kWh is compared to the current efficiency trends scenario. Annual electricity costs would be reduced by $1.6 billion to $5.1 billion.

The projected savings in electricity use corresponds to reductions in nationwide carbon dioxide (CO2) emissions of 15 to 47 million metric tons (MMT) in 2011.

Breakthrough in Data Center Design?

A notion not often considered is that a data center's consumption of energy is **by design**. The design and specification process — from intended server loading and IT equipment selection to the power and cooling infrastructure — determines the center's power demand. All the engineering done for detailing the support infrastructure (including power distribution and backup, server and electrical room cooling and lighting systems) is to ensure the reliable operation and maximum uptime of the installed IT engine.

The data center's initial design is a snap-shot: once built, modifications are tested by trial and error. A company's computing services are far from being a static environment. Data center managers are called upon to implement new application loading schemes resulting in server consolidations and virtualization.

Growth means new energy-efficient equipment replacing old, thin-provisioning equipment and capacity expansion assessments. The "error" part of testing is risky and potentially costly, and today, all changes are being audited for energy efficiency, risk of system instability and cost impact. One way or another, minimizing the power demands (cost of operation) of data centers while maximizing reliability and availability is the goal.

The issue is how to ensure system reliability and uptime while managing power usage and risk of system upset cost-effectively. At a recent industry conference, the question of data center energy efficiency by design was considered with the hope that the IT industry might discover a technological breakthrough which could radically alter the design of data centers and economics of energy use. To the chagrin of the participants, no dazzling answers were forthcoming. Rather, the conclusion was that data center designers and owners needed to "tune up what they own" since no solutions were offered up.

The Energy Efficiency Tune-up Tool — Energy Management by Design

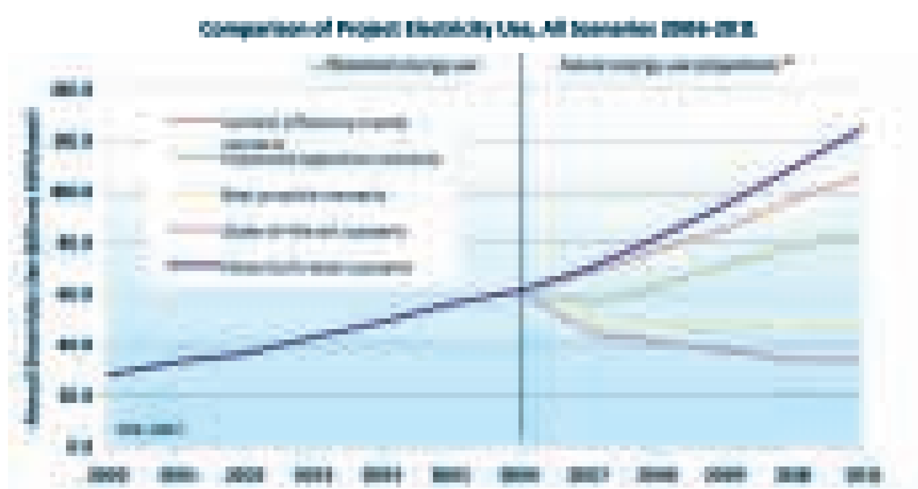
The Uptime Institute Design Charrette 2007[4] found a number of conditions which were necessary for the tune up:

- A way to generate the metrics that show what performance levels can be reached and at what level systems are currently performing. "This granular benchmarking drives the tune-up process."
- Thorough knowledge and operational experience of a specific data center.
- Practical engineering and economic analysis training with implementation skills focused on reducing risk of unintended downtime or reliability issues.

Power Analytics to the Data Center Efficiency Rescue

Power analytics is a design and simulation software methodology that allows electrical designers, facility managers and data center managers to easily perform highly-accurate simulations of their infrastructure design, under an almost unlimited range of operating conditions. Power analytics gives electrical engineering professionals the means to create a robust electrical "designbase" — a detailed design and knowledge base of the performance specifications of the entire electrical distribution system.

The key to an effective energy management program is accurate information regarding the consumption of energy. Based on the amount of IT equipment in racks, the power distribution and cooling equipment infrastructure, and the variations in application loading, power analytics can report accurate, real-time energy usage. This data can be compared to the "as-designed" energy usage calculated by the



analytic system to give insight into system unbalances, capacity restraints, or overloads. The results of virtualization and other energy efficiency measures can be followed and assimilated. Intelligent power analytics can suggest scenarios for improved energy utilization based on its predictive diagnostics ability and by "what-if" simulation. At the current energy costs (~$0.089 kWh), a nominal realized annual savings of ten percent for even a relatively small, lightly-loaded data center is significant — greater than $100,000.

Today's facility engineers are generally focused on the reliability and capacity of the data center's power distribution system while the data center manager is concerned with server availability and service level agreements. While they may be preoccupied with different aspects of data center operation, they both are in agreement regarding taking risks: they do not want to take them. The adage, "no pain, no gain" is simply not part of their conversation.

The fact is, though, energy conservation schemes, thermal efficiency advances, capacity improvements, server loading rearrangements, new technology applications, and other energy management measures involve the risk of unintended consequences. The simulation of a system's performance in a virtual environment is the safest way to test a system modification and assess risk.

Power analytics aptly coined "virtual electrical expert" offer a technological richness needed to analyze systems from a variety of perspectives; from static to dynamic simulations including the ability to model and embed the detailed control logic of the intelligent electronic devices responsible for controlling how power flows and how it is directed throughout the system.

In addition, a robust library allows users to perform specialized forms of analysis and optimization, including Fault Analysis, Protection Coordination, Power Flow Analysis, Power Quality Analysis and Mitigation, Dynamic Behavior Simulation, Design Optimization, and Sizing Optimization.

When installed, the power and uniqueness of the platform is derived from the complete encoding of the design specifications from the original, as-built power infrastructure. All power system electrical parameters are calculated from the stored design specifications. During the data center's normal operation, the parameters are compared with the real-time power data. The intelligence of power analytics can accurately corroborate as-specified power parameters, determine if there are system anomalies, and predict when and where there are potential vulnerabilities for system and equipment failure.

More advanced power analytics systems on the market — AGO, LLC. recommends the Paladin® family from EDSA Corp. — allow users to actually capture current system state data, and run detailed "what if" simulations to verify system operations for the data center commissioning process, to investigate the effects of equipment rearrangement, configuration modifications, capacity expansion and other data room modifications that might have an impact on the live system without the risk of actually doing live testing.

Simulations of maintenance and repair actions can help discover unforeseen program vulnerabilities and guide optimum cost-effective scheduling. Facilities engineers can review powering schemes for reliability and capacity. IT managers, concerned with availability and service level agreements, can explore dynamic application loading scenarios in a virtual environment without the risk of unintended downtime.

The real-time capability can intelligently predict the timing and location of potential system upsets, and, in the case of a downtime episode, can quickly apprise the right people as to the cause and solution. Since time is money, reducing overall downtime by as little as six minutes per year can mean a potential savings of about $100,000 if downtime is worth $1 million per hour.

Power analytics can formulate truly predictive diagnostics based on system design boundaries, and the implications of variable operating conditions from system aging. Intelligently scheduled system maintenance or repair based on a reliability assessment rather than a simple periodic basis can be less upsetting and costly.

A closer look at Power Analytics

When deployed, users will find that the power and uniqueness of the analytics platform is derived from the complete encoding of the design specifications from the original, as-built power infrastructure. All power system electrical parameters are calculated from the stored design specifications and, during the data center's normal operation, compared with the real-time power data. At any time, power analytics can accurately corroborate as-specified power parameters, determine if there are system anomalies and predict when and where there are potential vulnerabilities for system and equipment failure.

Furthermore, advanced features allow users to capture current system state data and run detailed "what if" simulations to verify system operations for the data center commissioning process, as well as investigate the effects of equipment rearrangement, configuration modifications, capacity expansion and other data room modifications might have on the live system without the risk of actually doing live testing. Simulations of maintenance and repair actions can help discover unforeseen program vulnerabilities and guide optimum cost-effective scheduling. Facilities engineers can review powering schemes for reliability and capacity. IT managers, concerned with availability and service level agreements, can explore dynamic application loading scenarios in a virtual environment without the risk of unintended downtime.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Key to an effective energy management program is accurate information regarding the consumption of energy. Based on the amount of IT equipment in racks, the power distribution and cooling equipment infrastructure and the variations in application loading, power analytics can report accurate, real-time energy usage. This data can be compared to the "as-designed" energy usage to give insight into system unbalances, capacity restraints or overloads. The results of virtualization and other energy efficiency measures can be followed and assimilated. Power analytics can suggest scenarios for improved energy utilization based on its predictive diagnostics ability and by "what-if" simulation. At the current energy costs (~$0.089 kWh), a nominal realized annual savings of ten percent for even a relatively small, lightly-loaded data center is significant — greater than $100,000.

