PUBLISHED BY 7X24 EXCHANGE INTERNATIONAL

# 7X24 Exchange INTERNATIONAL

THE END-TO-END RELIABILITY FORUM™

**Captain Mark Kelly**
2015 Spring Conference
KEYNOTE SPEAKER

# DEVELOPING HEALTHCARE DATA CENTERS WITH ENERGY EFFICIENCY IN MIND


ENGINEERING
PROCUREMENT
CONSTRUCTION
EHVERT designs, builds and operates critical facilities.
Call us for your next project at 416 868 1933
or email us at info@ehvert.com
AMHERST
Ehvert

# CONTENTS




*As a service to assist our valued members in staying informed about our dynamic industry, 7x24 Exchange is pleased to publish 7x24 Exchange® Magazine, offering articles by leading professional experts on current and future trends, best practices, and the state of our industry. Please note that the opinions and views expressed in these articles are those of the individual authors themselves, and do not necessarily reflect the views of 7x24 Exchange or any of our members.*

7x24 Exchange International

The end-to-end reliability forum.™

www.7x24exchange.org


## DIRECTORS AND OFFICERS

Chairman & CEO
**ROBERT J. CASSILIANO**
Business Information Services, Inc.

President
**DAVID SCHIRMACHER**
Digital Realty

Vice President
**CYRUS J. IZZO, P.E.**
Syska Hennessy Group

Director – Marketing, Vendor Representative
**JULI IERULLI**
Caterpillar

Director – Chapter Representative
**MICHAEL SITEMAN**
M-Theory Group

## STAFF

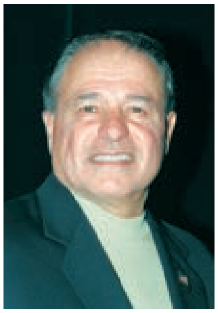
Director – Chapter & Member Relations
**KATHLEEN A. DOLCI**
646-486-3818 x103

Programs Director & Editor, 7x24 Exchange Magazine
**TARA OEHLMANN, ED.M.**
646-486-3818 x104

Senior Director of Conferences
**BRANDON A. DOLCI, CMP**
646-486-3818 x108


QUESTIONS?
*Call (646) 486-3818*
*www.7x24exchange.org*

# CHAIRMAN'S LETTER



*Robert J. Cassiliano*

As a blustery winter moves out we all welcome the warmth and newness of spring!

7x24 Exchange celebrated its 25th Anniversary in 2014 and now embarks on the next twenty five. The years ahead will be challenging and exciting as businesses continue their intense focus on financial performance. Technology innovation with the Internet of Things (IoT), mobile devices, Big Data, Cloud Services, and Cognitive Computing will drive the demand for increased compute power and storage capacity. This will result in data center construction worldwide. Who will be building these Data Centers? Will it be the way it has been for the last several decades with private corporations building and managing their "owned" facilities or will the prominent technology driven companies like Apple, AT&T, Facebook, Google, HP, IBM, and Microsoft and the leading colocation companies as well as the US Government be doing the lion's share of data center builds? The answer to this question is extremely important to those who design, build, operate, maintain, and manufacture products for Mission Critical Data Centers. It is essential for our businesses to know because it tells us who the customer will be. That's where relationships have to be developed. Recognizing a trend early and developing a strategy for the future positions a company to ensure the success of the business and provides for a competitive advantage.

As 7x24 Exchange embarks on the next twenty five years there will be continued focus on conferences providing attendees with the best of education, networking, and information sharing all in an environment designed for a memorable experience for you and your guests. 7x24 Exchange is committed to providing value to members, conference participants, and their companies.

The theme for the 2015 7x24 Exchange Spring Conference being held at the JW Marriott Orlando Grande Lakes in Orlando, Florida June 7 – 10, 2015 is **End to End Reliability: "Connect, Collaborate, Deliver".**

Conference highlights are as follows:

- Welcome Reception
- Sunday Tutorials
- Conference Keynote: "Endeavour to Succeed" by Mark Kelly, NASA Astronaut
- Keynotes by MTechnology, Schneider Electric & Keystone NAP
- Presentations on colocation, modular design, energy efficiency, and metrics
- Talks from GoDaddy, Department of Energy, Salute, and Eaton
- Exchange Tables on specific topics at Tuesday lunch
- An End-User Exchange Forum Luncheon

Sponsored Event: **"An Evening at Universal Orlando®"**

The program content is designed to provide value to conference participants and their companies by focusing on important topics of the day. Colocation, energy efficiency, and IT stack optimization are highlighted at this year's Spring event.

I look forward to seeing you at the Spring Conference in Orlando, Florida!

Sincerely,

Bob


*In keeping with its commitment to social responsibility, 7x24 Exchange donated $10,000 to the Wounded Warrior Project in honor of its 25th Anniversary. From left to right: Bob Cassiliano, John Jackson, Frank Gialanella, Paul Fox, Dennis Cronin & Kelly Vitolo.*

# UPS SOLUTIONS FOR A WORLD THAT NEVER SLEEPS

**The industry's most complete portfolio of UPS batteries.**

As the global leader in stored energy solutions, EnerSys® provides a comprehensive range of batteries for Uninterruptible Power Supply (UPS) applications.

From flooded and Absorbed Glass Mat (AGM) batteries, to Thin Plate Pure Lead (TPPL) solutions, you'll find chemistries and the products you need to meet your unique UPS needs.

Plus, with large manufacturing plants across Asia, Europe and North and South America, you benefit from strong global sales and support, supply reliability and world-leading technology.

For more information, visit **www.enersys.com**.

Power/Full Solutions

©2013 EnerSys. All rights reserved. Trademarks and logos are the property of EnerSys and its affiliates unless otherwise noted.
Subject to revision without prior notice. E.&O.E.

https://www.youtube.com/watch?v=KtFtnXBz2gg

by **Juli Ierulli**

# DEVELOPING HEALTHCARE DATA CENTERS WITH ENERGY EFFICIENCY IN MIND

As long as technology trends like big data and advanced communications continue to rise, companies will likely place more emphasis on data centers. Whether that means cloud computing, collocation or new data center construction, it's something companies must answer individually as each option has its benefits. There isn't a one-size-fits-all when it comes to data systems because no two situations are exactly the same.

While some companies are shifting toward cloud or collaborative data storage strategies, others are still looking to build data centers from the ground up. According to a leading research company, the global construction market, including IT and healthcare data centers in the collocation, telecom and enterprise segments, will grow from $14.59 billion in 2014 to $22.73 billion by 2019. Absolute control of the planning, designing and building processes is by far the biggest advantage of data center ownership, and for some companies, it remains a necessity.


St. Alexius
Technology & Education Center
PrimeCare

**The considerable amount of information generated by healthcare providers—including medical results, comprehensive health records, private communications, administrative data and research—needs to be stored in a place that's not only secure but also reliable. As a result, some healthcare organization leaders are opting to build and manage their own data centers.**

## HEALTHCARE DATA CENTERS

Hospitals are also seeking more advanced data storage options as a way to comply with recent changes in legislation. Under the Affordable Care Act, all healthcare providers must convert their medical records to an electronic format, making data center investment more attractive. Additionally, the Health Insurance Portability and Accountability Act currently mandates revised security practices for medical recordkeeping, which also impacts the way healthcare data is stored.

One hospital has furthered its vision of providing excellence in healthcare by weaving state-of-the-art efficiencies into its new data center facility. CHI St. Alexius Health is a one million square-foot acute care medical center located in downtown Bismarck, North Dakota. The 306-bed facility offers a full line of inpatient and outpatient medical services, including primary and specialty physician clinics, home health, and hospice services, to the residents of central and western North Dakota, northern South Dakota, eastern Montana and even Canada.

Founded in 1885, CHI St. Alexius Health began as a small hospital that operated from within a converted hotel building. Today, the medical center supports a large network of facilities, including more than 30 locations. While the hospital has been expanding continuously over the last 130 years to accommodate more patients and improve healthcare services, its latest growth phase included designing and building the Technology and Education Center.

"Some of our clinics and affiliations are up to 100 miles away, so CHI St. Alexius Health is more of a network of hospitals, and our main campus acts as the mothership," said Doug Johanson, director of facilities at CHI St. Alexius Health. "There are a lot of things happening to support the data side here, and not just for our onsite needs. For example, a patient can get his X-ray or MRI read remotely from home or sent to a local hospital, if needed. So, the activities we do here are very important as they affect our whole network."

## DESIGN CONSIDERATIONS

Mission critical facility managers looking to build and operate a data center should consider a number of factors beginning with location. While data centers can operate from almost anywhere, it's ideal to choose an area that avoids high-traffic zones, like airports or highways, and protects against natural disasters and accidents, like floods or chemical spills. Reliable power, infrastructure, access to water sources, maintenance points and future growth are other areas of consideration for a thorough design.

To offset administration space and relocate its IT department, CHI St. Alexius Health built the 100,000 square-foot Technology and



Education Center adjacent to the hospital's main campus. The new building, which can withstand a Category 5 tornado, includes a new server room and data center, a customized standby power generation system, the IT department, administrative offices and a clinical research area.

"When designing the Tech and Ed Center, we put a lot of thought into energy efficiency. We looked at power systems, chill beams, rack coolers, heat pumps and other features, but we also implemented ways to recover as much of that energy as we could," explained Johanson. "We're using the waste heat from IT to heat the building, which cuts energy load tremendously. It's working better than expected as it only costs 40 percent of what it takes to heat the main campus."

The new facility is built with a variety of energy efficiencies to help cut costs, improve sustainability and reduce environmental impact. In fact, the new building costs $1.48 per square foot in energy each year compared to $2.84 per square foot at the main campus. To achieve this, the hospital implemented an effective energy strategy.

## ENERGY EFFICIENCIES

The latest industry trends indicate system efficiency is the top priority when it comes to building data centers. Companies are applying energy-conscious design strategies to eliminate as much waste as possible. No detail is too small as building materials, storage components, heating, use of space, maintenance needs, security, wire routing, cooling systems, piping and even elevators are thoroughly considered.

CHI St. Alexius Health worked with the local Cat® dealer, Butler Machinery, to design a customized backup power system including six Cat C15 500 kW standby diesel generator sets with Cat Engine Paralleling and Integration Controls (EPIC), and two Cat Flywheel Uninterruptible Power Supply (UPS). Three custom enclosures were designed with two generator sets each, arranged side by side, to overcome space constraints and ease of maintenance concerns.

"A reliable standby power system is crucial to CHI St. Alexius Health. It serves our administrative offices, financial department and most importantly, our data center," explained Johanson. "We worked closely with Butler Machinery to design a fully integrated system, and we ended up with an intricate setup that utilizes multiple flywheels, several generator sets, and an A and B electrical feed, so we're never without power."

Butler Machinery aligned with the long-term vision at the hospital by providing a cost-effective solution that maintains quality. Capable of accepting 100 percent rated load in a single step, the C15 engines offer proven performance and optimized fuel economy. The remote-mounted EPIC system eliminates the need for traditional hard-wired components and manages the generator sets while seamlessly directing power through the distribution switchgear. Providing constant power protection, the flywheel UPS insulates the generator sets from transient and block loads, and provides operating efficiencies that exceed traditional battery-type UPS.

> We're not looking 10 or 20 years down the road. We're planning for the next 100 years, which is reflected in the way we designed...

Beyond the power system, the hospital also incorporated advanced energy efficiencies into the Technology and Education Center infrastructure. These features include:

- GEOTHERMAL SYSTEM – Heat generated by the data center is used to heat the building with a geothermal recovery design. A pump pulls water from 302 underground wells, which flows through pipes around the building. Waste heat from the data center increases the water temperature and then distributes warmth to other parts of the building. The process is reversed in the summer to cool the facility, making it a very efficient and cost-effective feature.
- CHILLED BEAMS – Heat/cool coil units, or chilled beams, take outside air with recovery reels to regulate temperature in the building. Only one air handling unit is required to support the new facility compared to the 13 units needed to manage the main campus, thus reducing duct work,



decreasing space requirements and improving efficiency.

- RECYCLABLE PIPING – Aquatherm, a lightweight, self-insulated plastic pipe, is fitted throughout the entire building. The plastic does not break down like other materials, preventing leaks and corrosive particles, which helps reduce maintenance costs and environmental impact.

- ELEVATORS – Variable-speed drives charge the elevator as it goes down, and then uses the generated energy on the way back up to reduce power needs. A regular elevator uses 75 percent more energy than the new system, and because no heat is generated, the elevator cab doesn't have to be cooled.

"We've always tried to be innovators, and I think the combination of technologies we've implemented is something that's unique to the Tech and Ed Center," said Johanson. "We want this building to last 100 years, so we took a detailed approach for designing a full package to achieve ultimate energy efficiency. The energy costs we save here can be spent improving healthcare and comfort for our patients, and that's our biggest priority."

## LOOKING AHEAD

To maintain data center sustainability, project managers should plan for future growth, which helps avoid additional building costs down the road and provides the necessary foundation for achieving the ultimate build out. Additionally, service support plays a large role in managing and maintaining the data center system, especially as unexpected needs may arise. Choosing partners that bring value beyond the installation and testing phases can help project leaders get the most from their system designs.

CHI St. Alexius Health designed the Technology and Education Center with expansion opportunities in mind. The server room has the potential to triple in size as data storage needs increase, and the standby power system design includes space for a fourth generator set enclosure to accommodate future power requirements.

"We're not looking 10 or 20 years down the road. We're planning for the next 100 years, which is reflected in the way we designed Tech and Ed," explained Johanson. "Every department has the ability to grow, and we have to be ready, so we can continue to improve the patient experience, support our medical staff and increase overall efficiency."

Butler Machinery helps CHI St. Alexius Health manage not only its new standby system at the Technology and Education Center, but also the other five Cat engines used to power its main campus facility, same-day surgery center and patient financial service area. Butler's engineers and technicians make themselves available 24/7 for maintenance, parts support, training and emergency situations to ensure the hospital has power at all times.

"It's hard to find a supplier that has the technology, flexibility and engineering knowledge to support what we wanted to do here," added Johanson. "With Butler Machinery's help, we were able to build a one-of-a-kind facility that's supported by a reliable standby system. Our relationship with Butler is more of a partnership, and we plan to continue working together. In fact, we're already working on a new energy project to bring full redundancy and backup power to the main campus."

*Juli Ierulli is Marketing Communications Manager at Caterpillar, Inc. She can be reached at ierulli_juli@cat.com*


Wavestar® RPP PowerHub® PDU Wavestar® PowerPak PDU Wavestar® STS JCOMM® BCMS Retrofit

# Transform. Distribute. Monitor. Protect.

*A Full Spectrum of High Quality Power Products*
*...Integrated to Your Specifications*

To learn more visit us at: ***www.pdicorp.com*** or contact us at: ***800.225.4838***

PDI ONYX PolyPhaser TRANSTECTOR

smiths power

# CLOUD COMPUTING:

## WHAT'S ON THE OTHER SIDE OF THE CLOUD?

by **Sev Onyshkevych**

It's everywhere you turn, and the term is talked about by every IT manager, analyst or reporter. We're talking about cloud computing. With the skyrocketing amount of stored data and the vast number of connected devices – it's no wonder hosted applications and infrastructures are becoming the cornerstone of global data strategies.

It's estimated that nearly five exabytes of data are created each and every day and the volume of data doubles every 40 months – each day, that's enough data to fill 100 billion filing cabinets full of text, and that number will grow! Case in point: companies such as Walmart regularly collect 2.5 petabytes every hour, enough to fill 50 million typical filing cabinets.

When data reaches petabytes, if not exabyte levels, the cloud becomes an attractive and often cost-effective choice for handling this volume of data. But do we really know what the cloud is, in real life?

This is how PC Magazine describes cloud computing: "In a big business, you may know all there is


# IT'S YOUR ENVIRONMENT. TAKE CONTROL OF IT WITH BUILDING ENVELOPE SOLUTIONS FROM SIKA.

**Data and Communication Centers** that house expensive high-tech equipment and remain operational 24/7 need a high performance building "envelope" that provides unyielding protection from the elements. SikaSmart from Sika is designed to protect every portion of your building's outer structure against water intrusion and weathering—from roof and exterior walls to basement. These problems often result in costly maintenance and repair, increased energy costs, poor indoor air quality—even a shortened lifespan for the building itself.

Visit **www.sikausa.com** to learn how SikaSmart building envelope solutions can protect your building and your sophisticated electronics.