The added complexity of energy management will increasingly drive system and financial decisions. Power analytics addresses the continuum of energy management, from availability and performance to reliability and quality; a timely and powerful solution for the greener and more reliable enterprise.

References

[1] The Green Grid, "The Green Grid Data Center Power Efficiency Metrics: PUE and DCiE" December 2007

[2] EPA, "Report to Congress on Server and Data Center Energy Efficiency", August 2, 2007

[3] Emission Database for Global Atmospheric Research version 3.2, Fast Track 2000 Project. This value is intended to provide a snapshot of global annual greenhouse gas emissions in the year 2000

[4] Executive Director Report: The Findings of the 2007 Charrette, Kenneth G. Brill, DESIGN CHARRETTE 2007, Data Center Energy Efficiency By Design

Barry J. Needle is the principal engineering consultant for AGO LLC. He can be reached at bjneedle@gmail.com.

COMPARING ALTERNATIVE SCHEMES FOR IT DATA CENTER POWERING

Ed Spears

In recent years, the enterprise data center has seen a fundamental change in the requirements for power and cooling support equipment. The previously "desirable" feature of increased efficiency and optimized energy usage has now become a "critical" requirement for all new Information Technology (IT) facilities. The cost of power and cooling has risen alarmingly as higher density processing becomes more prevalent. At the CIO and CFO levels, there is an uncomfortable realization that the cost of the IT equipment is no longer the limiting factor in the size and scope of the data center. It is now the support infrastructure that determines (or limits) the scope of new projects. Both cost of ownership and installation costs are being increasingly scrutinized by architects, engineers, consultants and users.

Even more alarming is the spiraling cost of energy to power and cool the computer, telephony and network facilities. In a typical application, only 60 percent of the power coming in to the data center is utilized for data processing. A staggering 40 percent of the incoming energy is thrown off as heat, according to Intel Corporation. Given the rising cost of power this situation is completely untenable and users, utilities and even government agencies like the Environmental Protection Agency (EPA) are demanding that these high costs be addressed by the power and cooling vendors, as well as the IT equipment vendors.

As a result, uninterruptible power system (UPS) and cooling vendors are scrambling to improve their efficiency performances. Every .5 to 1 percent of system efficiency can translate to significant savings, especially at power requirements greater than 100 kVA. However there is a limit to the magnitude of improvement achievable simply by tweaking conventional power converter designs. Much more significant improvement can be made by eliminating the power conversion stages (AC to DC, DC back to AC, etc.) as power flows through the UPS and after it enters the server chassis or data storage device. From an installation cost standpoint, remarkable cost savings can be realized by reducing the wiring size and simplifying the distribution network that delivers power to the critical loads in the data center. In order to realize these important savings, a fundamental change in the voltages distributed in the data center will likely be necessary.

The potential advantages, disadvantages and estimated costs will be evaluated for the following powering schemes:

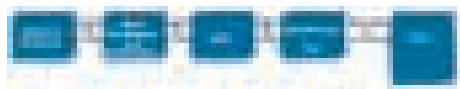
1) Higher voltages
   - A. 600VAC at the facility level
   - B. 480/277VAC within the data center distribution network
   - C. 400/230VAC directly to the IT rack

2) DC powering and distribution
   - A. Conventional -48VDC to the rack
   - B. Higher voltage within the rack

For each scheme, "end-to-end efficiency" will be cited which is defined as the losses for the entire energy sequence, starting from the power entrance to the data center through to the DC point of use voltage inside the IT device. This encompasses all power conversion stages in the power chain, and is to be compared with the baseline efficiency of a conventional 480V UPS and power distribution unit (PDU)-based step-down transformer distributing power to the rack. These findings align with the interpretation of power distribution configurations by The Green Grid, a global consortium dedicated to advancing energy efficiency in data centers and business computing ecosystems. Based on an Eaton Innovation Center study, the Baseline System is determined to be 72 percent for the purpose of analysis.

Baseline System: 480VAC UPS and 480-208VAC distribution transformer—End-to-End Efficiency=72 percent

Figure 1A: 600VAC input distribution voltage/UPS output voltage—End-to-End Efficiency=73 percent (similar to conventional 480-208VAC distribution)



The method in figure 1A would replace the ubiquitous 480VAC distribution voltage with 600VAC, both to and from the UPS. This would originate at the service entrance transformer for the building, and would feed the UPS input and bypass. The UPS output could be 600V as well, and the transformer in the data center PDU would step this voltage down to the conventional 208/120VAC for distribution to the IT equipment racks. The higher voltage would offer direct savings in the cost of copper wiring for feeders to the UPS and from the UPS to the PDU. A significant savings would also be realized in larger multimodule, parallel redundant UPS systems. These systems are often fed by 4000 amp switchgear. The 4000A is the limiting factor in these systems due to the cost and limited availability of circuit breakers at the 5000A rating and above. Operating a 4000A system at 600 volts as opposed to 480 volts would allow an additional 900 kVA of power to be fed to the large UPS system. In practice, this would allow an additional 750 or 825 kVA UPS module to be added to the system for very little increase in the cost and footprint of the switchgear.

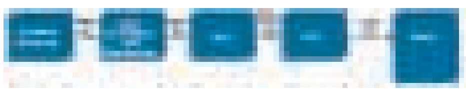
Advantages:

- More power through a 4000A switch board.
- Lower copper wiring costs to the UPS and from UPS to PDU.
- Smaller circuit breakers in the distribution network.
- Would not require any change to IT equipment (it will still run on 208/120V).
- Only limited modifications to accepted standards and practices. 600V distribution is common in Canada and its safety is documented and is integral to Canadian Electrical Codes.

Disadvantages:

- Possible changes needed to the U.S. National Electrical Code (NEC)
- UPS designs would need significant and costly changes to operate natively at 600V input and output. This could be mitigated by the use of autotransformers or isolation transformers around the UPS, but end-to-end efficiency would be reduced, thus negating the desired energy cost improvements.

Figure 1B: 480/277VAC distribution directly from the UPS to the IT equipment rack—End-to-End Efficiency=75 percent



The topology in figure 1B eliminates the need for 480 to 208V distribution transformers or PDU transformers. The 277VAC phase-to-neutral voltage from a 480 wye UPS output (or utility source) is distributed directly to the IT equipment rack. The elimination of the transformer and its associated data center footprint make a significant difference in installation and operating cost. The conventional PDU often takes up as much as 35 sq ft of valuable raised floor space when including required service access. The elimination of these large devices could save over $30k in floorspace costs per year, per device. A compelling benefit is the cooling savings realized by removing the distribution transformer and its associated BTU output which would amount to ~$5,400 per year for a 500 kVA data center. The problem, of course, is that typical servers and IT equipment are not presently rated to run at 277VAC (most are equipped with a "universal" power supply that allows only a 90-250VAC input range).

Within the last few years, a few vendors have introduced servers and storage devices that do operate from a 277V (or higher) source. However, this practice would need to become much more widespread to become a viable alternative.

Advantages:

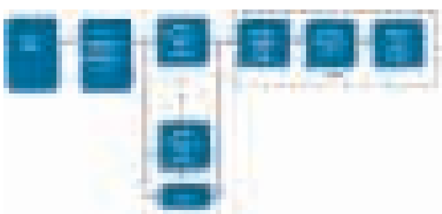
- Space and weight savings in data center
- Installed cost savings
- Power distribution function of a stand-alone PDU could be relegated to wall-mounted panels
- Efficiency savings up to 2 percent (via deletion of

transformer) >$5000 per year for a 500kVA power system.

Disadvantages:

- Very few IT devices are rated to operate at 277VAC (most operate at 240V max)
- Same issue exists for electrical devices like single pole circuit breakers and connectors, which today are typically rated for a maximum of 250VAC.
- New NEC safety regulations may be required to allow this practice due to higher voltage in the rack. Since racks are accessible by IT technicians and other users, this may be a concern.

Figure 1C: 400/230VAC power directly from the UPS to the IT equipment rack—End-to-End Efficiency=77 percent for ECO-mode UPS, or 75 percent using Double Conversion UPS



The scheme, as shown in figure 1C, enhances power savings by the use of non-galvanic (autotransformer) voltage transformation, which improves efficiency by about 1 percent. The phase to neutral voltage is 230VAC, and virtually all of today's IT equipment will operate about 2 percent more efficiently (85 percent at 230V vs. 83 percent at 208V), further maximizing the energy savings, and requiring no new product development. The maximum possible efficiency would be achieved through the utilization of the UPS's optional "ECO-Mode," or "High Efficiency" mode, which would further improve the system efficiency by 2 percent.

Advantages:

- Little or no change to existing UPS designs, other than UL listing of systems originally developed for 50Hz markets.
- No change to IT devices and loads, virtually all are rated to operate at 230 or 240VAC without modification.
- No changes needed to power distribution equipment, either inside or outside of the IT rack. Connectors and circuit breakers already exist with these ratings.

Disadvantages:

- Would require documentation changes and new UL listings for most UPS and some distribution components.
- Triple-N harmonic currents will sum in the neutral, possibly creating overheating problems in the distribution wiring.
- Overvoltage sensors in site monitoring equipment would need to be adjusted above the present 208V-based levels.

Figure 2A: -48V DC power to the IT equipment rack(s)—End-to-End Efficiency=77 percent

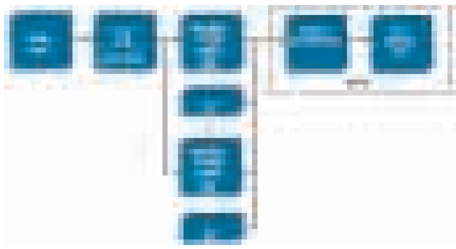


Figure 2B: UPS-based alternatives for -48 volt DC power distribution

The arrangement in figure 2A has been repeatedly suggested and/or requested of power vendors over the past 20 years. Logic suggests that providing DC rather than AC power to the critical data center loads would enable the most reliable use of a -48V backup battery system (no inverter circuit required) and reduce the number of power conversion stages between the incoming AC power and the computing equipment power inlet. Challenges to this approach include the issue of DC voltage drop and the cost of high current DC distribution. It is much more likely that this type of system would be deployed as a highly distributed type of architecture, as opposed to the traditional centralized (telecommunications industry) system model. Historically these issues have precluded any serious effort to introduce this architecture in non-telecom applications. The need for dramatic efficiency improvements brought this topology back to the forefront, with some proponents claiming end-to-end efficiency improvements in the range of 10-17 percent. However, in Eaton's controlled testing, current IT device internal power supplies were more efficient than others had assumed, and as a result, the end-to-end efficiency gains for this scheme were closer to 4-5 percent.

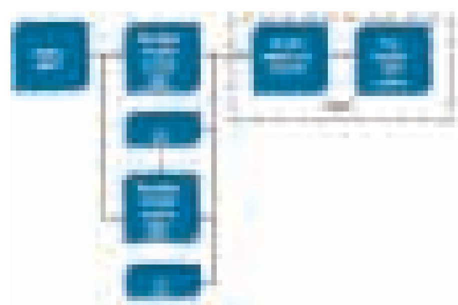
Advantages:

- The use of a "DC UPS" eliminates the "inverter" conversion circuit found in an AC UPS, as well as the step-down transformer in the PDU. The deletion of these items would enhance reliability and save energy costs as well as floorspace.
- Paralleling of AC/DC rectifiers for increased capacity or redundancy is simpler and less expensive than paralleling AC UPSs.
- Changes to standards and safety practices would be much less extensive and time consuming to devise and implement, since they already exist in the telecom environment with decades of positive experience in reliability and safety.

Disadvantages:

- DC line voltage drop would be a constant consideration. Variations in loading would result in variable voltages at the protected load. This could be counteracted by line drop compensators (inefficient) or larger copper conductors (expensive).
- The relatively low DC voltage would dictate the use of large copper conductors (wire and busbars), significantly adding to the initial installed cost for material, labor, footprint and subfloor space.
- This topology, while common in telecom, is less frequently seen in data centers. Education for both management and technical personnel is required before both will be comfortable with this type of system.

Figure 2C: High Voltage DC (380V) Distribution—End-to-End Efficiency=79 percent



The topology in figure 2C enhances efficiency by removing unnecessary power conversion stages, and also eliminates the issue of expensive DC distribution via the use of a higher DC distribution voltage. The batteries would be part of the DC rectifier system, or "DC UPS." HVDC would allow power to be distributed around the data center using similar or smaller gauge wire than is typical in AC systems. This would significantly reduce installation costs, while greatly reducing (but not eliminating) the problem of DC line drop. The many proponents of this type of design cite end-to-end efficiency gains of 7-9 percent over conventional data center powering schemes. The problem, of course, is that IT equipment and associated power distribution elements (circuit breakers, connectors, etc.) that are rated to operate at

this elevated voltage, are nonexistent. While these devices could be built today from existing components, without having to invent new devices, the costs, initially, would be very high. New designs for rectifiers, DC power distribution devices, both primary distribution and in-rack distribution, would need to be developed, standards written and agreed upon and service safety procedures adopted. These daunting impediments could be overcome, but would require time and a dedicated effort by many disparate vendors and users.

Advantages:

- Installed cost benefits of a High Voltage DC system: Smaller wiring, connectors and protective devices, lighter weight, less subfloor space, and smaller conduit.
- Significant efficiency gain over conventional powering schemes
- Simpler electronics, and therefore, higher reliability and availability
- Paralleling rectifiers is easier than in AC systems
- More resistant to line voltage drop

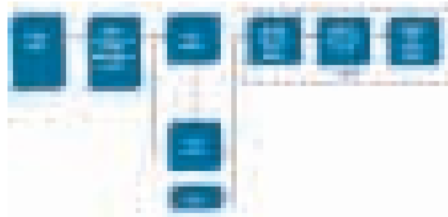
Disadvantages:

- No IT equipment exists that is designed to operate at 380VDC.
- Equipment standards would have to be written and agreed upon before development could begin
- HV DC may have safety issues not evident in AC distribution systems—training needed
- The large energy cost benefit is offset by the time required to address the related issues.

For the near term, Eaton feels that the most promising solution to the data center electrical distribution design opportunity is the 400/230 VAC scheme. This requires the least amount of new product development of both power devices and supported IT equipment. It would be the easiest for IT and facility managers to accept and implement. Additionally, the energy savings, while not of the magnitude of the DC alternatives, are considerable when compared to the status quo.

For the future, our research shows that a solution that combines "Hi-Efficiency" 400VAC to the rack, and 48VDC distribution to the loads; has an **end-to-end efficiency as high as 82 percent**, truly a game-changing level.

Figure 3: Eaton's Recommendation



This would surely require some investment in new standards, but very little in the way of new products for the power vendor or the server provider. The user would reap the benefits of high efficiency UPS products, and the power conversion savings of the 48V rectifier, without having to incur the losses found in conventional DC-DC converters, or deal with the safety concerns of HV DC distribution.

It is impossible to foretell what the future may hold, but we are encouraged and hopeful that we will finally see a fundamental change in data center powering schemes, forced by economic and environmental realities that are becoming evident and urgent—today.

Ed Spears is a product marketing manager in Eaton's Critical Power Solutions Division. He can be reached at EdSpears@Eaton.com.

CABLE CUTOUTS IN DATA CENTERS CAN

Kishor Khankari, Ph.D.

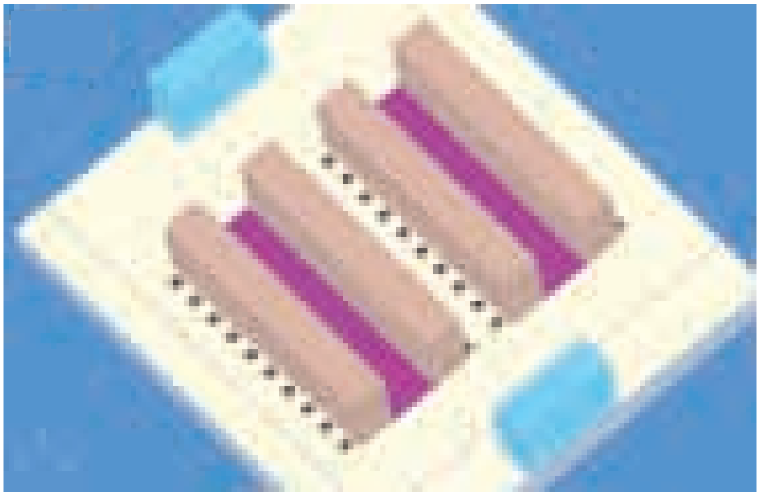


Figure 1

Good design of a data center ensures an adequate supply of cold air to meet the cooling demand from servers. In a well-designed data center, the supply airflow rate (CFM) from the air conditioning system meets or exceeds the demand airflow rate from the server fans. It also ensures the temperature of the supply air is low enough to remove the heat generated by the servers. It is important to bring this cold air near the server racks where it can be picked up readily by the server fans. In the case of raised floor data centers, the cold air from the supply plenum is brought up at the front of the server racks through perforated tiles.