**SIKA CORPORATION**
Phone: 201-933-8800
www.sikausa.com

SikaSmart™
EXPERT SOLUTIONS
FOR THE BUILDING ENVELOPE

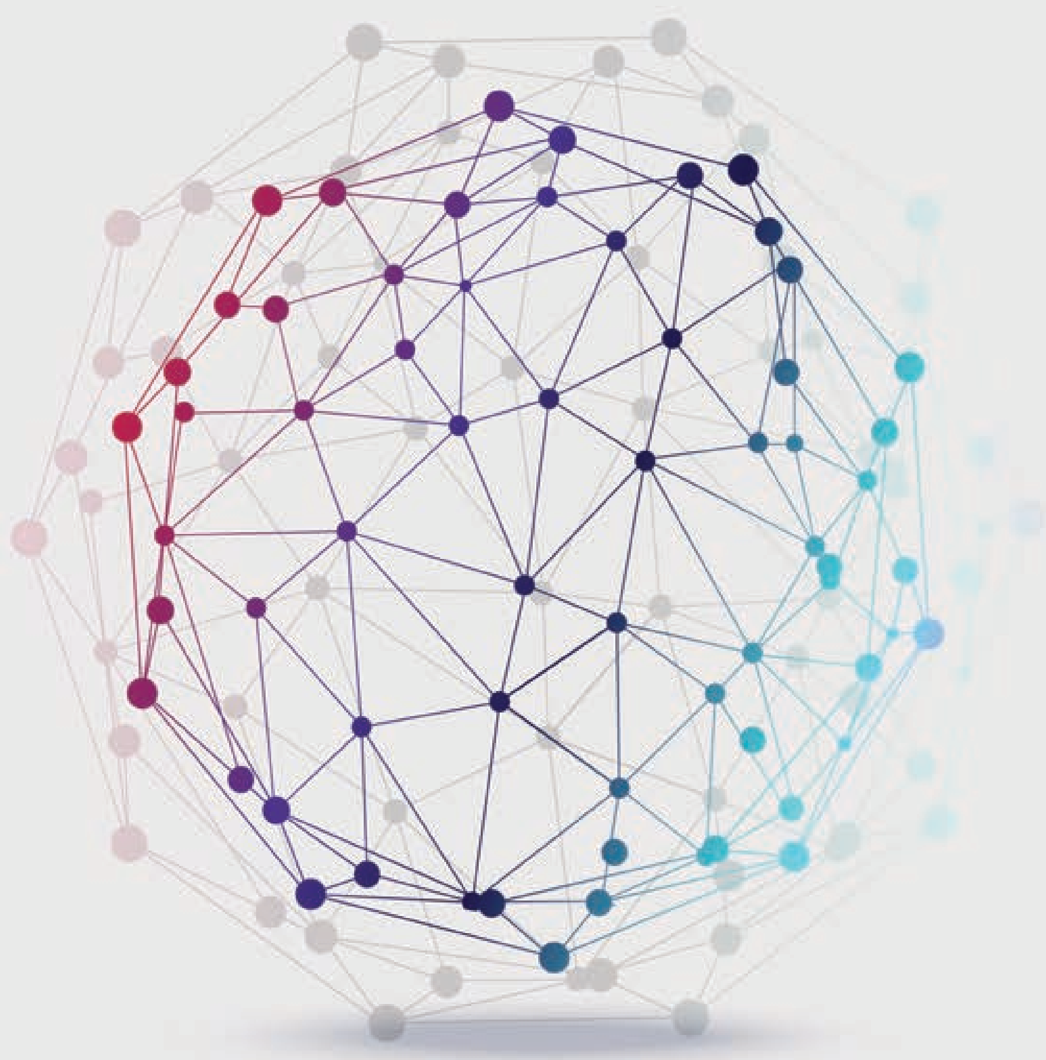
BUILDING TRUST

Sika®

SYSKA HENNESSY
GROUP

# What if

we can connect your world and
keep it that way
What would you do with your newfound free time?



While everyone else designs systems, we design peace-of-mind. We provide more 'you-time' and less time worrying about your data center's well-being.

Talk to us about your needs. Is your priority speed-to-market? Is it security? Uptime? Let us know how we can help and find out why we are ranked as the top data center design firm by ENR.

www.syska.com Consult + Engineer + Commission T: 800.328.1600

to know about what's on the other side of the connection; as an individual user, you may never have an idea of what kind of massive data processing is happening on the other end. The end result is the same: with an online connection, cloud computing can be done anywhere, anytime."

Oftentimes, when talking about "the cloud" people will actually look up into the sky, as if "the cloud" is an ethereal, non-physical entity. In reality, there is no single "cloud" – there are many clouds, both private and public, and behind each cloud, there is substantial physical infrastructure. To process, store and provide data access, the ubiquitous clouds utilize the same type of data center infrastructure as found in most companies, i.e., rack-mounted servers, switches, storage devices, firewalls, load balancing and a host of operating systems and security software. As the OPEX and CAPEX benefits of leveraging the cloud, and the economies of hyperscale become clear, investments in the infrastructure increase.

IDC supports this expansion theory: "The move to cloud computing is driving significant spending on data center hardware to support businesses' private cloud initiatives… IDC also forecasts that server hardware revenue for public cloud computing will grow from $582 million in 2009 to $718 million in 2014, and server hardware revenue for the larger private cloud market will grow from $2.6 billion to $5.7 billion in the same period."

Taking this one step further, data centers must also be supported by a comprehensive power infrastructure with several layers of hardware redundancy. This means massive amounts of electricity are consumed by the data processing infrastructure (servers, switches, storage) as well as facility-related equipment such as CRAE/CRAC units, and the power distribution and backup infrastructure.

Energy is the biggest expense associated with the cloud's IT infrastructure. To keep business-critical information always available and reliable, cloud data centers must operate 24/7/365 with no downtime – requiring consistent and enormous amounts of power consumption. To put this into perspective, worldwide data centers consume 30 billion watts of electricity – or enough to run 30 nuclear power plants. And based on the NRDC data center efficiency assessment: "In 2013, U.S. data centers consumed an estimated 91 billion kilowatt-hours of electricity — enough electricity to power all the households in New York City twice over — and are on-track to reach 140 billion kilowatt-hours by 2020, the equivalent annual output of 50 power plants, costing American businesses $13 billion annually in electricity bills and emitting nearly 100 million metric tons of carbon pollution per year." Now that the fog has lifted and the cloud's physical infrastructure and power consumption are exposed, another question arises: How do these facility operators manage and optimize these massive data centers? To gain operational and environmental insight many managers are leveraging Data Center Infrastructure Management (DCIM) software. DCIM is the unification of disjointed IT and facility-related data into a single informational source. The single-source view provides a holistic dashboard of data center performance – displaying energy consumption and environmental temperatures for optimization, capacity planning and alerts to potential downtime.

DCIM brings an added level of operational insight that helps IT and facility managers understand the interconnected relationship between facility equipment and IT racked-devices. This understanding is the result of energy monitoring sensors and software capable of tapping into a Building Management System (BMS) or Building Automation System (BAS), as well as directly into various pieces of infrastructure, sensors, Power Distribution Units, branch circuit monitors, power strips, even servers, to accurately aggregate and analyze Power Usage

Effectiveness (PUE) and cooling system energy efficiency.

## THE BENEFITS OF USING DCIM ARE REPLICATING THROUGH THE MARKET:

- 451 Research estimates total supplier revenue for the DCIM market will hit $1.8 billion by 2015.
- According to Gartner estimates, DCIM tools can reduce operating expenses by as much as 20 percent and extend the life of a data center by as much as five years.
- Other analysts note – for every degree Celsius infrastructure temperature is raised – DCIM creates a 4 percent savings on average for the typical energy bill.

Perhaps the biggest impact of a DCIM system is its ability to create a highly resilient infrastructure that helps mitigate the risks of downtime, without the CAPEX of creating two infrastructures. It removes the standard practice of having one backup piece of equipment for every primary component — a costly and highly inefficient strategy because it requires duplicate circuits, PDUs, UPS elements and generators.

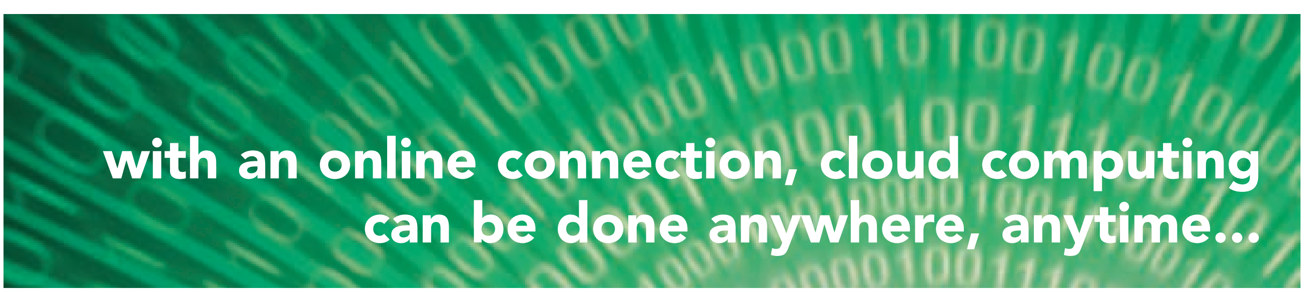
## A STRONG DCIM TOOL HELPS:

- Ensure a resilient environment by empowering managers to make real-time inquiries about capacity, and view the impact of "what-if" scenarios to strengthen vulnerable areas.
- Managers become proactive through alarm and alert functions to prevent potential failures through real-time network modifications.
- Create strategies for sustaining greater workloads, while offering trend analysis to stimulate proactivity.
- Pinpoint peak demand and identify when computing power might be less expensive.

## SIMPLY PUT:

DCIM is a solution with robust analytics, easy-to-read reports and dashboards that empower facility managers to make critical business decisions in real-time. The more data points they have at their fingertips, the faster managers can make time and money-saving decisions.

Once the understanding of how the cloud works becomes clearer, it's easier to see that its operational infrastructure is the same as many large enterprise data centers. However, unlike traditional enterprise data centers, the cloud has countless organizations who are stakeholders within its processing output. Therefore, it becomes even more critical for these cloud providers to ensure the integrity of their services through IT innovation and DCIM-enabled resiliency.




*Sev Onyshkevych is the Chief Marketing Officer for FieldView Solutions, Inc. He can be reached at Sev@fieldviewsolutions.com*


# We are proud to sponsor the 7X24 Exchange

WHITING-TURNER

*Leaders in Mission Critical Construction*
*Delivering Innovative Solutions Securely*

Greg Botteon
Mission Critical Coordinator
greg.botteon@whiting-turner.com
410-337-6912

Offices Nationwide
www.whiting-turner.com


# BUYER

As industries mature, they tend to adopt standards. These are typically best practices that have been formally agreed upon that provide customers with a level of assurance that the product they are purchasing meets a prescribed level of measurement for performance, safe operations, etc. Customers rely on standards as a method of performing comparative analysis on competing suppliers. By providing a common method of comparison, standards help insulate customers from the need to make their decisions solely on the basis of the claims of a provider.

Over the years, the data center industry has formally, or in a de facto sense, implemented a variety of standards such as ASHRAE TC 9.9, or the Green Grid's PUE. Unfortunately, as in many industries, there comes a point when a standard just isn't enough – that's when a third party certification gets introduced. You see there is just too much temptation for certain folks to make claims on "standard" compliance when they know that they don't strictly meet the standard at hand. When evaluating data center providers, customers often have to navigate between what is real and a vendor's standard-inspired puffery.

## MORE THAN A VENDOR'S CLAIMS

A prime example of the "phantom" application of a standard can be found with the Tier system originally developed by the Uptime Institute in collaboration with dozens of large enterprise users. Comprised of four (4) escalating "Tiers" that prescribed the physical componentry required to deliver specific levels of mechanical and electrical reliability, the system became recognized as the de facto standard for reliable data center design. Despite the broad acceptance of the standard, few data center providers have elected to have their designs and facilities actually certified by the Institute itself. This avoidance on the part of providers to actually having their claims validated by the developer of the specification itself is, while perhaps not malicious, a misrepresentation to prospective customers as to their facility's fealty to the standard—or any standard for that matter.

In recent years, this "drive-by" approach to the Uptime Institute's (UI) Tier standard has been exacerbated by the penchant of many data center providers to label their designs with the designation of "Tier +". These self-proclamations diminish the value of the standard itself by demoting it from a recognized reference point to a mere guideline that is open to liberal interpretation. By severing the link between structure and performance, this mode of casual compliance removes the customer's ability to make their data center decision based on prescribed norms and forces them to rely only on the assertions of potential providers. The gravity of this situation becomes apparent when we consider that only 21 US facilities (as of March 2015), out of an estimated universe of over 3000 MTDC's in the US per 451 Research, have received any form of Tier III review and acceptance by UI. As a result, there are countless numbers of companies whose mission critical applications are supported by data centers whose reliability is, shall we say, undocumented.

The issue of UI Tier certification becomes even murkier when the number of "Constructed Certified" data centers is compared to those that have achieved design certification. As you may expect, a certified data center design means that UI has reviewed the plans for the new facility and verified that they represent a Tier-certified data center on paper. Unfortunately, what looked good on paper isn't always what is actually built. In fact of the 21 design certified data centers for the US listed on UI's website only 12 have also been constructed certified. What happened between the drawing and final construction on the other nine is anyone's guess, but the customer did not receive what they paid for. Due to these discrepancies between drawings and delivery, end users must insist that their provider obtain UI constructed certification to ensure that their data center actually meets the specifications necessary to support their mission critical operations. You can verify for yourself at uptimeinstitute.com.

This same level of compliant "non-compliance" can also be found in



# BEWARE

by **Chris Crosby**

relation to many providers' sustainability claims in which "built to LEED standards" has replaced actual certification. Once again this failure on the part of providers to validate their own claims negatively impacts the customers they wish to serve. By failing to provide objective evidence of their adherence to the documented standard they weaken the foundation upon which their prospective customers seek to make their decision. Your can verify a provider's LEED assertions at http://www.usgbc.org.

## MY DATA CENTER IS FULLY TESTED—ISN'T IT?

Commissioning is a multi-staged process that is designed to ensure that a data center operates as designed. Unfortunately, commissioning is often viewed as a "would be nice to have" event. However, if we compare commissioning to test flying a new aircraft for the first time, it is easy to see that obtaining space in a fully commissioned facility is a customer's best protection against catastrophic and costly site outages.

Commissioning consists of five levels, with levels four and five being the most important for our discussion here. Level 4 commissioning consists of fully testing each component of the data center's equipment to ensure that each piece operates as required. Level 5 commissioning is the essential component of the commissioning process since all of the site's systems are tested on an integrated basis at both peak loads and in a variety of failure scenarios to ensure that all of the data center's systems work as designed. As we shall see, the most critical aspect of Level 5 commissioning is ensuring that the site is able to surmount critical failures, such as a power outage, to maintain the operations necessary to support a mission critical environment.

The functional design of a data center is intricately intertwined with its ability to complete the full five levels of the commissioning process. Many data center alternatives use a single MEP backplane. Analogous to a power strip, each new data center is "plugged into" the backplane as it is added. Although commonly used, architectural designs with "future growth phases" based on this concept can only complete the first four levels of the commissioning process. This is due to the fact that, just as when the power is turned off to the power strip, the failure mode scenarios required in Level 5 cannot be performed since turning off the power brings down all of the attached data centers during expansion.

The other alternative in backplane design is to use discrete backplanes for each data center. In this structure each data center operates independently from its companions. As a result, new data centers can be fully Level 5 commissioned since simulating a power failure for testing does not negatively impact any existing data hall. Thus, the backplane structure of a data center solution determines its ability to undergo a complete commissioning process when expansion is necessary. This is one of the potential hazards of "modular" building in large shared environments – you cannot level 5 test future phases within the existing live environment.

Failure to complete a full Level 5 commissioning process is analogous to purchasing a product that is only 90% complete. Operating your new facility on faith is akin to flying in that untested airplane. Sure, it may fly, but wouldn't you feel better knowing that it would before you boarded?

## HOT WORK

In many instances, standards provide insurance for both the customer and the site's operations personnel. Over the past few years, the intense need to maximize the uptime of a facility has been used by many providers to justify an increasing level of "hot work". This means that many operations that would normally be performed in a non-powered environment are now done on live components. These actions are both dangerous and against the law.