Airflow Leakages Mean Loss of Cooling Capacity

However, just providing enough cold air in a data center does not ensure that all the supply air will pass through the perforated tiles and then through the servers. The cold air from the supply plenum can leak through unintended and intended openings in the raised floor and bypass the perforated tiles. The supply plenums in the raised floor data centers are generally pressurized up to 0.03 to 0.05 inches of WC above the pressure in data center rooms. Such a pressure difference across the raised floor can cause the cold air to escape through small cracks and gaps in the floor. Instead of passing through the perforated tiles and servers, this air instead leaks through the other undesirable openings. In order to compensate for this loss of cold air, the air from the other parts of the room and usually from the adjacent hot aisles, enters the cold aisle, mixes with the cold air, and raises the temperature of the air that enters the servers. This in turn results in the loss of net available cooling capacity and can affect data center cooling performance and energy efficiency.

Some of the leakage paths include cable cutouts located both inside and outside server racks, gaps between the floor and the perimeter walls of the data center room, gaps between the floor and the walls of the computer room air conditioning (CRAC) units, and gaps between floor tiles. Under certain situations, cable cutouts can cause the most significant loss in the available cooling capacity. These cutouts are the holes cut in the blind floor tiles to bring cables from the supply plenum. Generally, these holes are cut behind the servers. Because they often are made too large, they allow significant cold air leakage. The rate of air leakage through the cable cutouts depends on the size and opening of the holes — the gaps that remain after the cables are passed through the cutouts. The larger the size and open area, the more air leaks through the cable cutouts.

CFD Case Study

This article demonstrates how the size and open area (percent of the total area) of cable cutouts affect the cooling performance of a data center. Computational fluid dynamics (CFD) analysis was conducted for a data center of 1,400 sq. ft. with a heat density of about 115W per sq. ft. of room footprint. This data center is equipped with two CRAC units, each with 25 tons of cooling capacity and 14,500 CFM supply airflow rate. As shown in Figure 1, there are a total of 40 server racks, each with an average heat load of 4kW with 40 perforated tiles each with 25 percent open area. In addition, there are 40 cable cutout holes behind each server rack. In this case study, three sizes of cable cutouts (6 in x 6 in, 9 in x 9 in and 12 in x 12 in) and three levels of open areas (10 percent, 50 percent and 80 percent) for each size category were analyzed. It was ensured that this data center operates with 16 percent excess airflow rate over the demand airflow rate from the server fans and with 10 percent excess cooling capacity than

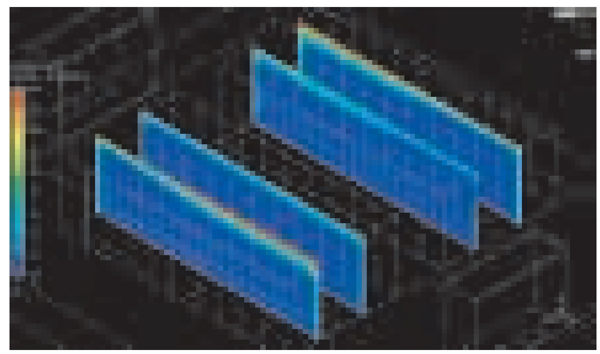


Figure 2a: Cable cutout open area 10 percent

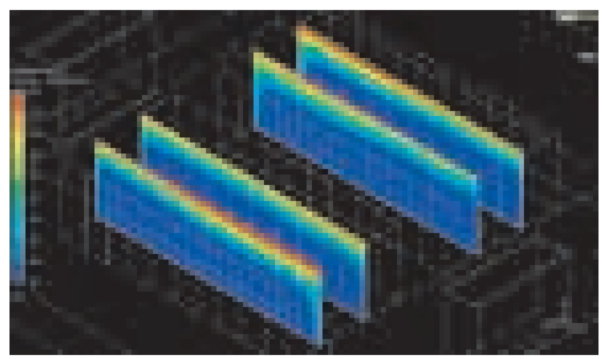


Figure 2b: Cable cutout open area 50 percent

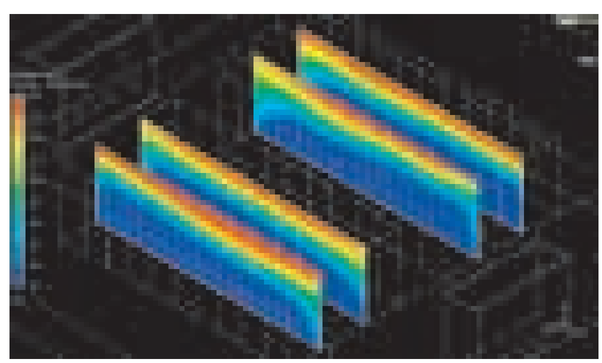


Figure 2c: Cable cutout open area 80 percent

LEAD TO LOSS IN COOLING CAPACITY

the cooling load from the servers. Demand flow rate is the total flow rate of air passing through the servers. In this analysis it is assumed to be 156 CFM per kW of heat load. CFD simulations were performed using software from ANSYS, Inc.

Figures 2a through 2c show thermal maps of the air temperature on the inlet side of server racks for the 9 in x 9 in cable cutouts. It shows that an increase in the open area from 10 percent to 80 percent increases the inlet air temperature from 69 degrees F to 78 degrees F. Figure 3 shows the comparison of the maximum temperature of the inlet air for all nine cases. Note that even in the case of the lowest (10 percent) open area, increasing the size of the cable cutout from 6 in x 6 in to 12 in x 12 in increases the maximum inlet air temperature from 68 degrees F to 71 degrees F. The analysis showed that when the percent open area reaches 80 percent, the maximum inlet air temperature reaches close to the upper limit of ASHRAE-recommended thermal guidelines of 77 degrees F. This situation could become even more severe when the heat load in the data center increases or the amount of excess air supply or excess cooling capacity decreases.

In spite of providing an excess supply of air and cooling capacity, why are the inlet air temperatures in this data center are so high? Figure 4a shows the effect of the size and percent open area of cable cutouts on the estimated percent loss of the supply air through cable cutouts. Figure 4b shows the equivalent loss in the cooling capacity. It indicates that for this data center, every 10 percent increase in the open area of cable cutouts, the cooling capacity decreases by an average of 1 Ton for 6 in x 6 in, 2 Tons for 9 in x 9 in, and 2.5 Tons for 12 in x 12 in size of cable cutout. Increasing the size and percent open area of the cable cutout increases the rate of leakage or bypass flow. This bypass flow robs the air from the perforated tiles and deprives the servers from getting the cold air. In order to compensate for this loss, hot air from hot aisles enters the cold aisles and increases the temperature of inlet air to the servers. Such leakages from cable cutouts encourage wrap-around flows and recirculation between the hot and cold aisles.

Such leakages and loss of cooling capacity can be avoided by plugging the cable cutouts and other similar holes and cracks in the raised floor. There are many commercial products available in various forms to achieve this. When selecting these products, it is important to ensure they can effectively reduce the percent open area and stop the leakage. Another option would be to use overhead cable trays and minimize or eliminate the number and size of the cable cutouts in the raised floor.

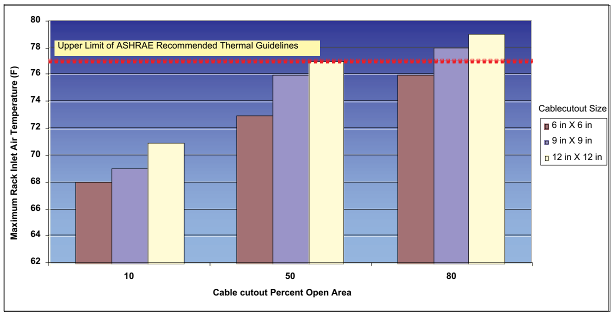


Figure 3

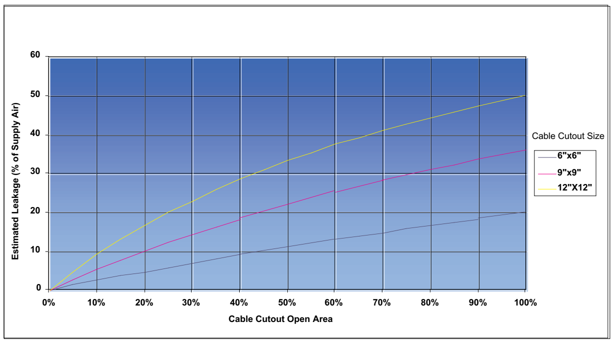


Figure 4a

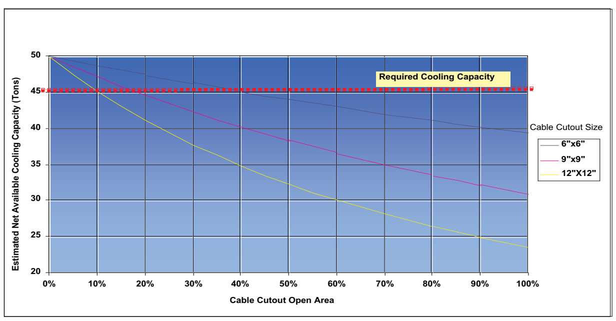


Figure 4b

Summary

Unintended openings, such as cable cutouts in the raised floors of data centers, can cause leakage of the supply air from the pressurized supply plenum. Such bypass of the supply air away from the perforated tiles effectively reduces the amount of supply air and available capacity. It further encourages the undesirable airflow patterns in data center rooms, such as wrap around and recirculation between the hot and cold aisles. This can result in higher inlet air temperatures to servers and reduced energy efficiency of a data center. The situation can be avoided by plugging intended and unintended openings and holes in the data center floors. This article, with the help of computational fluid dynamics (CFD) simulations, demonstrates how the size and open area of the cable cutouts affect the cooling performance of data centers.

Kishor Khankari, Ph.D. is the Associate Partner / CFD Specialist of Syska Hennessy Group, Inc. He can be reached at kkhankari@syska.com.

IMPROVING DATA CENTER RELIABILITY THROUGH COMMISSIONING AND ENERGY EFFICIENT DESIGN

Paul Tiña

Commissioning data centers constantly challenges Commissioning Agents due to the varying complexities of critical support systems. However, regardless of complexities, commissioning ensures that these systems are reliable and perform individually and interactively in accordance with the Basis of Design, Specifications, and the Owner's operational needs. In addition to commissioning, incorporating energy efficient designs can also improve the reliability of critical support systems.

Reliability and Tier Classifications

To better understand reliability and data center design, it helps to recap some industry standards. The following tier classification system is used for rating the reliability and availability of mission critical data center facilities:

Tier 1 is the lowest tier level and provides only a single path for power and cooling distribution with no redundant components.

Tier 2 is similar to Tier 1 in that it provides only a single path for power and cooling distribution, but reliability is enhanced with the addition of redundant components.

Tier 3 provides at least two paths for power and cooling distribution, with only one of the paths being active. It also provides redundant components similar to Tier 2. A facility designed to a Tier 3 level includes infrastructure that can be shut down for maintenance purposes without affecting the critical loads. This is referred to as being "concurrently maintainable."

Tier 4 provides at least two active paths for power and cooling distribution, includes redundant components, and is concurrently maintainable and "fault tolerant." "Fault tolerant" means that the facility can sustain at least one failure in its infrastructure without impacting critical loads.

In determining the optimum reliability level for a data center, an Owner needs to evaluate downtime in terms of potential loss of revenue, as well as the reliability of the incoming utility power source. Infrastructure costs relating to downtime are not a linear function. Costs increase exponentially as downtime increases. Most modern data centers are designed with probable annual downtime of approximately 5 minutes, which translates to site availability of 99.999%.

Understanding a data center's tier classification enables Commissioning Agents to develop testing procedures to ensure that critical support systems are operating in accordance with the design intent. This includes simulating all possible failure scenarios to confirm that redundant components are able to support the critical load, as well as ensuring that the facility's monitoring and alarm systems provide real-time reporting (locally and/or remotely) of these failures. This will enable the Owner or operations personnel to troubleshoot the system in a timely manner. By subjecting critical support systems to real world or "worst case" operating conditions and exposing problems or faults that could affect the reliability and efficiency of these systems, commissioning ensures that critical support systems are operating at optimum levels.

Energy Efficient Designs Reduce Operating Costs

Load design criteria for data centers have historically been in the range of 30-50 watts/sf. At present, load densities of 150-200 watts/sf are not uncommon. Some high-density mission critical facilities are being designed for 300-500 watts/sf of critical load. Manufacturers are continually looking at ways to improve efficiency of servers. More efficient equipment is more reliable and requires less infrastructure. As sustainable engineers, Glumac is constantly looking for ways to improve energy efficiency in our data center designs to reduce operating costs for facilities. Energy efficient designs improve reliability of data centers by utilizing fewer components that require preventive maintenance, repair or replacement, or could become a single point of failure in the critical support system.

One example of a more reliable, energy efficient design is preconditioning the outside air entering the data center. In lieu of reheat coils located inside each computer room air conditioning (CRAC) unit, dehumidification occurs in an independent outdoor air dehumidification coil. The cooling coils inside the CRAC units would provide only sensible cooling. This design lowers the overall mechanical process-cooling load for the facility considerably, while maintaining the same supply air temperature along the cold aisles in the raised floor area. Depending on load density and server equipment operating temperature limitations, increasing the supply air temperature is a means of utilizing energy more efficiently.

Studies have been done on the feasibility of distributing DC power directly to server equipment. The rectifier and inverter processes of converting AC to DC, then back to AC is less efficient and increases the demand for process cooling to account for losses in the system.

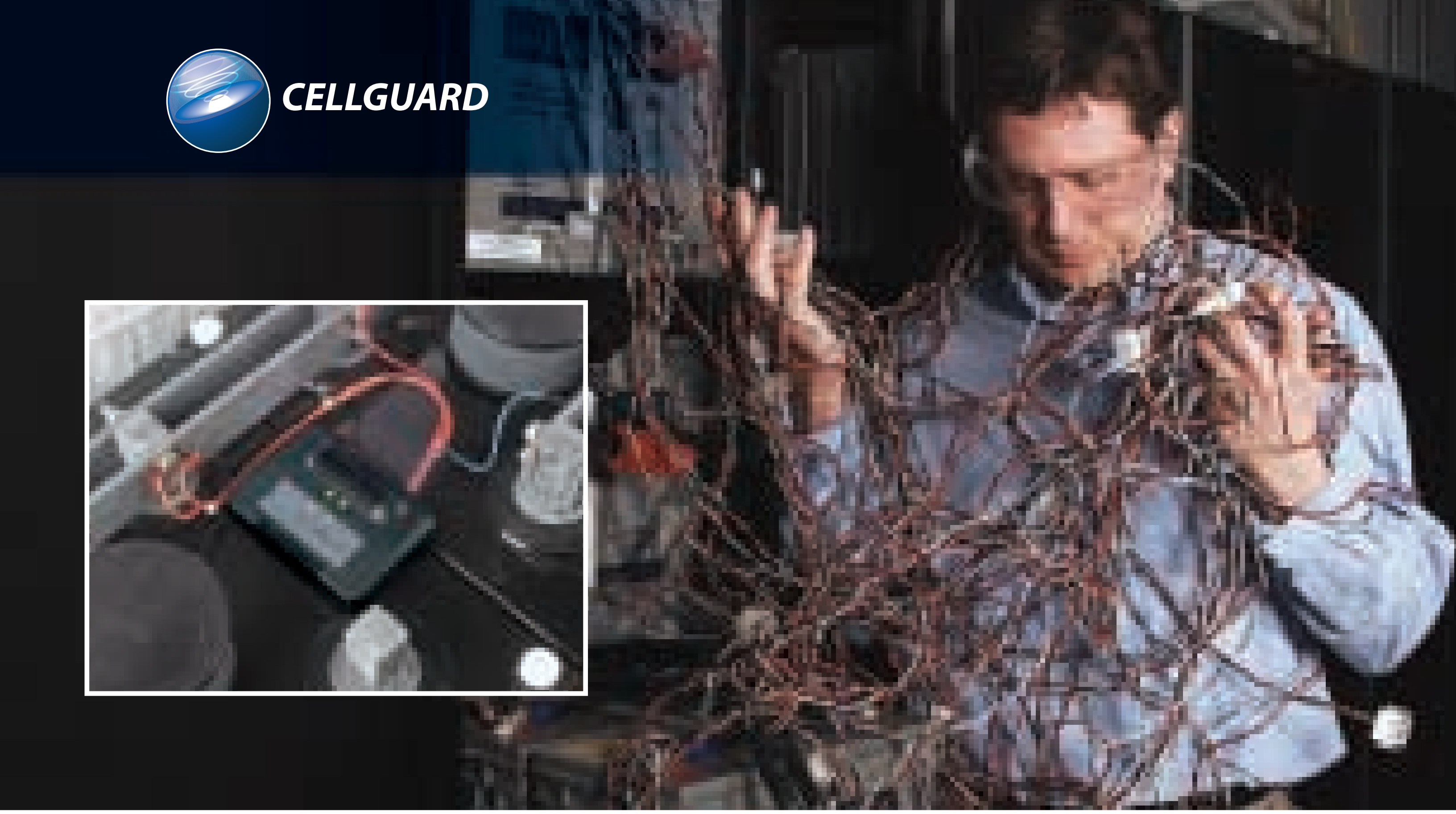
Use of alternative energy sources, such as reciprocating engines or turbines, provide greater reliability by reducing a facility's dependency on the utility grid (reducing risk of planned or unplanned outages and protecting critical loads from utility disturbances), as well as utilizing cleaner energy sources and reducing dependence on fossil fuels. In the case of a co-generation plant utilizing natural gas-fired engine generators, the waste heat generated from the engines can be captured and used for other building systems (such as steam, space heating, domestic hot water, etc.). A heat exchanger may be installed for process cooling needs and refrigeration.