One of the most common by-products of these instances where work is performed on energized equipment is a phenomenon referred to as arc flash. The National Institute of Occupational Safety and Health (NIOSH) defines arc flash as "the sudden release of electrical energy through the air when a high voltage gap exists and there is breakdown between conductors". The results can be absolutely catastrophic with the production of enormous pressure, sound, light and heat. For those unfortunate enough to be anywhere near an arc flash they can see heat reach 35,000 degrees—four times hotter than the sun's surface. Those same workers can also be exposed to molten shrapnel, and burns, vision and hearing loss can be common physical results of the aftermath.

From an architectural perspective, the increase of phased, multi-tier modular data centers with shared components such as switchgear, paralleling gear and distribution boards, has increased the risk of arc flash due to the adding of equipment to a live (energized) backplane. This issue is exacerbated by the high cost of downtime that increasingly has generated a desire on the part of facility's operators to make changes or modifications without "shutting anything down". From a legal perspective, regulation has outlawed "business reasons" as a valid excuse for live work. Thus, more work is performed in a live environment than can safely be justified, with the line between troubleshooting and actual maintenance in a live environment becoming increasingly blurred.

Both the National Electrical Code, and the National Fire Prevention Association (NFPA) in their 70E standard have defined guidelines to prevent incidents of arc flash. From the prospective of a data center customer, most providers will not proactively provide information as to whether actions like common equipment maintenance are performed on energized equipment. Lack of required labeling for arc flash regulations should alert prospective buyers to providers who are not compliant with the latest policies for health and safety. Ultimately, per NIOSH, "The organization has a responsibility in preventing arc flash injuries… Organizations have the duty to provide appropriate tools, personal protective equipment, and regular maintenance of equipment and training. A commitment to training is a commitment to safety". Unfortunately, in too many instances, it is still up to the customer to make these inquiries to ensure the health and well-being of site personnel are factored into their operating procedures.

## ALL THE POWER YOU NEED…UNTIL YOU NEED IT

Although oversubscribing on power isn't subject to any documented standard, it is a common practice of many providers that end users must be aware of. Unless capacity is added, the power load of a data center is fixed. For end users in shared colocation facilities this means that the site's power is apportioned between the end user and the other firms with data centers within the facility. Realizing that not every end user is operating at peak capacity, many providers use a practice referred to as "oversubscription" when contracting with their end users for power. In the early days of the wholesale data center space, users could be certain that oversubscription was not in place. In those days, only retail providers oversold power capacity. More recently, as wholesale and retail lines have blurred, customers that are contractually buying a certain amount of kW capacity should take extra steps to ensure that their capacity is NOT oversold.

In an oversubscribed situation the provider's guarantee for the power contracted for by the end user is based on the knowledge that, very often, not every end user is operating a peak capacity. Thus, the peak use of one is offset by the less intensive use by others within the facility. Unfortunately, in an oversubscribed mode, power becomes a scarce commodity as the intensity of use for one of more tenants increases and ultimately leads to the provider being unable to deliver on the level of power contracted for. Additionally, in multi megawatt facilities, the core issue has to do with how this oversubscription is managed. This is often a labor intensive effort with many opportunities for human error. Prospective colocation customers should always understand a potential provider's power policies before entering into an agreement.

This pattern of devolution from industry standards places a greater burden on today's data center customers. Failure to ask for, and receive, objective evidence of a provider's adherence to the standards that underlie their performance claims places the customer in the position of having to make their decision based more on the sizzle rather than the steak. Caveat Emptor (let the buyer beware) was the advice of the ancient Greek's to wary prospective customers, in the world of data center standards compliance; it's still good advice.

*Chris Crosby is the Founder and CEO of Compass Datacenters. He can be reached at ccrosby@compassdatacenters.com*

# STULZ Knows Data Centers!

With over **20 years** of experience building **outdoor air handlers** for mission critical applications, the STULZ team is uniquely qualified to provide the most reliable, energy efficient cooling solution, customized for the specific application.

## Ask us about an Air Handler configuration for your specific application today!

- Indirect Evaporative
- Direct Evaporative
- Traditional DX & Chilled Water
- Packaged Rooftop
- Modular Data Center Cooling

Email us: info@stulz-ats.com • Call us: (301) 620-2033 • See our products: www.STULZ.com

STULZ®

| Outdoor Cooling | | Indoor Cooling | | | Retrofit & Conditioning | | |
|---|---|---|---|---|---|---|---|
| Modular Container | Air Handler | Ceiling | Row | Perimeter | Humidification | EC Fan Retrofit | Replacement |

# CONTROL ROOM COLLABORATION TOOLS – GOING BEYOND SYSTEM HARDWARE

by **Destiny Heimbecker**

Today's control room is a direct reflection of the advances being made in information technology and mobile devices. With an ever increasing number of video and data sources available, efficient collaboration and decision-making is only possible if operators and key stakeholders have easy and timely access to this information. For this reason, when designing a modern control room, collaboration software is now as important as the screens on which the data is being viewed.

Control rooms historically include an array of large format displays driven by a display wall processor that accepts inputs from a variety of sources, including desktop computers, broadcast, and security videos. There are, however, flaws with this traditional configuration and the technologies used to create it. The number one issue being that all of the information is displayed on only one location, which means that anyone not physically present in the control room cannot view the information and therefore act upon it. In other words, the very strength of the traditional control room can also be its weakness. Decision makers need to have access to the critical tools that enable effective collaboration —such as the ability to create, combine, and share various user perspectives of data, images, and video. This means presenting information wherever it is needed —not only on the control room's display wall and operator workstations, but outside the control room as well. This means that the information can be viewed in crisis rooms, meeting rooms, even outside of the building, which literally means that it can be viewed by the applicable people around the world — wherever decisions need to be made. Collaboration software tools are the game changer in this industry as they offer the ability to push content from the control room to an adjacent war room, share content between operator screens, provide content collaboration on the main wall, or even share content with remote desktops and mobile devices. The control room is no longer constrained to a single location.

One example of this collaborative control center design is the Southeastern Pennsylvania Transportation Authority. When it was time to upgrade its visualization platform with a grant from the U.S. Office of Homeland Security, the Southeastern Pennsylvania Transportation Authority (SEPTA) had a long list of demands: enhance real-time situational awareness, boost system reliability, and facilitate communication among all of its stakeholders. Eight display walls are networked throughout the facility, centralizing all information while providing the ability for operators to share sources on any and all displays operators can launch visuals from multiple desktops to create, save, and recall layouts on the spot. Utilizing Barco's control room and management suite collaboration is enhanced between operators, managers, and other personnel, featuring an intuitive and easy-to-use sidebar utility. By bringing every operating system into the command center, SEPTA can now view activity on all of the region's subways, railroads, buses, and trolleys, while connecting with law enforcement and media channels.

Ron Hopkins, Assistant General Manager of Operations at SEPTA said, "The seamless screens give us much more flexibility in how we manage video, so we can capture and display any feed or image to create a common operational picture. This is especially useful when a crisis arises and we need to coordinate with other agencies." Ron added, "It's proven its value many times already during inclement weather, equipment breakdowns, and service outages, giving us the information we need to quickly react and effectively remedy situations."

Security is another industry, among many, that relies heavily on an efficient control room to achieve its goals. A security operations center (SOC) is a centralized unit in an organization that deals with security issues, on an organizational and technical level. A SOC within a building or facility is a central location from where staff supervises the site, using data processing technology. Typically, it is equipped for access monitoring, and controlling of video, lighting, and often, alarms, and can monitor activity at all campus facilities, including camera and remote access controls for doors and gates. The role of the SOC continues to evolve over times and as events escalate beyond the operations center, virtual operators are being brought on board to deal with higher-level security events. By adding this new virtual element, the SOC becomes dependent on the people who are called upon to staff it in times of crisis or need, as well as on the tools and technology that will provide visibility into incidents and that will help lead to quicker incident resolution. Operators may be on the scene of the crisis, reporting information via mobile videoconferencing, which is being shared via war room back at the hub. Another virtual operator being utilized by the SOC of today is social media. Mobile connectivity to the control room allows for sharing of pertinent information about the current state of security incidents and assist peers in mitigating attacks. Companies will further benefit from heightened situational awareness, improved visibility, and access to a vast knowledge base.

Utility companies are also leaning on network collaboration to increase their level of communication. As the sole electric utility for the island of Bermuda, Bermuda Electric Light Company (BELCO), is responsible for monitoring and managing electricity generation and delivery to 36,000 metered connections throughout a 21-square-mile area. The video wall displays a highly-detailed, wide-area view of the island's power grid, providing real-time data and video on power usage and availability across numerous workstations in the operations center — an especially critical capability during hurricane season and other high-alert weather periods. The greatest benefit of the new video wall system is its information-sharing capability, which enables managers, operators and customer service staff to simultaneously view real-time supervisory control and data acquisition (SCADA) information throughout their computer network. Another example of collaboration in a utility company is through PPL, an energy company headquartered in Allentown, Pennsylvania. The company currently delivers electricity to 1.4 million customers in Pennsylvania. PPL wanted the ability to bring real-time data from their OSIsoft® PI System®, which lived on a separate server from the rest of the control room.They were able to work with their technology integrator to create the firewall technology they needed to bridge the servers and allow their operators to view a wealth of additional data that was not available to them before. This has become an invaluable asset to their operators in assisting with situational awareness.

This media-driven age calls for a paradigm shift in control room operations. The optimum control room solution features an"any source, anywhere" networked visualization platform that can handle unlimited inputs and outputs to deal with the abundance of data and enable collaborative decision-making across multiple functions and geographies. This means presenting information wherever it is needed — not only on the control room's display wall and operator workstations, but outside the control room as well. Today's control room design must think beyond the hardware to access the critical that enable effective collaboration and the ability to create, combine, and share various user perspectives of data, images, and video at any given moment.

---

*Destiny Heimbecker is the Marketing Communications Coordinator at Vistacom Inc. He can be reached at dheimbecker@vistacominc.com*

# CO-OPERATIONS: INTEGRATING FACILITY OPS THROUGH COMMISSIONING

by **Brian Durham**

## INTRODUCTION

The process of commissioning is often viewed as validation of components and systems only. Done right, commissioning is a comprehensive integration process that includes not only the physical infrastructure but also the people who will operate the facility.

Data Center construction and operations are often managed by two of the organization's internal groups, often with different objectives. A design / build team has to be concerned with infrastructure requirements, schedule, and construction costs while facility operations is focused more on availability and operating expenditures.

All of the above are a part of the company's holistic objectives, although in the absence of common leadership or synergy between the groups, often the design / build objectives don't take into account those of facility operations.

Often missed during commissioning is the opportunity for facility operations to contribute and better understand sequences, consequences of outages, and other attributes of the infrastructure by participating in the full project lifecycle commissioning process. Missing this once-in-a-facility's-lifetime opportunity is an unfortunate and all too common occurrence.

## OPPORTUNITY ABOUNDS

There are a number of specific areas where operations stands to benefit from participating in commissioning, including:

- Sequence Optimization
- Equipment Familiarity
- Troubleshooting Techniques
- Resource Identification
- Cause and Effect Baseline Knowledge
- Continuous Improvement

Commissioning begins in earnest during the design phase with project requirements review and participation in commenting on the design itself. This is a great time to engage operations to provide initial input.

A critical aspect during this phase is the Sequence of Operations (SoO) development which will take into consideration the facility's operating obligations. Having operators comment on the SoO, and then subsequently participate in the validation testing, provides an important opportunity for the team to influence and truly understand the design basis of the facility.

The inner workings and nuances of equipment operation are never more accessible than during start-up and functional testing (commonly referred to as Levels 3 and 4 of the commissioning process). If planned properly, operators can be scheduled to participate in activities like chiller control checkouts, manipulating system flow, and electrical switching evolutions.

Once these components and systems are deemed operational and placed in service, the equipment is infrequently available for this type of hands-on manipulation. By including facility operations in testing, the operators stand to better understand the equipment for the purpose of maintenance evolutions, future problem identification, and troubleshooting during emergency situations. In instances where they have not experienced this level of familiarity, they are at a disadvantage and forced to be tentative when they are better served as decisive.

Speaking of troubleshooting, the commissioning process typically



# Critical Power Monitoring for Mission Critical Success.

**Introducing the new STARLINE® Critical Power Monitor (CPM).**

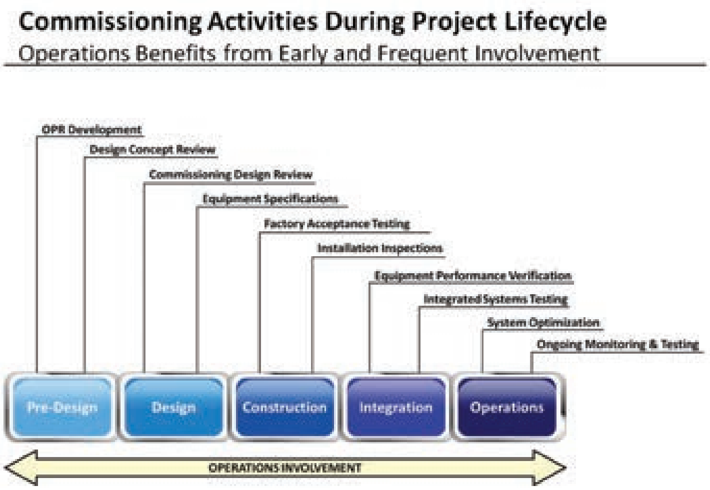
You want the best for your data center. When it comes to power distribution, STARLINE gives you the best in efficiency, reliability, and customization. Now the STARLINE CPM offers an enhanced monitoring package that will allow you to monitor, integrate and display more data center power information easily and reliably.

**The STARLINE CPM also features:**

- Revenue grade metering functionality
- Monitors multi-circuit configurations
- End feed and branch circuit models
- Display and non-display versions available
- Wired Ethernet and serial communications are standard, optional 802.11n Wi-Fi connectivity
- Ability to use both Modbus and SNMP protocols simultaneously
- Telnet and Modbus TCP/IP are also standard protocols

To learn more about how our CPM can help your data center or other mission critical installation, please visit www.StarlinePower.com.

STARLINE®
TRACK BUSWAY




involves some trial and error. The commissioning team often works with the design / construction / vendor team to troubleshoot issues throughout commissioning.

Operators who have exposure to this troubleshooting will benefit from a better understanding of the equipment, in addition to developing valuable historical knowledge of what has occurred prior to operation. Additionally, it is an opportunity for operations to start to develop processes for future troubleshooting.

Relationships are often built during the integration of a facility where members of the design, construction, commissioning and operations teams are all working together. This can be a stressful time but often the best resources from many corners of the team become evident during the process. Technical resources in equipment manufacturing organizations, start-up technicians, design professionals, and MEP coordinators all can prove valuable contacts to operations over the years to come.

One of the first steps in learning is recognizing what is normal and what is not. During functional testing commissioning teams stress the systems to baseline the performance and ensure that it works in a variety of expected operating conditions.

Component and system anomalies are expected during functional testing where equipment operation is often validated at design capacity. These anomalies are very revealing in demonstrating the consequences of failure. As a result, facility operators who have witnessed and participated in these evolutions are much better prepared to respond to issues once the facility is serving live traffic.

Participating in this phase provides the base of knowledge that facility operations will need for the development of emergency operating procedures. Having access to, and knowing how to perform these procedures can dramatically minimize the impact of outages.

In addition to improving notification and response time, monetary value is realized by making adjustments with an understanding of what is or is not a truly service affecting event. Examples of this include what spare parts are maintained on hand, how service agreements are established, and how sites are staffed.

Levels 4 and 5 commissioning are the beginning, but not the end of integration and optimization. Many data center owners encourage, if not expect, continuous improvement in this dynamic environment.

Improved reliability, energy conservation, and adoption of new technologies for efficiency gains are often a part of an operations team's objectives. Participating in commissioning provides operators with a base of knowledge that allows them to better recognize those opportunities for continuous improvement.

## CONCLUSION

Commissioning agents and data center design build departments should consistently encourage participation by facility operations with engagement beginning in the planning stages of their projects.

For this to be successful, facility operations teams have to make the time to participate in the process. Doing so requires support from the organization which is easily justifiable considering the significant payoffs.

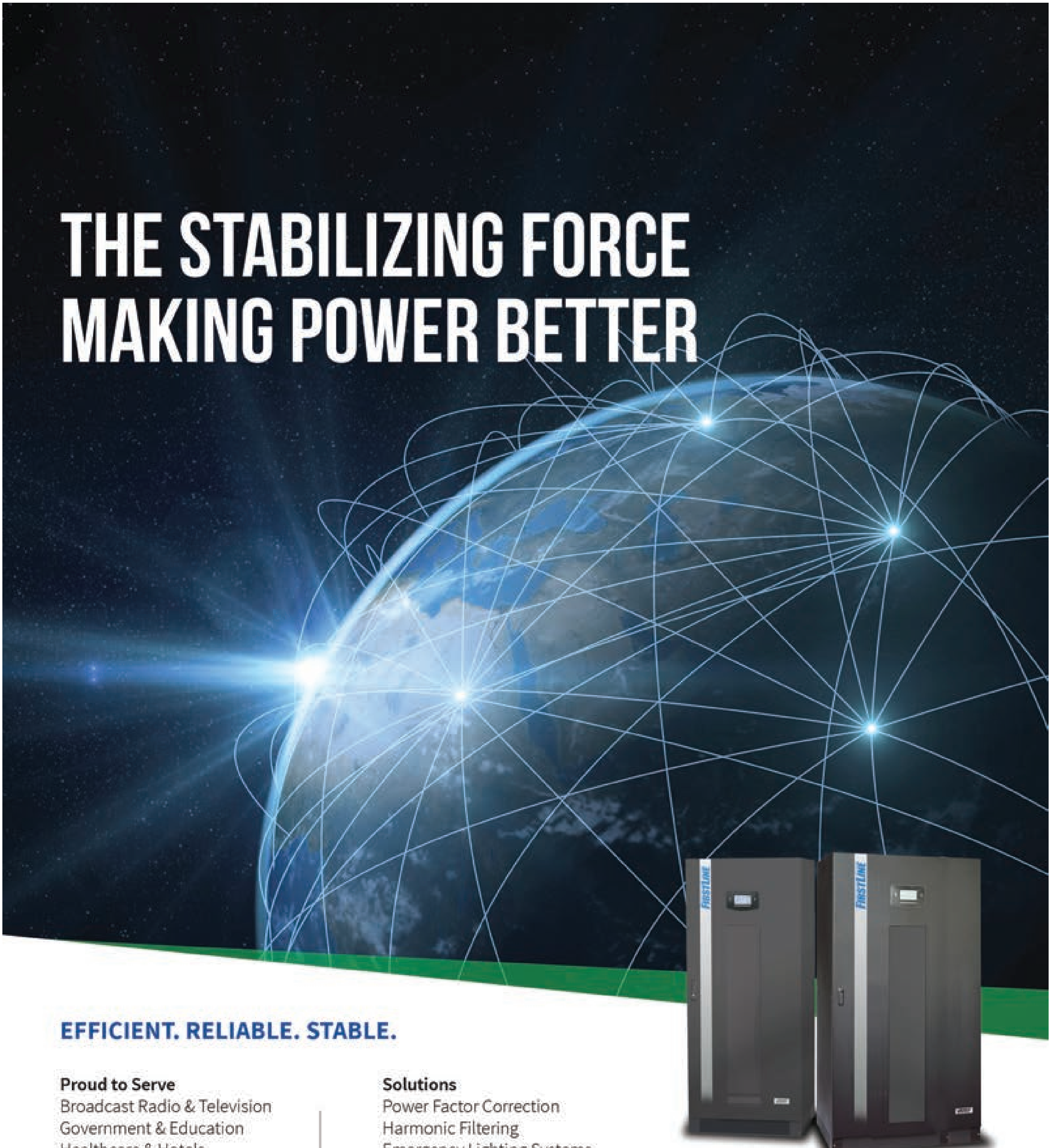
The majority of data center outages are the result of human error. A critical aspect of providing operations with the tools they need, begins with their active involvement in commissioning.

When integrated into the commissioning process, data center organizations consistently find their operations teams are more proactive in responding to abnormal or emergency situations and more effective in the day-to-day operation of the facility.

All of this is achievable with relatively little additional effort by simply defining the requirements up front and ensuring thorough planning.

*Brian Durham is the Vice President of Field Services for DLB Associates Consulting Engineers. He can be reached at BDurham@dlbassociates.com*

# THE STABILIZING FORCE MAKING POWER BETTER




**EFFICIENT. RELIABLE. STABLE.**

**Proud to Serve**
Broadcast Radio & Television
Government & Education
Healthcare & Hotels
Water Treatment
Manufacturing
Data Centers
Telecom
Oil & Gas

**Solutions**
Power Factor Correction
Harmonic Filtering
Emergency Lighting Systems
Frequency Conversion
Uninterruptible Power Systems
Voltage Regulation
Battery Monitoring
Power Conditioning

STACO ENERGY® PRODUCTS CO.

**WWW.STACOENERGY.COM**


by **Steve Fairfax**

Data centers are specialized critical facilities designed to house dense collections of computing equipment: servers, storage arrays, switches, routers, and related items. Data centers range from small room-sized facilities with a total electric load of some tens of kilowatts to very large, purpose-built facilities and campuses dissipating tens of megawatts. Conceptual designs and initial planning for 100 MW data centers are in progress.

Data centers typically incorporate a substantial collection of electric power and cooling equipment. Nearly all data centers are designed to supply continuous power and cooling[1] and incorporate combinations of redundant assets, standby equipment, and energy storage to achieve this goal. A typical large data center includes:

- Redundant electrical distribution systems supplying "dual cord" loads
- Dual cord computing equipment; so long as power is available on either cord, the equipment will operate. Normally power is provided to both cords.
- Standby diesel engine/generators and associated fuel stores
- Uninterruptible Power Supplies (UPS) and associated kinetic or electrochemical energy storage. UPS bridge the gap between loss of utility power and availability of power from standby generators.
- Redundant computer room air handlers
- Redundant water cooling towers and fans
- Looped water distribution piping designed to allow isolation and repair of damaged components while operating
- Redundant refrigeration assets (some modern data centers reduce or eliminate mechanical refrigeration)

The purpose of these complex, highly redundant systems is to increase the reliability of the data center. The owners and users of the facility expect it to operate even if the local electric utility experiences an outage, and during extremes of hot or cold weather.

## PRESENT DATA CENTER METRICS

Popular data center metrics include Power Utilization Effectiveness (PUE) and the Tier Classification system, a proprietary rating system developed and administered by the Uptime Institute in the early 1990s.

PUE is related to efficiency; it is the ratio of total data center electric load to the power consumed by computer equipment. Power to drive refrigeration units, fans, pumps, lights, and other non-computer loads increase PUE. A smaller PUE is considered more desirable; a PUE of 1 would seem to be the lower limit, but by reclaiming heat rejected by computer loads it is theoretically possible to operate facilities with PUEs less than 1.

The Tier classification system is a proprietary scoring method administered by the Uptime Institute and certain authorized parties. The Uptime Institute charges a fee to award a "Tier rating" to any facility.

The Tier system is primarily a measure of system redundancy, on a scale of Tier 1 to Tier 4. Tier 1 systems have limited redundancy but typically incorporate a UPS with a bypass path and a standby generator. Tier 2 systems incorporate redundant components, for example multiple UPS modules, chillers, and standby generators. If N units of each asset are required to serve the facility load, N+1 or more are provided.

Tier 3 facilities incorporate dual power and cooling pathways, and Tier 4 facilities provide still higher levels of redundancy.

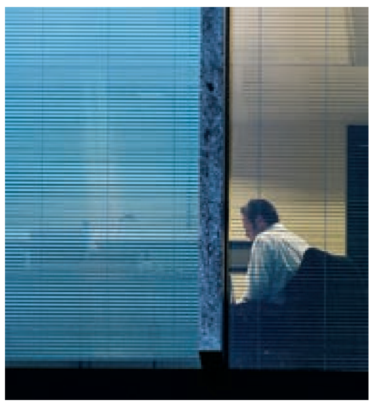
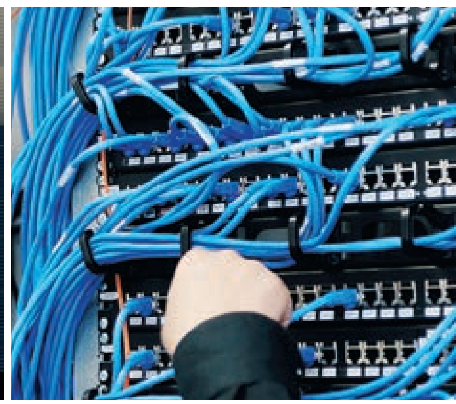
While the Uptime Institute claims that Tier levels are associated with availability, analysis by MTech and others[2], [3]have demonstrated that this is not the case. The claimed availability levels for each Tier are the result of the assumptions built into the system by the Uptime Institute[4]. Most notably, both independent analyses conclude that there is very little difference in availability between Tier 3 and Tier 4 facilities.

Even if the Tier system were an accurate predictor of availability, it does not address reliability.

# Intensium® Flex

# Perfect compact power for UPS systems



© Saft – © Photos : Saft, Fotolia – C238 - IBG 057-2-12

Intensium Flex is the ideal backup solution for high power UPS and DC power systems in confined spaces.

- Reliable, maintenance-free lithium-ion technology
- Compact lightweight battery package
- Modular flexible archicture
- Optimized supervision through remote control and diagnostics

www.saftbatteries.com

saft

### Risk, Reliability, and Availability in Critical Facilities

A critical facility is one where failures are to be avoided to the maximum extent possible. Failure of "mission-critical" facilities jeopardizes the operations and sometimes the existence of the associated enterprise.

It is not possible or desirable to build a number of critical facilities, observe their performance, and address any shortcomings in later versions. Critical facilities such as nuclear power plants must demonstrate that by design they are extremely unlikely to fail in a manner that jeopardizes human health and safety.

Data center failures are typically measured in terms of financial losses. As our society and its infrastructure grow ever more dependent on the Internet and data centers, data center failures will inevitably produce human casualties. Today a failure in a major hospital data center could compromise patient care and obviate many claimed benefits of centralized digital patient records.

Risk is the product of probability and consequences. If the consequence of a data center outage is $1 million, the risk to the associated enterprise is proportional to the probability of an outage multiplied by $1 million. If the data center anticipates one failure per 20 years, the expected loss per year is approximately $50,000 (1/20 x $1,000,000). If there is a failure every year, the expected loss is $1 million per year.

Availability is the average time that a system or asset is available for use, or is operating. Availability can be a useful metric for planning revenues and fleet management, but availability cannot be used to evaluate risk.

This inherent limit of availability is demonstrated as follows; in one year, critical facility 1 has a single outage lasting 24 hours. In the same period critical facility 2 experiences ten outages of 2.4 hours each. Both facilities have 24 hours during the year (8760 hours) when they are not available. Both have the same availability: (8760-24)/8760.

The two facilities have very different reliability. Critical facility 2 is ten times more likely to fail than critical facility 1. Data center owners, who typically experience substantial losses even after brief outages, tend to be much more interested in how likely a facility is to fail than in average uptime.

## CLASS AS A MEASURE OF CRITICAL FACILITY PERFORMANCE

Reliability is the probability that a system will operate for the specified period of time (or number of trials), called the mission. The highest possible reliability is 1; this is not achievable by human-made systems.

Reliability can be expressed as 1 – (probability of failure). A synonym for probability of failure is unreliability.

MTech has been calculating reliability, unreliability, availability, and risk for 17 years. We have observed that many of our clients find these terms novel and initially confusing.

We propose to call the percentage Unreliability for a 1-year mission the critical facility Class. A Class 10 facility has 10% chance of failure per year. A Class 1 facility has 1% chance of failure per year. A Class 0.1 system has only 0.1% probability of failure per year, one chance in 1000.

The unattainable class is Class 0, with no chance of failure. Gravity is a Class 0 system, but there are no Class 0 systems made by mankind. Like the temperature absolute zero, Class 0 is a physical possibility but beyond the abilities of present-day technology.

MTech uses fault tree analysis and associated tools to develop mathematical models of critical facilities. We use these models to calculate facility unreliability, sensitivity to component performance, and risk. Our clients include data centers, producers of equipment marketed to data centers, oil and gas facilities, nuclear power plants, and energy storage products.

Our experience over the past 17 years is that most data centers could be Class 5 or perhaps Class 2 facilities. A few are Class 1, and few if any would realistically meet a Class 0.1 standard.

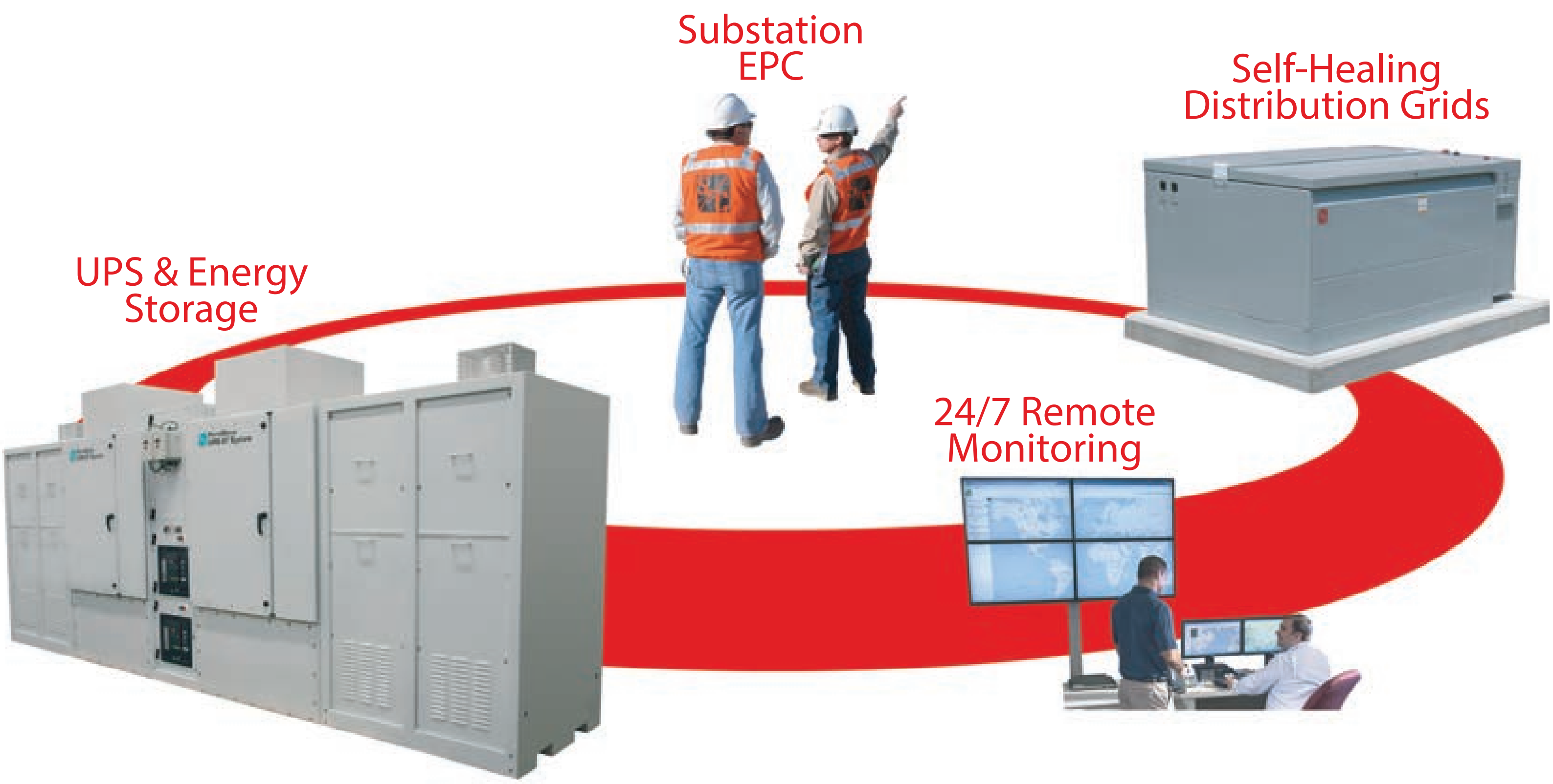
The fact that nearly all critical facilities are exposed to external hazards beyond their control can be reflected in the Class rating. Many disaster recovery plans use 100-year events as the threshold for activation. It is deemed too expensive to engineer effective facility protection for the 100-year fire, flood, or earthquake. The disaster recovery plan is executed should they occur.