Utility companies, such as Pacific Gas & Electric, offer incentives for data centers that utilize energy-efficient equipment and associated controls, such as use of variable frequency drives on process cooling equipment.

Sustainable Thumbprint

As engineers for a sustainable future, Glumac is continually researching design methods to reduce the environmental impact of new construction. More "green" data centers will be emerging in the near future: facilities that utilize recycled and regionally sourced construction materials, more efficient lighting and lighting control systems, more efficient process cooling, as well as sustainable site elements. Just as important as satisfying the basis of design and the Owner's operational needs is making sure that our engineering designs and practices also satisfy the needs of future generations.

Paul Tiña, P.E., LEED® AP is Silicon Valley Managing Director, Associate Principal of Glumac. He can be reached at ptina@glumac.com.



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Asset Management: The Business Case for Battery Monitoring

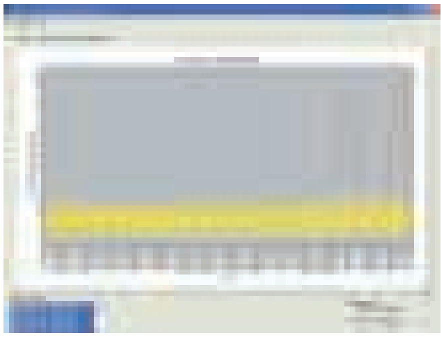
Brian Hanking

In a power critical environment (Tier 2 upwards) it is essential to know the state of health of the lead acid batteries supporting the critical load.

Despite the cutting edge technology which resides inside today's UPS systems, when a building's AC power fails, the UPS needs to draw its power from banks of lead acid batteries to feed the critical load until it is able to start and synchronize the standby generators. There is a strong business case to be made for investing in a state-of-the-art battery monitoring system to manage these assets and ensure that critical batteries are in a good state of health and will function when required. The business objectives include:

1. Minimize the likelihood of unplanned downtime
2. Reduce costs
3. Increase operating efficiency
4. Improve budgetary controls and spending

Until such time as these critical batteries are required they are typically kept in a state of full charge to ensure the maximum run time when called upon (typically 5 to 25 minutes). The fact is most UPS power failures are not due to UPS problems but actually are due to battery failure. In many cases valve regulated lead acid (VRLA) batteries can fail within just a few days. (See graph below.)



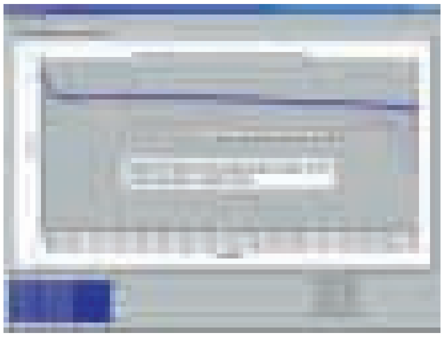
(This real world example shows the daily ohmic value of two cabinets of VRLA batteries. The two red lines indicate the failure of two of these jars over the course of just a few days. Only daily ohmic measuring can show these results in such detail.)

The most modern battery monitoring systems have been specifically designed to monitor the ohmic value of all of the jars every day. They can do this because of the very light test load used, combined with superior electrical noise filtering techniques. Such systems can also monitor generator start batteries that are often neglected until needed.

A battery monitoring system can:

1. Provide a "window on your battery" with its continuous, accurate monitoring and alarm notification.
2. Provide clear information in the form of graphs for forensic analysis.
3. Reduce manpower demands and increase safety during maintenance.
4. Allow extended life of the batteries through efficient and rapid preventative maintenance.

The graph below shows what such a system automatically records when any discharge takes place.



(This real world example of a 30 minute witness discharge test clearly shows one bad (shorted) cell and several weak cells within the strings — these cells were immediately replaced.)

Cost justification on a disaster recovery basis

For most major data-oriented businesses today, unplanned downtime is to be avoided at all costs and is typically a major subject in any company's disaster recovery plan and Mean Time To Recovery (MTTR) calculations.

It is assumed here that the reader knows the full costs and implications of his own company's downtime but for purposes of this discussion here are some typical known business statistics:

Brokerage Operations	$8 million per hour
Credit Card Sales	$3.5 million per hour
Pay per View	$200 thousand per hour
Home Shopping	$150 thousand per hour
Catalog Sales	$100 thousand per hour

(Data courtesy "Media Disaster Recovery Reaction" 2003)

The graph below shows the likelihood of a company going out of business in relation to the time they are not functioning due to an unplanned outage.

(Data courtesy "Contingency Planning Research)

So, it can be seen the cost of any outage within a critical installation can be highly expensive at best. At worst, the entire business is in peril.

The benefits of having a modern battery monitoring system:

Managing the assets of a data center with a modern battery monitoring system provides a number of benefits. A system that provides daily ohmic value readings can:

1. Greatly reduce the risk of unplanned downtime due to battery failure.
2. Reduce the workload for the maintenance team, increase battery and workforce efficiency and provide the proper management of very large numbers of batteries.
3. Ensure that the entire battery system is

available by monitoring generator start batteries.

4. Through continual automatic information gathering provide
   a. Good clear baseline readings during acceptance test.
   b. Clear decisions on warranty claims.
   c. Performance information during unplanned outages.
5. Provide immediate notification of detected faults.
6. Ensure that future battery replacement is carried out in a properly timed and budgeted manner.
7. Improve health and safety conditions for personnel tasked with battery maintenance.

The risk of not having battery monitoring

Any power backup system that does not take into consideration the condition of the batteries within it is incomplete and as such the risk of failure of the entire system due to an unforeseen battery failure is very real. Furthermore, as well as being impossible to determine the probability of battery uptime when required, it is also not possible to manage this expensive battery asset correctly, resulting in batteries either being replaced too late (unplanned downtime) or too early (overspending and with negative environmental implications).