This suggests diminishing returns for investing in facilities with Class ratings much lower than 1. Even if 250-year events are set as the threshold, three independent

# Let Your **Power** Be Our **Priority**

Relax. You have enough to worry about when it comes to your data center's operations. **Trust S&C's medium-voltage experts** to make sure that your power system's reliability and availability are taken care of.

## Your Data Center Medium-Voltage Experts for




Learn more at
**sandc.com/MVexperts**

**S&C ELECTRIC COMPANY**
Excellence Through Innovation

©2014 S&C Electric Company 100-A1403

exposures e.g. fire, flood, earthquake at once per 250 years each, means that external factors will limit the facility to at best Class 0.75.

MTech's fault tree analysis of electric and cooling systems cannot determine Class ratings without important limits and assumptions. Our studies have shown that so-called preventive maintenance is a major, in some cases dominant, cause of system failure. A realistic "budget" for class rating a very high performance facility might include the following terms:

| | |
|---|---|
| Facility Power and Cooling Systems Unreliability: | Class 0.5 |
| Maintenance-induced Failures: | Class 0.5 |
| Sum of fires, floods, other 250-year events: | Class 1 |
| Facility Class rating: | Class 2 |

This example shows a useful property of Class ratings: they can be added, so long as each term represents separate threats to the facility.

Another useful attribute is comparison between facilities. A Class 5 facility is 5 times more likely to fail than a Class 1 facility, and 10 times more likely to fail than a class 0.5 facility.

Reliability cannot be compared so easily. AC 5 facility has 95% reliability for one year, a Class 1 facility has 99%. The difference in reliability is only 4%. It is tempting to say that a Class 1 facility is five times more reliable than a Class 5 facility, but that is incorrect.

## DETERMINING CRITICAL FACILITY CLASS

Calculation with fault tree analysis has many useful attributes, but is not the only way to predict or measure critical facility Class. Reliability block diagrams, when used appropriately, can perform similar calculations.[5]

Measurement and observation may be used. A single facility that operates for some years without any failures might be tempted to claim "Class 0" performance, but would risk rambunctious skepticism from informed customers and damaged credibility. A more defensible and conservative approach would be to estimate or calculate the expected Class of the facility, and then use statistical analysis to show that the years of zero downtime are consistent with those claims within a given level of statistical confidence.

Owners and operators of large fleets of data centers can collect and publish data supporting Class ratings of their entire fleet. A co-location provider who could offer potential customers evidence of fleet Class performance along with best and worse-case facilities in the fleet would have a significant competitive advantage over a single facility owner, who must collect their data much more slowly.

Original equipment manufacturers can also employ Class ratings, so long as they carefully define the assumptions and limits of the claim. MTech's client Active Power recently published a white paper showing that the unreliability for the CleanSource 750HD UPS with extended runtime was 0.36% for short outages (less than 10 seconds.) That claim might be expressed as "The CleanSource 750HD provides a Class 0.5 component for critical facility electric power systems subjected to 1 short outage per year." Since there is no allowance for scheduled maintenance in the 0.36% figure; Class 0.5 is offered as a likely example.

An important component of Class rating is the frequency of demands placed upon the system. Demand failures are events that require standby systems to operate, or active systems to change operating state, often by switching. If a standby diesel/generator set has a 1% probability of not starting when utility power fails, a facility with a single generator cannot achieve Class 10 performance if there are 10 or more utility outages per year. In a highly reliable urban network distribution system, it is entirely possible to support a claim of Class 10 performance with no standby generator at all.

A credible class rating must disclose all assumptions and data used to produce the claim, including the frequency and duration of utility outages, assumptions about on-site and off-site fuel supplies, allowance for failures produced by maintenance and other sources of human error, and exclusions of certain events such as major storms, earthquakes, or fires.

MTech proposes the Class metric as an aid for discussion and improvement of mission critical facility performance. It can be used in design, operation, maintenance, and failure analysis. Class, the probability of failure over a full year of operation, is related to but distinct from reliability.

MTech makes no claim of intellectual property rights to the term Class or its use to characterize the performance of critical facilities. We encourage the use, discussion, criticism, and debate of Class as a critical facility performance metric. Those who wish to use Class to characterize their facilities should describe in detail the methods, assumptions, and limits that were used to produce the claim.

# All the capabilities you want... and some you may not have considered!

## Custom Designed and Built Power Control Systems

With mission-critical data and life safety at stake, why would you try to make do with a standard catalog power control system? Why would you settle for a less than optimal solution?

Don't compromise. Insist on a powerful, flexible, fully-integrated Russelectric Power Control System... custom-designed and built with your specific needs and wants in mind. Russelectric will custom tailor a power control system that not only provides all the operating, monitoring, and reporting capabilities you want, but one that is intuitive and easy to use because it is based on your way of doing things. And because Russelectric specializes in custom systems, we can often suggest features and capabilities you never even considered.

1-800-225-5250 russelectric.com

An Employee-Owned Company / An Equal Opportunity Employer

Russelectric

POWER CONTROL PEOPLE YOU CAN RELY ON

Raritan

# Intelligent PDUs.

## Meet the PX® Series.

### Outlet-Level Metering

Better than ISO/IEC +/- billing-grade accuracy for monitoring colo usage or creating bill-back reports with rich data on V, A, kVA, KW, and kWh.

### Remote Outlet Switching

Sophisticated sequencing can power equipment with one or more power feeds, on or off in a set order, to conserve energy during non-working hours.

### High Power 3-Phase Distribution

400V 3-phase high power models supporting up to 55kW per rack iPDU, up to 54 locking outlets, plus 60°C resistance for dense high-heat environments.

### Environmental Sensor Ports

Easily deploy sensors to monitor data center temperature, humidity, airflow, and differential air pressure, leaks and contact closures.

### Cost-Saving USB Ports

Multiple USB ports provide Wi-Fi networking, cascading, quick setup, firmware upgrades, security cams, and a remote display.

### Color Chassis and Compact Designs

Available in ten colors that reduce errors and make it easier to identify power feeds, and space-saving Zero U, 1U, 2U, and 3U form factors.

## Learn More Today

**raritan.com/datacenterpower**

800-724-8090 sales@raritan.com

© 2015 Raritan Inc.

## APPENDIX A

From 2010 Uptime Institute[6]

**Tier I Assumptions:**

Two 12-hour scheduled outages for maintenance
1.2 failures per year, 4 hours per failure

**Tier 1 Availability:**

2x12 + 1.2*4 = 28.8 hours down per year => (8760-28.8)/8760 = 99.67 % availability.

**Tier 2 Assumptions:**

One 18-hour scheduled outage per year
1 failure per year, 4 hours per failure

**Tier 2 Availability:**

18 + 4 = 22 hours down per year => (8760-22)/8760 = 99.75% availability

**Tier 3 Assumptions:**

No planned outages
1 failure per 2.5 years, 4 hours per failure

**Tier 3 Availability:**

4 / 2.5 = 1.6 hours down per year => (8760-1.6)/8760 = 99.98% availability.

**Tier 4 Assumptions:**

No planned outages
1 failure per 5 years, 4 hours per failure

**Tier 4 Availability:**

4 / 5 = 0.8 hours per year downtime => (8760-0.8)/8760 = 99.99% availability

## APPENDIX B: RELIABILITY AND AVAILABILITY

**In some industries, losses due to facility downtime are proportional to downtime:**

Lost $ = Rate * Downtime

In data centers and many other critical facilities, there are substantial losses incurred during the first instant of downtime. For example, A banking facility might require 16 hours to restore normal operations after a major data center outage disrupts ATM operations. The losses in terms of business, customer satisfaction, regulatory effects, etc., all happen in the first instant; even if power is restored in 1 second, it takes 16 hours to restore the full ATM network.

**In these facilities, losses due to facility downtime include an initial loss term, represented as D:**

Lost $ = D + Rate * Time

The amount of loss probably increases with duration of the outage[7], but the penalty D is always incurred.

**If a planner wants to estimate the total losses for a facility over its operating lifetime, and the facility does not have large initial losses, the calculation is:**

Total Loss = ∑ (Rate * downtime) = Rate * ∑downtime

This is true because Rate is constant. The symbol ∑downtime means "the sum of all downtime."

**If this planner has a valid figure for availability of the system, they can calculate the expected downtime over a given interval:**

∑downtime = (1 – Availability) * mission_time

If availability is 99%, and mission time is 10 years, then

∑downtime = (1 – 99%) * 10 * 8760 hours = 876 hours.

The calculation is different if the facility suffers a significant loss for each event, regardless of its duration.

Total Loss = ∑ (D + Rate * downtime) = n*D + Rate* ∑downtime

Where n is the number of outages expected over the mission time. **Availability cannot be used to predict the number of events. Reliability must be used to determine the frequency of outages.**

*1 In some facilities it is acceptable to interrupt cooling for short periods.*
*2 "Reliability of Data Centers by Tier Classification", Arno, R., Friedl, A., Gross, P., Schuerger, R.J., Industry Applications, IEEE Transactions on (Volume:48 , Issue: 2 ), March-April 2012, pp. 777 - 783*
*3 "Reliability of Example Mechanical Systems for Data Center Cooling Selected by Tier Classification", Arno, R., Githu, G., Gross, P., Schuerger, R., Wilson, S., Industry Applications Society Annual Meeting (IAS), 2010 IEEE*
*4 See Appendix A*
*5 "IEEE Recommended Practice for Determining the Reliability of 7x24 Continuous Power Systems in Industrial and Commercial Facilities", IEEE Std 3006.7-2013*
*6 Insert citation*
*7 The rate of loss need not be linear with time, for example food or drug spoilage might not occur for some time after an outage begins. The analysis of availability versus reliability still applies.*

*Steve Fairfax is the President at MTechnology, Inc. He can be reached at Fairfax@mtechnology.net*

# MODERN IT INFRASTRUCTURES SUPERCHARGE DATA CENTER EFFICIENCY, RESILIENCY AND COST EFFECTIVENESS

by **John Peter Valiulis** and **David Sonner**

From 2003 to 2008, data center managers invested big to expand their IT equipment and supporting infrastructures. This expansion was a response to exploding capacity demands sparked by the growing use of digital media and content requiring ever-increasing compute power. Given that data center infrastructure investments typically follow a 10- to 15-year planning cycle, many data centers today are being supported by power and thermal management systems originally designed with this growth in mind.

While these systems adequately addressed demands during that time, they lag behind modern systems in their ability to solve the challenges data center managers now face, such as reducing operating costs, which only became a major business challenge in recent years. Typically, systems installed in that time period of explosive growth are less efficient, more costly to operate and often underperform by the intended design, which at that time was to ensure the highest availability at any cost.

Fortunately, there are a number of modernization opportunities to help data center and IT professionals ensure their data center is as dynamic and cost sensitive as their business is today. Often, these opportunities can be realized by implementing industry best practices or updating/replacing this older legacy equipment. This article focuses on strategies and steps to implement the thermal management and power best practices and technologies that can help you improve efficiency and asset utilization, which in turn reduce operating and capital expenses.

## THERMAL MANAGEMENT

Data center thermal management has traditionally consumed the highest amount of energy in the data center, with compressors, fans and very low recommended operating temperatures contributing to energy burdens. Employing new thermal management technologies and best practices can dramatically improve efficiency, performance and visibility.

Modernizing a thermal management strategy can:

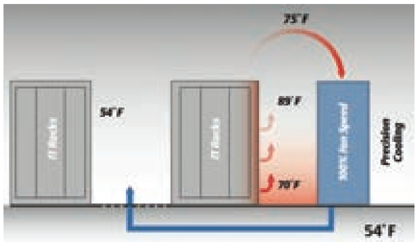
- Cut cooling energy costs by 60 percent
- Increase cooling capacity by 40 percent
- Provide a higher level of IT equipment protection
- Deliver greater visibility and insight into data center operations

A variety of opportunities exist to tap these benefits.

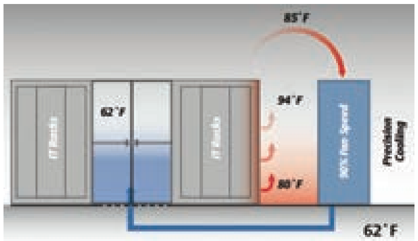
### DEPLOY HOT-AISLE OR COLD-AISLE CONTAINMENT

Containment keeps hot and cold air from mixing, which increases the temperature of the return air (the hot air that is expelled from the server racks and circulated back to the heat removal equipment). Higher return air temperatures allow heat removal units to operate more efficiently. A 10° F increase in return air temperature can increase unit capacity 38 percent, boosting efficiency in the process.

In addition, with containment, the thermal management system no longer has to control conditions across the entire facility. Instead, temperatures in an aisle can be precisely controlled based on conditions in that aisle. If the aisle is filled with high density racks and all IT systems in the aisle are working at or close to capacity, the system can focus heat removal to maintain




*Without aisle containment, return air temperature is near 75° F.*




*With containment, return air temperature can be raised to 80° F and fan speed reduced, which increases energy efficiency.*

YOUR
DATA CENTER.
OUR EXPERT MANAGEMENT.

QTS®
Data Centers Powered by People



QTS Critical Facilities Management

Keeping your data center online and efficient is a complex task. QTS can simplify the process. With QTS Critical Facilities Management (CFM), we manage your data center as if it were our own. Using an integrated approach with a proven framework and methodology, we can provide performance efficiency improvements up to 20% which are guaranteed over the life of the contract.

Strategic business intelligence and governance delivers maximum uptime and exceptional performance.

Comprehensive, proven processes and operating procedures drive efficiencies and cost savings up to 20%.

Centralized monitoring systems along with skilled personnel ensure your operations run smoothly 24x7x365.

Dedicated, go-to resource for day-to-day operational management support and ongoing project management.

To learn more, visit qtsdatacenters.com/CFM.

desired temperatures in that aisle. If demand on the data center is low and a particular aisle is not generating much heat, thermal sensors and controls will perform accordingly.

## TURN UP THE TEMPERATURE

In your data center: Aisle containment also enables you to manage cooling to address server inlet temperatures, rather than indirectly based on return air temperatures. This increased precision can provide the confidence to raise data center temperatures closer to the ASHRAE maximum of 80.5° F.

In your chiller: In thermal management systems that use water to capture and remove heat, raising water temperatures in the chiller can deliver additional savings. Chillers have traditionally been set to keep water temperature at 45° F, but many facilities are now raising chilled water temperatures above 55° F to reduce chiller costs and widen the window at which economizers can operate.

## MATCH COOLING TO THE LOAD

Variable capacity thermal management units equipped with variable speed digital compressors and variable speed or EC fans are becoming the norm. These technologies allow thermal management units to match their capacity to changes in the IT load and operate more efficiently at all capacities. This is key to improving unit efficiency, since the thermal management system is sized for a maximum IT load that rarely occurs. Any system that can't efficiently adapt to actual operating conditions is wasting energy.

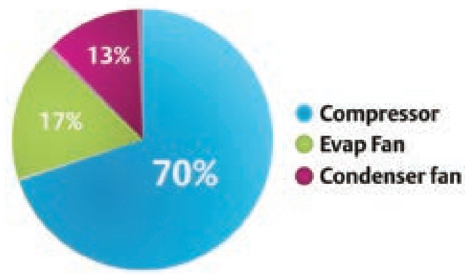
Fans are big consumers of energy in thermal management units. Upgrading from fixed speed to variable speed fans can yield a particularly strong return on investment because of the relationship between fan speed and energy consumption: reducing fan speed by 20 percent provides almost 80 percent savings in fan power consumption. That means a relatively small adjustment in fan speed can cut fan energy consumption in half.

## UPGRADE THERMAL MANAGEMENT SYSTEM CONTROLS

Intelligence can make or break a thermal management approach, and intelligence requires sophisticated controls. Sophisticated does not necessarily mean expensive. An amazing amount of functionality is built into the current generation of many thermal management system controls, including multi-unit teamwork control with fan coordination, coordination between external condensers and indoor cooling units, capacity and power usage monitoring, auto-tuning, economizer control, and custom staging and sequencing. New controls provide the ability to safely implement and coordinate each of the strategies mentioned above.

## EXTEND VISIBILITY BY USING WIRELESS SENSORS

The more visibility the controls have into equipment operating parameters and conditions in the data center, the better decisions they can make. New generations of wireless sensors are making it simpler and more affordable to extend visibility beyond return air and supply air temperatures to include server inlet temperature. When variables such as server inlet temperature, supply air temperature, return air temperature, water temperature, outside temperature, fan speed and unit energy consumption are all monitored in real-time, the control system has the data it needs to optimize performance within a single unit, across multiple indoor units, and between indoor and outdoor units.




*Compressors are the biggest energy consumer in thermal management systems. During optimal ambient conditions, a system equipped with a pumped refrigerant economizer can provide full economizer operation to reduce compressor energy consumption to zero.*

## DEPLOY NEW ECONOMIZER TECHNOLOGY

The introduction of variable capacity cooling marked a major step forward for data center thermal management, but the promise of matching thermal management equipment performance to real-time conditions is just now being realized by using economizers integrated with intelligent controls in thermal management systems.

Traditional economizer systems use outside air or complex water systems to minimize the use of compressors or chillers. They have a long history in the data center and even in temperate climates can deliver significant savings. For example, in Atlanta, Georgia, economization can provide cooling energy savings of more than 40 percent. The challenges of economizer use have always been to use outside air or water in ways that do not impact the reliability of IT systems and to be able to easily control the level of economization based on changing outside temperatures.

Economizers with pumped refrigerant have now been integrated directly into thermal management systems that include a high-efficiency variable capacity compressor. System controls measure IT loads and outdoor temperatures and automatically switch in and out of economization mode. During optimal ambient


Page/
Providing high performance and energy efficient design solutions for mission critical facilities
Our Architecture/Engineering teams design mission critical facilities that stay operable in the face of disruptive events. Our projects support IT loads from 200kW to more than 300MW and are used by Fortune 100 clients for research and development, as well as production and storage in a range of industries. Page is ranked the 4th largest Data Center Architecture firm in the nation by Building Design + Construction.
/ Learn more at pagethink.com
/think forward
Austin / Dallas / Denver / Houston / San Francisco / Washington DC / International Affiliate Offices

conditions, they can provide full economizer operation to reduce compressor energy consumption to zero. This system eliminates water use and the need to introduce outside air directly into the data center. It also cuts the maintenance costs associated with dampers or louvers and water treatment for most economization systems.

The energy-saving benefits of economization also extend to chillers. Relying strictly on outside air, or using free cooling in concert with other technologies for heat removal, dramatically reduces chiller energy consumption and, in some cases, water usage.

## SAVINGS FROM IMPROVING THE LEGACY THERMAL MANAGEMENT SYSTEM ADD UP

Taking advantage of the aforementioned thermal management opportunities in a legacy data center can make a significant difference in the energy bill, as shown in the example below.

Assume a legacy data center operating under the following parameters:

- 5,000 square-foot data center
- Direct expansion (DX) thermal management system with 500kW capacity
- Precision cooling in hot-aisle/cold-aisle arrangement
- 75° F return air temperature
- $0.10/kWh energy cost

### GET A HANDLE ON NEW CUSTOM AIR HANDLING TECHNOLOGIES

Typical standard rooftop air handling units are simply unable to maintain the precise temperature and humidity control demanded by mission-critical environments. However, custom air handlers are now on the market that have been designed specifically for large data centers using evaporative, chilled water or DX technologies.

Air handling units designed for the data center can offer a level of customization and flexibility needed in these unique environments and are typically used in data centers from 5-30 MW or higher. The units usually feature intelligent controls that provide advanced protection and enable air flow, temperature and economizer function to be adjusted automatically based on IT load and ambient conditions. With these control systems in place, the units can work more efficiently and help data center managers achieve annual mechanical PUE under 1.2. As with traditional data center thermal management, advanced controls are critical to successful operation. Many of these systems can also be simply integrated with building management systems and DCIM solutions.

### REDUCE PUE USING FREE COOLING CHILLERS

As with custom air handling units, a new generation of air-cooled chillers has been designed specifically for data centers and mission-critical applications. These chillers use built-in economizers, system optimization software and state-of-the-art components—for instance, advanced controls, digital scroll compressors, EC fans, microchannel condensers and electronic expansion valves—to deliver high efficiency (mechanical PUE as low as 1.08) and high availability.

Free cooling chillers contain built-in redundancy, fast restart capability and continuous cooling availability in case of water shortages, extreme ambient temperatures and unstable power supplies. Free cooling chillers come in units up to 400 tons in capacity and are ideal for chilled water data centers up to 6 MW.

## POWER INFRASTRUCTURE

If your data center runs on a legacy power infrastructure, its weaknesses likely are its high operating cost and inflexibility. Newer power technologies are designed to eliminate these deficiencies and provide substantial benefits, including:

- Up to 25 percent end-to-end efficiency improvements

**THE ANNUAL ENERGY BILL FOR THIS DATA CENTER IS $190,000, WHICH CAN BE CUT SUBSTANTIALLY:**

| | Annual Energy Cost | % Energy Savings | Annual Energy Savings $ |
|---|---|---|---|
| Legacy system without improvements | $190,000 | **NA** | NA |
| First, add containment and increase return air temperature 10° F. Then add advanced controls to optimize airflow and cooling capacity | $133,000 -$123,500 | **30-35%** | $57,000 - $66,500 |
| Upgrade to New DX Technology with Pumped Refrigerant Economization | $85,500 - $66,500 | **55-65%** | $104,500 - $123,500 |

MILLER ELECTRIC COMPANY:

# CRITICAL POWER DIVISION

Miller Electric Company provides turnkey installation of critical power systems for some of America's largest Corporations. These same companies rely on Miller Electric to provide, design, construction, operations, maintenance and preventative maintenance for their critical facilities.

Our services have allowed us to partner with our critical power customers to provide state of the art infrastructures with emphasis on uptime and energy efficiencies for critical facilities.

## SERVICES OUR MISSION CRITICAL TEAM DELIVERS:

- Design Build
- Construction
- Turnkey installation of Critical Power Systems, including Generators and UPS systems.
- Preventive Maintenance
- Infrared Imaging-Predictive Maintenance
- Repair & Troubleshooting
- Fuel Services/Periodic Tank Cleaning
- Onsite Maintenance Staffing
- 24-Hour Emergency Service

Miller Electric Company performs work all over the country for any size Critical Client. We have nine Branch Office locations which support our clients from coast to coast.

Through our various in-house capabilities we offer solutions to your needs in the area of:

- BIM (Building Information Modeling)
- Prefabrication
- Voice & Data
- Security Cameras
- Engineering & Design
- 100% Safety Program
- Fiber Optics
- Years of Data Center Experience
- Highly Trained Critical Power Staff & Support

MILLER

EC11

U.S. GREEN BUILDING COUNCIL MEMBER

MILLER ELECTRIC COMPANY

*"Quality Service Since 1928"*

904.388.8000 • WWW.MECOJAX.COM

COMMERCIAL • DATA CENTERS • HOSPITALITY • HEALTHCARE • INDUSTRIAL • INSTITUTIONAL • INTEGRATED SYSTEMS • CRITICAL POWER • INTELLIGENT TRANSPORTATION • RENEWABLE ENERGY

JACKSONVILLE, FL • GAINESVILLE, FL • MIAMI, FL • TAMPA, FL • ATLANTA, GA • WASHINGTON, DC • BIRMINGHAM, AL • LITTLE ROCK, AR • CHARLOTTE, NC • MOBILE, AL • RICHMOND, VA • IRVING, TX

- 15-25 percent reduction in operating expenses
- 75 percent or higher asset utilization

Even seemingly small power infrastructure efficiency improvements can add up to big savings. For instance, with energy costs at $0.10/kW, a 1 percent efficiency improvement for a single 1 MW UPS translates into approximately $10,000 in annual savings. For instance, updating a legacy power system with a new power distribution system can improve its efficiency by about 2 percent for an annual energy savings of $20,000, with a five year ROI. Upgrading to a modern UPS system will reduce losses at the UPS itself by 4-5 percent, yielding a $40,000-$50,000 annual savings and also a five year ROI.

In addition to cutting operating expenses, modern power infrastructures can improve application availability, and they can reduce the complexity and increase the cost-effectiveness of future growth. The strategies outlined below will enable you to gain a more efficient, productive and available data center while managing capital costs.

## DEPLOY NEW TRANSFORMER-FREE, DOUBLE CONVERSION UPS TECHNOLOGIES

Legacy uninterruptible power supply (UPS) systems for enterprise data centers typically operated at a peak efficiency of 91-92 percent at 100 percent load (85 percent efficiency at 40-60 percent load). The other 8-9 percentage points are lost as a byproduct of the conversion process, and this has traditionally been accepted as a reasonable price to pay for protection from unplanned downtime. But with new high-efficiency options, many modern UPS technologies offer higher efficiency in all modes of operation.

Today, transformer-free UPS systems operated in double conversion mode are 96-97 percent efficient at 100 percent load and 94-95 percent efficient at 40-60 percent load. Considering that only a 1 percent efficiency improvement at $0.10/kWh for a single 800kVA UPS translates into approximately $10,000 in annual savings, the reduction in operating expenses can be significant when you multiply this savings by the number of UPS units in use.

Some UPS systems also offer an eco-mode operation option that allows the conversion process to be bypassed, and operating efficiency increased even further. This mode can be enabled when data center criticality is not as great or when utility power is known to be of the highest quality. This is accomplished by utilizing the automatic static bypass switch of the UPS during eco-mode.

This bypass normally operates at very high speeds to provide a break-free load transfer to a utility or backup system during maintenance and to ensure uninterrupted power in the event of severe overload or instantaneous loss of bus voltage. The transfer takes less than 4 milliseconds to prevent any interruption that could shut down IT equipment. With eco-mode and using intelligent controls, the UPS can stay on utility power as an efficiency mode of operation, circumventing the normal AC-DC-AC conversion process while the UPS monitors bypass power quality. If utility power is out of specification, the UPS will transfer back to double conversion mode.

## INVEST IN NEWER POWER DISTRIBUTION UNIT (PDU) TECHNOLOGY

The UPS system and PDUs are key components in the data center power infrastructure; the UPS feeds power through the PDUs to IT equipment throughout the facility. The three functions of the PDU system have not changed over the past decade:

1. Transform the voltage from 480V or 600V to 208/120V so it can be used by the IT equipment. Most servers run on 208V line-to-line today.
2. Distribute and control the power. There is a circuit panel on the secondary side of the PDU feeding various servers located on the data center floor. Many businesses meter their circuits to measure the amount of energy provided to each server or set of servers. Metering is especially helpful to colocation providers to measure customer energy use and, depending on the rate structure, bill for it.
3. Monitor energy consumption to manage planning. Data center managers can view and understand energy consumption from a central location via the PDU system, allowing them to take holistic actions to improve efficiency.

At the PDU level, the efficiency of the transformer technology has improved and meets certain mandated efficiency standards that are in place today. The National Electrical Manufacturers Association mandates standard TP 1-2007 (NEMA TP 1-2007), which specifies minimum efficiency levels based on transformer size. Generally, the specified efficiencies are greater than 98.5 percent for the most common PDU sizes used today. Before the TP 1-2007 standard, PDU efficiency was 96-97 percent, so deploying newer PDUs can add another two or more efficiency points at the PDU itself.

## ENABLE A HIGH-DENSITY ENVIRONMENT

Dense environments are inherently

# We Design
# We Build
# We Deliver

Committed to our customers since 1973



REGAL

Thomson Power Systems

Quality • Reliability • Commitment

LEARN MORE ABOUT OUR ADVANCED PRODUCTS WWW.THOMSONPS.COM

more efficient, which means, as with the other solutions covered in this article, that operating costs are reduced. Approaches such as two-stage power distribution also enable high-density environments to achieve the same levels of availability and scalability as low-density environments.

Single-stage distribution often is unable to support the number of devices in today's data center, as breaker space is used up long before system capacity is reached. By separating deliverable capacity and physical distribution capability into subsystems, two-stage distribution overcomes this limitation.

The first stage receives high-voltage power from the UPS and can be configured with a mix of circuit and branch level distribution breakers. The second stage or load-level units can be tailored to the requirements of specific racks or rows.

Growing density can be supported by adding breakers to the primary distribution unit and adding more load-level distribution units. Additionally, higher amperage in-rack PDUs can be deployed to manage higher electrical requirements within the rack. These systems can provide 60 amp capacity per strip, compared with 15 amp for traditional rack power strips, and they also feature a modular design that makes it easy to add receptacles or support high-density equipment.

## AUTOMATE ENERGY USAGE DATA COLLECTION AND ANALYSIS

Energy efficiency monitoring can track total data center consumption, automatically calculate and analyze PUE, and optimize the use of alternative energy sources. Unfortunately, many facilities don't have energy monitoring capabilities. Automating collection and analysis of data from the UPS and PDU monitoring systems can prevent overloading, improve energy efficiency and increase IT productivity. Power should be monitored at the UPS and the room PDU and within the rack.

Using data from the UPS, the monitoring system can track UPS power output to determine when UPS units are running at peak efficiency. Monitoring at the room or row PDU provides the ability to plan more efficient loading of power supplies and dynamically manage cooling; panel board monitoring provides visibility into power consumption by non-IT systems, including lighting and generators, to ensure efficient use of those systems; and rack-level monitoring provides the most accurate picture of IT equipment power consumption with continuous monitoring of volts, kilowatts, amps and kilowatts per hour. The ability to automate data collection, consolidation and analysis related to efficiency is essential to data center optimization and frees up data center staff to focus on strategic IT issues.

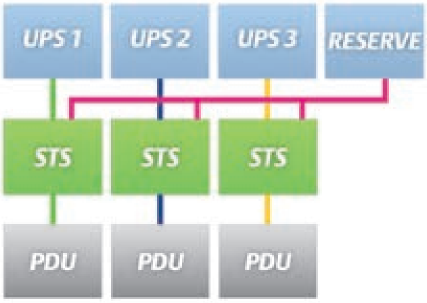
## MAKE SMART USE OF INTELLIGENT DIGITAL CONTROLS

Some UPS systems are equipped with intelligent digital controls that enable more efficient operation through other options such as intelligent paralleling in multi-module systems. Intelligent paralleling manages the load across multiple UPS modules and can automatically deactivate modules that are not required to support the load, while still ensuring that the system is providing adequate redundancy. For example, a four-module N+1 system sized to support 700kVA using four 250kVA UPS modules can support loads below 400kVA with only three modules. This capability boosts utilization rates and can improve system efficiency by up to 6 percent without sacrificing protection.

## IMPROVE UPS UTILIZATION RATES BY DEPLOYING A RESERVE ARCHITECTURE

A dual-bus (2N) architecture is often chosen for the power system in enterprise applications because it provides the required level of fault tolerance and concurrent maintainability for Tier 4 data centers. A properly designed dual-bus system will eliminate every single point of failure, and maintenance can be performed on any component while continuing to power the load.

But the downsides to failsafe uptime are higher cost and low utilization rates for power system components. This is because to ensure safe operating conditions when one bus is carrying the full load, power system components on each bus are typically over-provisioned to about 110 percent of the data center load. With more capacity than needed, the UPS utilization rate falls below 45 percent under normal operating conditions. In periods of low demand—for example, when the data center is first deployed—utilization can be 20 percent or lower. Typically UPS systems operate most efficiently at utilization rates above 30 percent. At




*The reserve architecture creates a fault tolerant architecture with utilization rates of approximately 75 percent.*

# IEM™

Industrial Electric Mfg

Vesta Arc Resistant MV Switchgear

IEM is the largest independent full-line manufacturer of electrical distribution equipment in North America. We specialize in delivering advanced electrical products and systems for critical applications world-wide.

Vesta Arc Resistant Switchgear is designed to meet the needs of customers who demand the highest quality power distribution assembly with the smallest foot-print.

To learn more, visit **iemfg.com** or call us at **888.436.8668**

## Simply Reliable Solutions for Continuous and Efficient Data Center Power

IEM Power systems designs and builds integrated power control systems for the data center industry.

Our Rotabloc solution is a fully integrated Rotary UPS system comprising of the UPS, Engine Genset, Switchgear, and Integrated Control System – lowering cost, reducing risk and improving reliability.

- Low CAPEX and OPEX
- Full System Integration
- Over 96% Efficiency
- 8 Year Warranty on Bearings
- Minimal Life Cycle Costs
- Environmental Savings

Built, tested, and supported by our U.S. facilities.