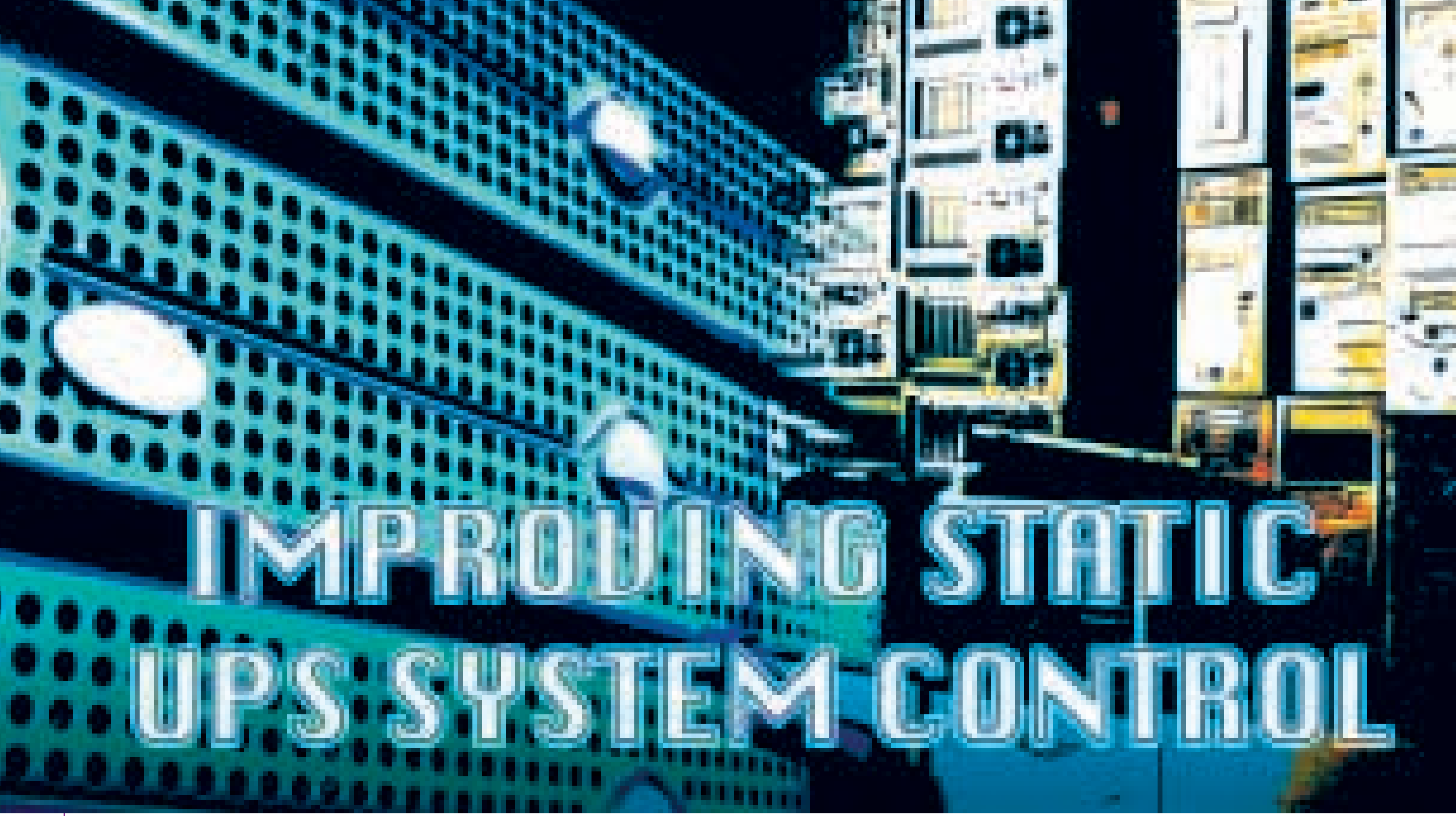
Meeting the business objectives

A state-of-the-art battery monitoring system requires a small initial investment of capital and training. But once installed and used properly, such a system readily meets the business objectives listed at the beginning of this article:

1. Minimize the likelihood of unplanned downtime. The battery monitoring systems helps ensure that the standby batteries, including the generator batteries, are functioning and at full power when needed.
2. Reduce costs. In addition to helping prevent the cost of unplanned downtime, the battery monitoring system reduces the requirements for ongoing maintenance.
3. Increase operating efficiency. With advanced knowledge of battery conditions and possible failure, the data center manager can avoid schedule disruptions, deploy technicians more effectively and even monitor remote sites without dispatching personnel.
4. Improve budgetary controls and spending. Ongoing maintenance and battery replacement become more predictable. Failing batteries can be replaced while still under warranty. Instead of bulk replacement after two or three years, the data center can safely keep batteries much longer, replacing only the ones that are starting to fail.

In terms of asset management, cost reduction and efficiency of operation there is a strong business case for battery monitoring.

Brian Hanking is the Director of Sales, NDSL Cellwatch. He can be reached at bhanking@cellwatch.com



IMPROVING STATIC UPS SYSTEM CONTROL

Christopher Johnston, PE

Control of today's static UPS systems is based on the needs of obsolete computer hardware that is no longer in use. Changing the control to take advantage of today's computer hardware will increase UPS systems' reliability and robustness.

Background

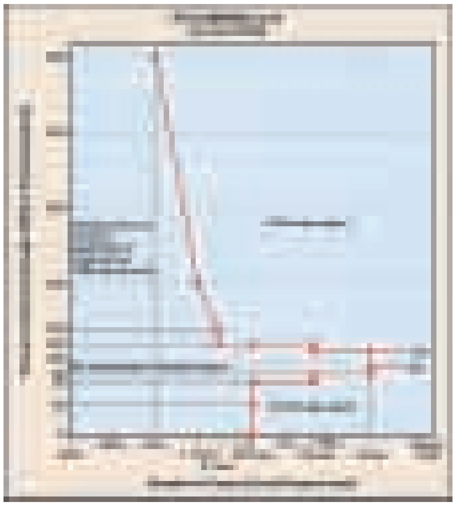
Since static UPS systems first came to market, their control is based on two main principles:

Principle 1: Maintain continuous output power at all costs.

Principle 2: If the system automatically transfers to bypass without a computer outage, the system has not failed.

Computer hardware then was much less tolerant of momentary undervoltages or losses of input power than today's hardware. The Computer Business Manufacturer's Association (CBEMA) issued this curve in the early 1980s:

In 2000 the Information Technology Industry Council (ITIC), the successor to CBEMA, issued a revised curve to reflect hardware changes:

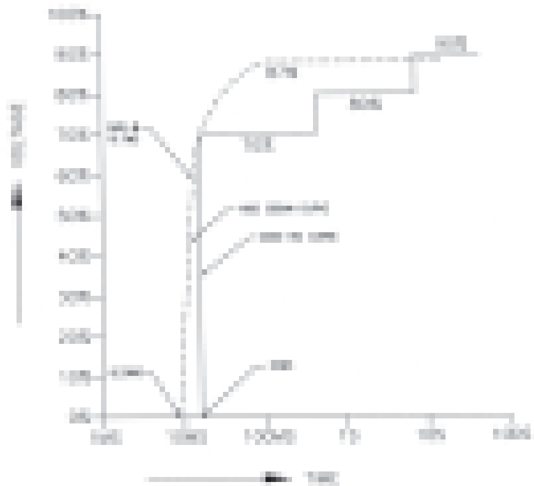


Overlaying the two curves and looking at the undervoltage range we see:

This comparison shows us that 2000 computer hardware could ride through a complete loss of voltage for up to 20 milliseconds while early 1980s hardware could only ride through up to 8.33 milliseconds. However, the key principles of UPS control did not change with the times. To fulfill Principle I, all transfers between the inverter and the bypass remain closed transition type (make-before-break). Principle 2 is necessary to justify the extended repair times that can result from rough transfers. However, the critical output is unprotected while on bypass so the Owner's risk increases.

In normal operation the inverter is synchronized with the bypass (within a few degrees) and is within voltage limits. However, when the inverter operates abnormally, it loses synchronism with the bypass or goes outside its voltage limits, or both. During abnormal operation the bypass automatically closes to protect the critical output and the inverter is told to switch off line. If the inverter is not off line when the bypass closes, a reverse power condition into the inverter can occur. This reverse power can cause substantial damage to UPS system components plus large voltage transients to the critical output since the bypass source must supply the critical output plus supply power back through the inverter to clear the fault. Under Principle 1, these closed transition transfers were necessary in early static UPS systems because the inverters utilized SCR technology that cannot quickly switch off line. As a result, the inverter and other components were sacrificed to maintain continuous output power.

Application of Principle 1 increases the risk to the critical output because of the extended time necessary to repair and test the UPS before putting it back on line (Principle 2).



Our Opinion

Closed transition transfer is unnecessary with today's computer hardware and static UPS systems. The computer hardware uses power supplies that tolerate up to 20 milliseconds input power interruption without a computer outage. Today's UPS inverters utilize IGBT technology that can be switched off line quickly. Sacrificing the inverter and other components to maintain continuous output power is unnecessary and increases the Owner's risks and costs.

Static UPS manufacturers should make all transfers between inverter and bypass open transition type (break-before-make), accomplished within the ITIC curve limits. In open transition transfer the inverter is first switched off line and then the bypass is closed. This method eliminates reverse power conditions and the resulting damage and risk. The transfer control should also employ recent advances that minimize inrush currents due to switching of transformers downstream of the UPS.

Christopher Johnston, PE is Senior Vice President/Critical Facilities Chief Engineer of Syska Hennessy Group. He can be reached at cjohnston@syska.com.

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2008 Fall Conference Highlights

The Fall Conference themed End-to-End Reliability: The Green Horizon will be held at the JW Marriott Desert Springs in Palm Desert California from November 16-19. The conference will feature dynamic keynote addresses, tutorial sessions, breakouts, a virtual tour, case studies, another spectacular vendor event, knowledge exchange sessions, exchange tables during meals and more….