To learn more, visit **iemps.com** or call us at **+1 347.429.1505**

RBT Rotary UPS

IEM Power Systems™

*Critical Power Solutions*

ISO 9001 Certified

Fremont, CA • Jacksonville, FL • Vancouver, BC • Battice, Belgium

# GO BIG WITH GENERAC

**SINGLE-ENGINE GENERATORS FROM 750KW TO 2MW, AND MULTI-MEGAWATT, INTEGRATED ONBOARD PARALLELING SYSTEMS.**

For data centers, healthcare, wastewater treatment, or any "mission critical" power application. Go big with Generac Industrial Power. Proven technology that's designed, built, tested, and certified at dedicated facilities in Wisconsin. By the company focused on power generation since 1959. Trusted experts in backup power.


Learn more at generac.com/GoBig or call 855-493-3863 @Generac GeneracIndustrial GeneracIndustrialPower

20 percent, efficiency begins to drop.

In a legacy data center with 45-50 percent utilization, efficiency is about 83-86 percent at 100 percent load after accounting for losses from low utilization rates.

Instead of dual-bus, some enterprise data centers and most colocation data centers today employ "reserve" power system architectures, which offer comparable availability, greater efficiency and scalability, and higher resource utilization at lower overall cost than dual-bus architectures. A reserve architecture creates a redundant system architecture and can be designed with downstream power distribution similar to a dual-bus architecture. This allows the UPS to operate at higher utilization rates while providing a highly fault tolerant design. Switching to a reserve architecture can raise UPS system utilization to approximately 75 percent, and Emerson Network Power has experience with some reserve architectures that achieve better than 85 percent utilization.

## CONSIDER TAKING A NEW PATH TO GROWTH

Overcoming the long-standing practice of over-provisioning is an important strategy for reducing capital expenditures, but if you don't have capacity sitting idle, how is growth managed? Having a scalable power system allows you to purchase and rapidly deploy assets based on predicted growth, conserving capital until real business growth spurs expansion. Today a variety of paths to a scalable power infrastructure can be taken.

Besides improving asset utilization and efficiency, reserve architectures also make it easy to grow simply and rapidly, which is why they are common in colocation facilities that need to increase capacity quickly when new customers are added. Reserve architectures allow data center managers to scale up smoothly as needed. With an architecture of single buses (N+1 or N+2), the simplest path is to standardize to a rapid deployment of that exact bus. Growth is then an easy process of repeating that deployment.

At the equipment level, having capacity-on-demand is an effective way to prepare for future growth. Technologies are available that enable capacity increases without additional footprint requirements — either through unlocking capacity via software, or by adding internal capacity modules within a UPS cabinet. Both approaches reduce initial capital expenditures.

A scalable power infrastructure can also be built knowing that in the future more physical modules will be added—for example, if future capacity requirements are unclear and if the data center can operate on a simpler and somewhat less reliable 1+N architecture. Today's 1+N UPS designs allow a data center manager to purchase very simple switchgear and only one UPS module, and when more capacity is needed, another module can be purchased and installed without the additional expense and deployment time associated with system-level controls.

By modernizing the power infrastructure, data center managers can better manage costs by improving efficiency and initial capital expenditures. Deploying a modern, efficient, scalable power infrastructure can save tens of thousands to hundreds of thousands of dollars, improve performance and provide an easier path for growth.

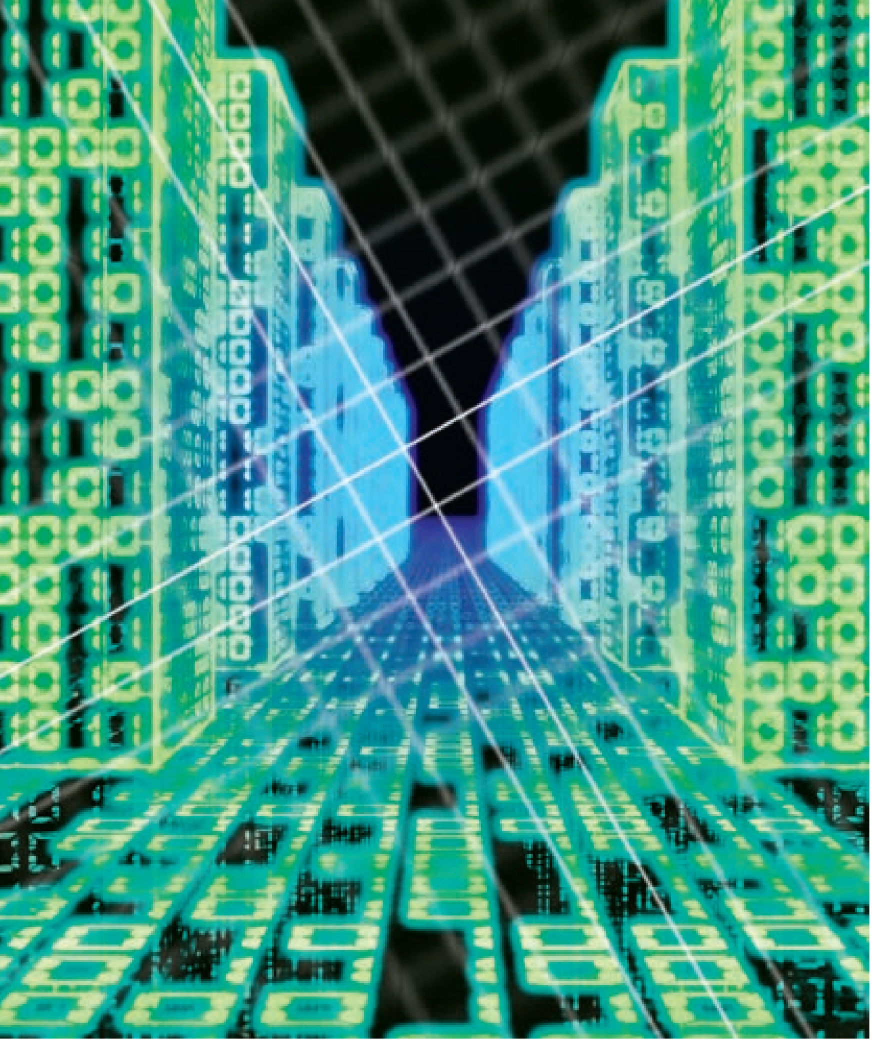
## MODERNIZATION: YES OR NO?

A good first step toward making this decision is to assess your infrastructure equipment to understand its operating efficiency. With this information in hand, you can determine annual operating expenses and compare them to the potential savings from modernizing your data center. A number of tools are available that will help you assess your existing equipment and compare it to more modern approaches in order to justify your savings. Once you understand your ROI, you will be able to make good business decisions about deploying a cost-effective, resilient and highly available IT infrastructure.

Taking advantage of the modernization opportunities discussed in this article may also prove to be the most cost effective approach to enabling growth and accommodating demands for additional capacity. Many data centers are capacity constrained by their technology. New technologies can support greater computing capacity, which may delay or eliminate the need to build new facilities or outsource computing. New technologies also provide insight into data center operations that can be used to maintain availability and improve planning.

*John Peter Valiulis is the Vice President Marketing, Thermal Management at Emerson Network Power. He can be reached at JP.Valiulis@emerson.com*

*David Sonner is the Vice President Marketing, Liebert AC Power at Emerson Network Power. He can be reached at David.Sonner@emerson.com*



by **Jim Harmon**

# DATA CENTER MAINTENANCE AND EFFICIENCY BEST PRACTICES

If your job responsibilities include data center site maintenance, you have a critical responsibility and face a huge challenge when it comes to meeting those obligations. Scheduling and conducting proper maintenance could mean the difference between reliable system operation or periodic failures and unexpected shutdowns.

The single most significant benchmark in measuring a good maintenance program is zero failures. Saving energy and controlling costs are important to an effective program, but they run a distant second when considering the need for a reliable maintenance program. When considering these decisions, it's important to remember that a small cost savings now could result in a costly future outage.

There are a number of steps that you can take in order to ensure reliable system operation. This starts with the premise that the data center design includes some level of redundancy along with a review to eliminate single points of failure. At this stage you must keep in mind that an aging infrastructure requires a more intensive maintenance program than a site with newer equipment.

EEC recently posted a blog article with some positive steps for data center and facility managers to keep their centers up and running, while concurrently assisting in energy saving and controlled costs. Although this is not an all-inclusive list, we will touch on a few of the key ideas and provide a checklist of tasks to consider for implementation:

## CONDUCT A REGULARLY SCHEDULED MAINTENANCE PROGRAM:

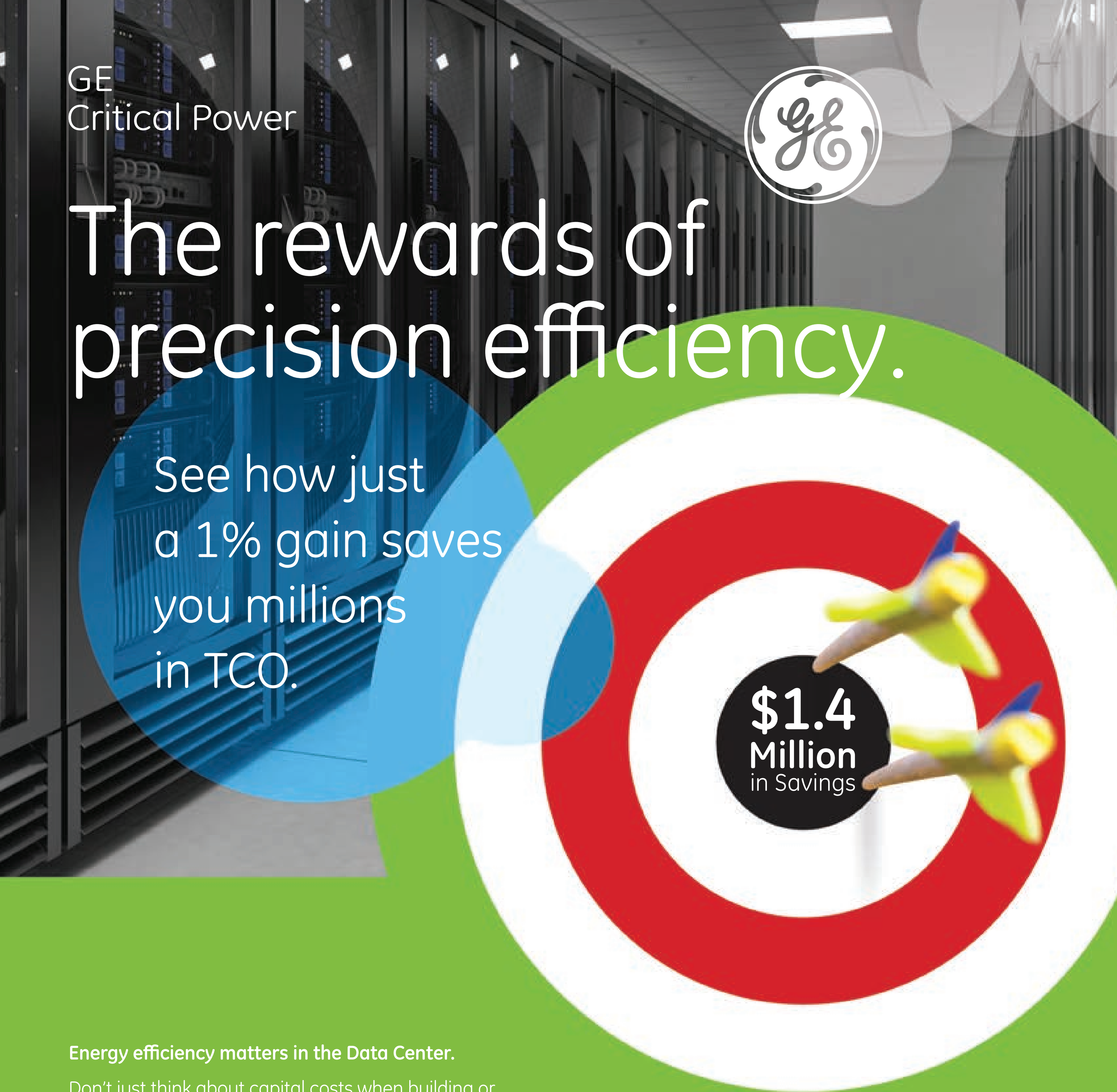
Proactive and preventive maintenance programs offer the best opportunity to identify problems early allowing you to take corrective action, while routine maintenance ensures reliable and continuous operation. This is especially true for CRAC units, Generators and UPS/Battery systems.

- **UPS batteries & capacitors:** Battery failures are the single highest contributors to load loss. A redundant battery string is a wise investment, but proper testing and maintenance is the key to avoiding costly downtime alongside review of date codes on batteries and capacitors to determine "end of life". Proactive replacement of these components will help avoid unplanned emergencies and costly failures.

GE
Critical Power

# The rewards of precision efficiency.

See how just a 1% gain saves you millions in TCO.




**Energy efficiency matters in the Data Center.**

Don't just think about capital costs when building or upgrading your data center. It's your operating costs—and how much energy you use to power the data center—where you can find significant savings.

Just a 1% gain saves companies $1.4M over a 10-year period—while a 3.5% gain saves up to $4.8M!

**See for yourself—the numbers don't lie!**

Learn more about the industry-leading reliability, efficiency, and ROI of GE Critical Power solutions for the Data Center.

**www.geindustrial.com/LookCloser**
**877 546 3243**

- **CRAC (Computer Room Air Conditioner):** In addition to proper maintenance, follow these tips:
  - **Turn off re-heat in CRACs** (if possible).
  - **Check glycol levels (freeze points):** water glycol mix – often over time water is added diluting the mixture in your glycol loop, which increases the risk of freezing.
  - **Cool servers per ASHRAE standards:** The latest ASHRAE standards recommend higher setpoints, allowing instant energy savings.
- **Generators:** Standby Power systems need routine maintenance to ensure reliable operation when a utility failure occurs. In addition to proper maintenance, consider these additional steps.
  - Frequently check the starting batteries and block heaters.
  - Frequently check and maintain the belts and hoses.
  - Frequently check and maintain all fluids.
  - After every PM activity, be sure the technician has returned the operating switch to "Auto".
  - Implement a program to annually sample and test coolant, fuel and oil for breakdown or contaminants.
  - Automatic Transfer Test – Using Building Load
  - Implement a program for annual load bank testing (more often if possible).
  - Implement a program for fuel polishing if the fuel will be idle for long periods of time.

## ROOM LAYOUT AND AIRFLOW MANAGEMENT:

- **Block the holes:** This will eliminate air loss, promoting proper air flow and improving static pressure:
  - Install blanking panels.
  - Seal cable cutouts with brush sealed floor grommets.
  - Block off the voids/holes in drywall below raised floor and above drop ceiling.
  - Seal all voids under doors leading into DC rooms and support areas.
- **Perform a Computational Fluid Dynamics (CFD) analysis:** This will simulate the airflow through your data center and identify problems that can lead to overheated servers. This is generally the first step in understanding issues and identifying opportunities for improvement.
- **Hot aisle/cold aisle layout:** This layout enables cool air to flow to air intakes on the front of the rack and hot air to exhaust out the back, then return to the (CRAC) return ducts. You will reduce hot spots and you could lower your power consumption significantly.
- **Use existing drop ceilings as a return plenum and install return air plenums on CRAC units:** This will direct the hot air exhaust from the back of the server racks to the return on the CRAC, reducing recirculation of hot air.
- **Use the proper floor tiles:**
  - Replace missing floor tiles.
  - Put floor grates or perforated tiles in cold rows, especially in front of the hottest racks. If necessary, rearrange or change to different floor grates to match the airflow to the heat load.
  - Avoid placing floor grates too close to the CRACs, this will "short circuit" the airflow, sending it right back into the CRACs and rob the rest of the room/row of sufficient cool air.
  - Install solid floor tiles in hot rows to prevent cold air from coming through the floor.
  - If you still have data center hot spots, consider installing directional or fan assisted floor tiles to move the underfloor cooling air exactly where it is needed.
- **Remove under floor obstructions in raised floors:** Unused cables beneath the raised floor tend to build up over time, thereby reducing or blocking airflow. Be sure to remove them to ensure high quality airflow to your servers.
- **Install variable speed fans or variable speed drives:** These devices are designed to automatically speed up or slow down as needed to manage air flow and reduce energy usage.