James Bradley, Best-Selling Author of "Flags of Our Fathers" will kick off the conference with a session entitled "Doing the Impossible". Featured keynotes include Ken Brill, Executive Director of the Uptime Institute on the topic "Revolutionizing Data Center Efficiency" and Mark Mills, Founding Partner of Digital Power Capital presenting on "The Future Energy Landscape". Additional conference sessions include:

7x24 Exchange board members and founders celebrate the opening of the 2008 Spring Conference with record attendance over 600 in Boca Raton, Florida last June. From left to right: Roy Chapman, John Jackson, Dave Schirmacher, Bob Cassiliano, Russ Mykytyn, Ken Brill, Frank Gialanella, Bill Leedecke & Dennis Cronin

- Microsoft – Kicking Anthills: The Changing Landscape of Mission Critical Environments
- Sun – Data Center Reality: Sun's Eco Strategy in Action
- Performance and Cost Comparison of High Density Cabinet Solutions
- Data Center Profiling Tools from the US Department of Energy – Assessing Energy Performance
- The Dilemma of Energy Conservation and High Availability
- Data Migration – An Essential Component of Your Green Strategy
- Factors Affecting Systems Life Expectancy
- Upgrading the Infrastructure of a Live Data Center Without Interruption
- Comcast – You Say You Want an Evolution: Revolutionary Approach to Data Centers and a Greener Future
- Cisco – The Green Roadmap
- IBM – Sharing the Best and Worst Practices for Greening Data Centers
- DC Power Today
- Enabling the IT Atmosphere Through Remote Connectivity
- Miracles at Medium Voltage: Minimizing Conversion and Conduction Losses
- Vendor Sponsored Event: 7x24 Exchange Lands at the Palm Springs Air Museum

Don't miss the vendor sponsored event! Fly into the desert with 7x24 Exchange as we visit one of the world's largest collections of World War II warplanes, artifacts, memorabilia, antique cars and uniforms. The Palm Springs Air Museum is a non-profit educational institution, whose mission is to exhibit, educate and eternalize the role of the World War II combat aircraft and the role the pilots and American citizens had in achieving this great victory. In addition to flying aircraft, related artifacts, artwork, and library sources are used to perpetuate American history. The significance of World War II is unparalleled in all of the history of the world in that it was the greatest, most costly conflict ever fought, taking the lives of more than 70 million people. It was Air Power that altered the outcome of that war and forever changed the lives of every person alive today.

For the complete Fall Conference program and registration information please visit 7x24exchange.org or call (646) 486-3818.

Special thanks to the following partners for their support of this event:

ABB, ASCO Power Technologies, Chloride, ComRent, Cummins Power Generation, Data Aire, Emerson Network Power, Global Data Center Management, GE, Gilbane, Global Power Supply, Greenstone, IBM, IDC Architects, Kohler, Layer Zero Power Systems, Mitsubishi Electric, MTU Onsite Energy, Russelectric, SIEMENS, Stulz, TAS, Virginia Economic Development, and Wright Line.

Interested in presenting at 7x24 Exchange? Complete the Call for Presentations at www.7x24exchange.org or call 646-486-3818 x104

2008 FALL CONFERENCE

End-to-End Reliability: THE GREEN HORIZON

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Visit www.7x24exchange.org and download the Call for Presentations

Deadline: January 9th

SUBMIT AN ARTICLE FOR THE SPRING NEWSLINK

Visit www.7x24exchange.org and download the Call for Articles

Deadline: February 13th

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- Northwest (Seattle)
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- Greater Washington DC

Attention end users and vendors...

Visit www.7x24exchange.org today to participate in your local chapter

In Retrospect

Brian K. Fabel, PE
1961 – 2008

Brian Fabel, a dedicated member of 7x24 Exchange, passed away unexpectedly last June at the age of 47 of a massive coronary while running with his beloved dog Scout.

He was a respected speaker and author, having written and presented on dozens of fire protection topics. His speaking style was relaxed, confident, and informative. During his career, he reached thousands of people across the country.

As Director of National Accounts for Orr Protection Systems, Mr. Fabel helped develop relationships with end-users regionally and nationally. He was widely known as an innovative professional providing solutions to complex fire protection problems around the world. Over the years he held numerous positions in sales and management with varying responsibilities in both the Louisville and Cincinnati regional offices. He served on the company's Guiding Coalition.

Brian leaves behind his wife Patrice and two sons, Ryan & Kyle.

Brian Fabel as members and colleagues remember him:

"I only knew Brian for a short time through the 7x24 Exchange association where my wife and I met Brian and his wife Patrice in Boca Raton. Brian spoke at many of our local 7x24 Texas chapter conferences as he was an excellent speaker. Brian will be sorely missed by all who knew him as the world has lost a wonderful human being. Brian touched so many lives in so many positive and influential ways."

"Brian has been a valued speaker sought by the Board for every 7x24 Exchange Conference. His educational sessions always received outstanding ratings. He was a key contributor to the success of the organization!"

"Brian was a clown. He rarely made a quiet entrance or missed an opportunity to crack a joke."

"Brian was well respected for his industry experience and knowledge. He worked very hard at staying current. He would only offer information that he confidently believed was accurate."

"Brian's speaking style was calm and assured. The audience never felt like they were getting a sales pitch. He was up there as one of their peers, educating them."

"Brian was passionate about his work and his company. As a subject matter expert, Brian was eager to position Orr Protection as the go-to source of good and valuable information. Brian felt that he and his colleagues helped the world be a better place by equipping others to save lives and, in the process, save livelihoods through protection against the catastrophic consequences of fire."

Brian's wife Patrice and sons Ryan and Kyle will be kept in the prayers of their 7x24 Exchange circle of friends.

Donations in his memory may be made to:
The American Heart Association • 2936 Vernon Pl., Cincinnati 45219-9932

NEWSLINK OPPORTUNITIES

Following are the Editorial Guidelines for Newslink together with the Member Advertising Rate Card. Advertisers interested in placing an ad may fax the insertion order to 7x24 Exchange at 212.645.1147 or email to jeremy@7x24exchange.org. Questions? Please call Jeremy O'Rourke at 646.486.3818x109.

NewsLink Member Advertising Rate Card

BLACK AND WHITE RATES

Size	1X	2X	3X
Full Page	$1,500	$1,300	$1,100
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1/2 Page	700	600	550
1/3 Page	600	550	500
1/4 Page	500	450	400

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COVERS & PREMIUM POSITIONS – INCLUDES 4 COLOR

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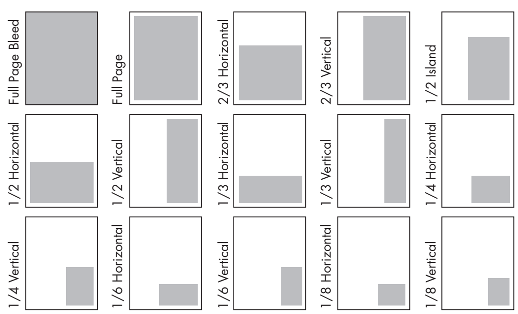
4th Cover	3,500	2,750	2,500

NON-BLEED AD DIMENSIONS

Size	Width	Length
Full Page	7.5″	10″
2/3 Horizontal	7.5″	6.5″
2/3 Vertical	5″	10″
1/2 Island	4.875″	7.5″
1/2 Horizontal	7.5″	4.875″
1/2 Vertical	3.625″	10″
1/3 Horizontal	7.5″	3.25″
1/3 Vertical	2.5″	10″
1/4 Horizontal	4.5″	3.25″
1/4 Vertical	3.25″	4.5″

8 1/2″ x 11″ MECHANICAL REQUIREMENTS



Live Area: 7.5″ x 10″
Trim Size: 8.5″ x 11″
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EDITORIAL GUIDELINES FOR NEWSLINK

Manuscript specifications: Feature articles vary in length from 500 to 2,000 words. While Newslink accepts articles in a variety of formats, it prefers to receive materials on CD. All articles must be received by the deadline to be considered for a specific issue. Material submitted after the deadline will be considered for the following issue.

Bylines: All articles should include a brief (1-2 sentence) author biographical sketch at the end of the article, that includes the author's name, title, affiliation, address, and phone number. Photos of authors are never used. Newslink does not pay authors for contributions.

Visuals: Authors are encouraged to submit photographs and charts, graphs, or other illustration that will help readers understand the process being described, though it does not guarantee that visuals will be used with the article. Submit all charts, graphs, and other artwork separately; do not incorporate them in the body of the article. Indicate caption material separately. Newslink reserves the right to publish submitted visuals.

Editorial procedures
All articles are reviewed for suitability. Accepted materials are then edited for grammar and to conform with Newslink's editorial style. All attempts are made to preserve the author's writing style, however, Newslink has the right to edit for style, clarity, and to fit space allotments, and to make final selection on headlines, subheads, and graphic treatment. Manuscript submission implies author agreement with 7x24 Exchange's Editorial Policies.

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