*Introducing the new*

# Centric 480VAC UPS

GAMATRONIC™

*Our Power Your Confidence*

Gamatronic has been preventing down time for more then 40 years & is proud to present our next stage in UPS systems.

The Centric 480VAC ranging from 30 to 960kW is the perfect solution for your power critical needs.

It is an all in one modular, scalable, transformerless UPS with a surprisingly small foot print.

## *Gamatronic, our power your confidence*

To learn more of Gamatronic's UL certified UPS systems visit us: www.gamatronic.com

Or email us: Ilanitg@gamatronic.com

# Mission Critical Lifecycle Services

If you're seeking a **world-class solution partner** in all phases of mission-critical products and services, Electronic Environments Corporation (EEC) is your logical choice. Noted for its outstanding industry contributions, EEC has an un-compromising reputation for excellence and a unique, **holistic approach to critical infrastructure.**


We bundle specialized services into **custom turnkey solutions** designed specifically for the IT and telecom markets, elevating and building your best interests within any custom solution. Because of our vendor-neutral values, we've earned a sustained reputation that begins and ends with a passion for customer success and enduring relationships.

Leveraging nearly three decades of proficiency in critical infrastructure solutions, EEC provides you with the highest levels of performance, reliability, and value. EEC also offers **fully integrated design, engineering, construction management, and maintenance solutions** that exclusively focus on the physical infrastructure supporting your 24x7 mission-critical operations.

EEC revolutionized traditional infrastructure solution deliveries with our holistic-approach, **Mission Critical Lifecycle Services**™. Through this approach, thousands of EEC customers have benefited from reduced costs, increased availability, enhanced responsiveness, and optimized performance. With strategic alliances, including NTT Facilities Group, EEC is able to provide integrated solutions worldwide.

CONTACT US
508.229.1400
info@eecnet.com
eecnet.com

NTT FACILITIES GROUP

Electronic Environments
Infrastructure Solutions

- **Institute Team Work Mode on large CRAC units** (if possible): By networking units together, you can prevent simultaneous cooling/reheat operations and simultaneous humidification /dehumidification operations.

## EXAMINE THE IT LOAD AND IT EQUIPMENT:

- **Institute an abandoned server removal program:** Remove unused servers that demand power.
- **Max out blade chassis** before installing additional chassis.
- **Install missing side panels on all server racks** (especially at row ends).

## ENERGY MANAGEMENT AND ENERGY SAVINGS OPPORTUNITIES:

- **Monitoring Systems:** Before making any large efficiency updates, you will want to determine how much energy is currently being used by installing a monitoring system. This will give you a baseline to measure your efficiency progress.
- **Install energy efficient UPS systems.**
- **Install metered rack PDU strips** (with monitoring capabilities if possible) – Metered rack PDUs provide power utilization data, allowing Data Center Managers to make informed decisions on load balancing and right sizing IT environments to lower the total cost of ownership.

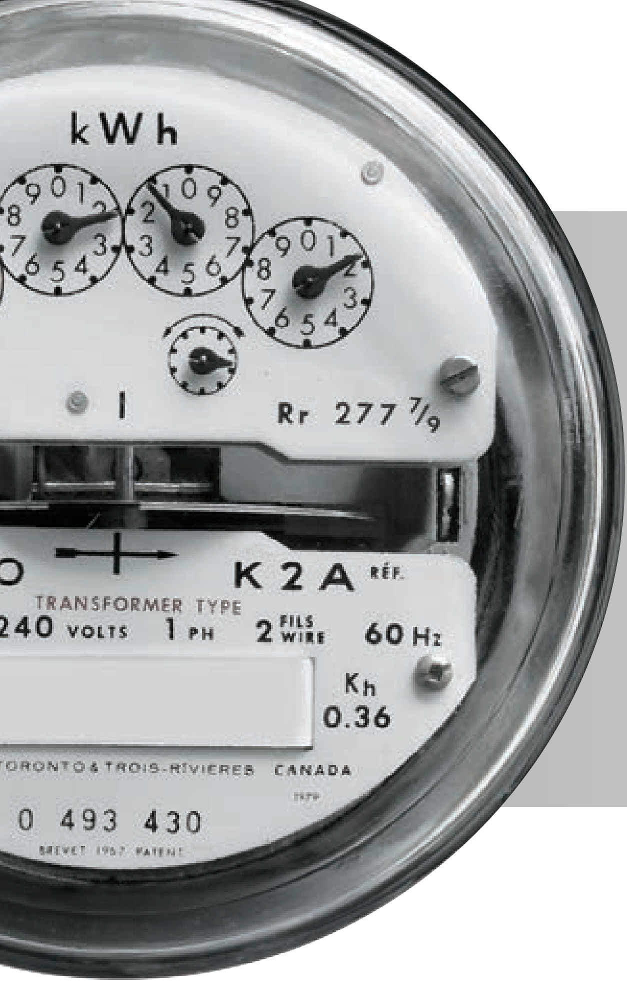
## CONDUCT A PROTECTIVE DEVICE COORDINATION STUDY:

This will ensure that the data center electrical distribution operates as intended to isolate faults in the system and minimize unnecessary down time.

Although there are no true "quick fixes", initiating the simplest recommended best practices will allow you to begin to reduce downtime, control your data center costs and get started on the path to an energy efficient data center.

---

*Jim Harmon is the President at Electronic Environments Corporation, MCFS. He can be reached at jharmon@eecnet.com*



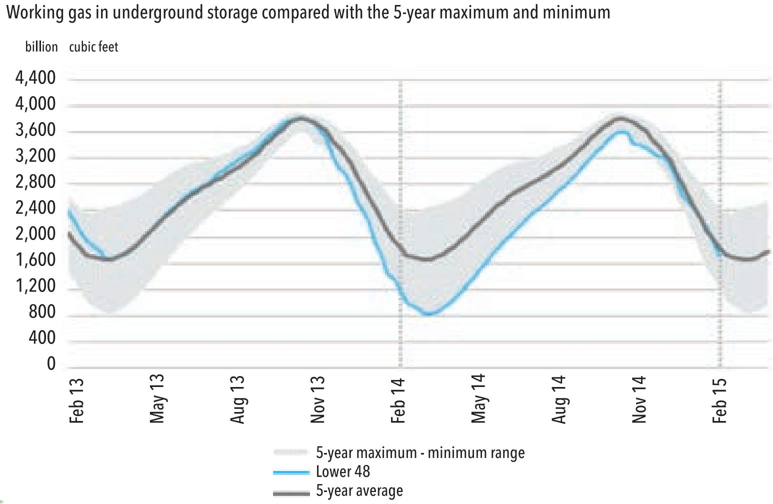

# HOW DATA CENTER OPERATORS CAN AVOID ENERGY PRICE HIKES IN AN UNPREDICTABLE MARKET

by **Tim Comerford** and **Joe Santo**

Energy consumption is one of the largest operating expenses for a data center, contributing to nearly 50 percent of total operating expenses. Due to 2013/2014 winter's "polar vortex" that caused a deep freeze in much of the U.S., many large energy consumers in unregulated markets saw their energy prices quadruple. In fact, we have seen a tremendous amount of volatility in energy prices over the last decade.

The beginning of 2015 has seen continued energy volatility with oil prices down approximately 50% from the fall of 2014. All the experts differ on when and if the prices will rebound. Natural gas prices this past winter were relatively stable; however, some regional markets saw significant swings due to cold weather in the eastern half of the country. Part of the volatility continues to stem from gas pipeline/capacity constraints in various regions.

Working gas in underground storage compared with the 5-year maximum and minimum




Source: U.S. Energy Information Adminstration

Data center operators and owners can minimize the impact of unpredictable energy markets by better understanding the markets and establishing smart energy procurement strategies. Below is background on energy pricing trends, factors likely to impact future pricing, and proactive strategies for procuring energy in an unpredictable market.

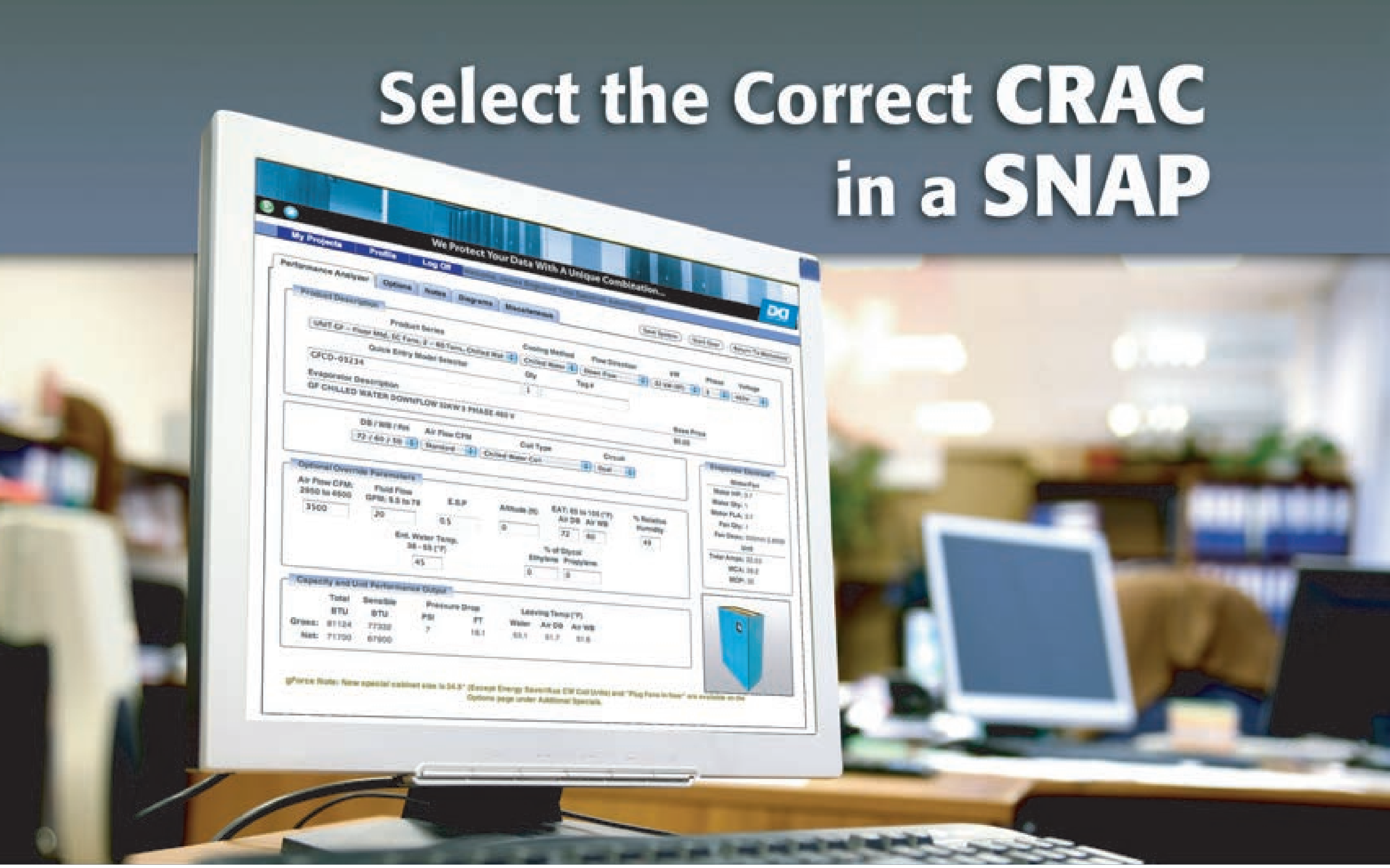
## FACTORS IMPACTING PRICING

There are a number of factors impacting natural gas and electric rates, including:

**1. Natural Gas Storage:** In the beginning of 2014, natural gas stockpiles hit the lowest level since 2004 as a result of cold weather and winter storms. The deficit was closed due to the mild weather during the summer of 2014, record gas


ATLANTA | AUSTIN | BALTIMORE | DALLAS | DENVER | HOUSTON | NEWPORT BEACH | ORLANDO | PASADENA | PHOENIX | RALEIGH-DURHAM
REDWOOD CITY | RICHMOND | SACRAMENTO | SAN DIEGO | SAN FRANCISCO | SAN JOSE | TAMPA | WASHINGTON DC | WEST PALM BEACH

# Select the Correct CRAC in a SNAP



## PRECISION SELECTION FOR MISSION CRITICAL COOLING AT YOUR FINGERTIPS 24/7.

**Data Aire's enhanced online Product Selector Guide now allows engineers to precisely dial-in and determine the exact CRAC unit, CRAH unit, heat exchanger, condensing unit or fluid cooler for any data center or mission critical cooling application.**

- User-friendly Product Selection tool that saves time
- Web-based software – accessible 24/7
- Calculate unit capacities and values instantly
- Develop engineering schedules and project reports
- Free registration

Protecting data processing centers from overheated and humid environments has been Data Aire's mission for over 40 years. For more information, or to register as a user, contact Data Aire at 800.347.2473, or visit dataaire.com.

Register here.

dataaire

production and a mild start to the 2014-15 winter season. By the end of February 2015, storage was about 500bcf higher than the same time in 2014, but about 140bcf below the five-year average.

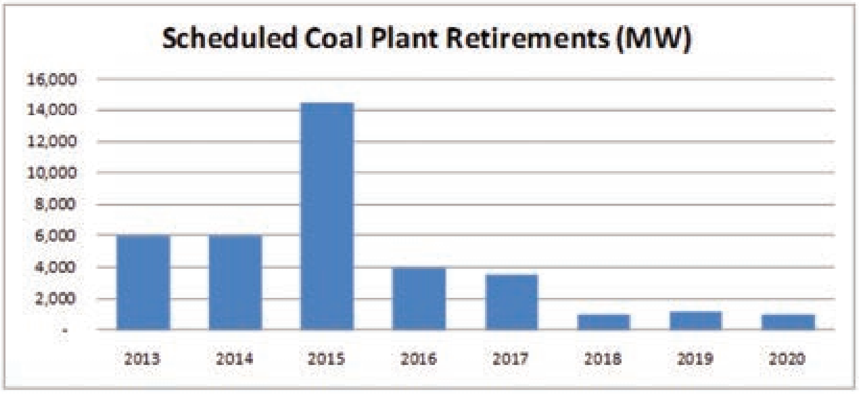
What do these numbers mean for energy pricing? Storage should be in pretty good shape heading into the summer 2015. But the question will be how hot the weather will get. A very hot summer will mean more gas being used at electric power plants, which will reduce the amount of gas going into storage.

**2. Retirement of Coal-Fired Power Plants:** Natural gas generation of electricity continues to grow as coal-fired power plants are retired. This has created a permanent increase in demand for natural gas. A few key statistics are:

- Natural gas has become the fuel of choice for electric generation, especially as new EPA standards impact 1,400 coal and oil units.
- Scheduled coal plant retirements between 2013 and 2020 will result in increased natural gas generation.
- Approximately one-third of electricity in the U.S. is generated using natural gas. Another one-third is coal and the last one-third is comprised of all other (nuclear, renewable, etc.).

As coal-fired power plants are retired, the increased base load natural gas demand for electric generation will increase price sensitivity.

**3. Natural Gas Exporting (Liquid Natural Gas):** In 2015-2016, large




energy companies will begin exporting natural gas to Asia and Europe where they can achieve prices roughly triple the price in the U.S. This will cause a longer term change to the supply-demand balance. It will also begin what could be a transition from a North American natural gas market to a global natural gas market (similar to oil).

**Worldwide Natural Gas Prices – Snapshot as of June 2014:**

- United States: $3.80 /dth
- Europe: $7.80 /dth
- Asia: $14.00 /dth
- South America: $15.00 /dth

## WHERE DO PRICES GO FROM HERE?

Natural gas and electric prices are at very attractive levels and are not far off from a 10-year low. How long prices will stay here remains to be seen. Weather will certainly be a driver in the short term. Longer term, we see demand for natural gas increasing due to coal plant retirements and increased natural gas exports. This increased demand will put upward pressure on both natural gas and electric prices. At these current levels, customers should give serious consideration to locking into a longer term deal.

## PROACTIVE MANAGEMENT IN AN UNPREDICTABLE MARKET

Energy procurement should not be an annual task, or something reviewed just prior to the expiration of a supply contract. This is an ongoing process which, if managed correctly, can lead to positive bottom line results despite the extremely volatile market.

There are two important strategies that can be employed when structuring an energy supply agreement to limit exposure to price run-ups or spikes:

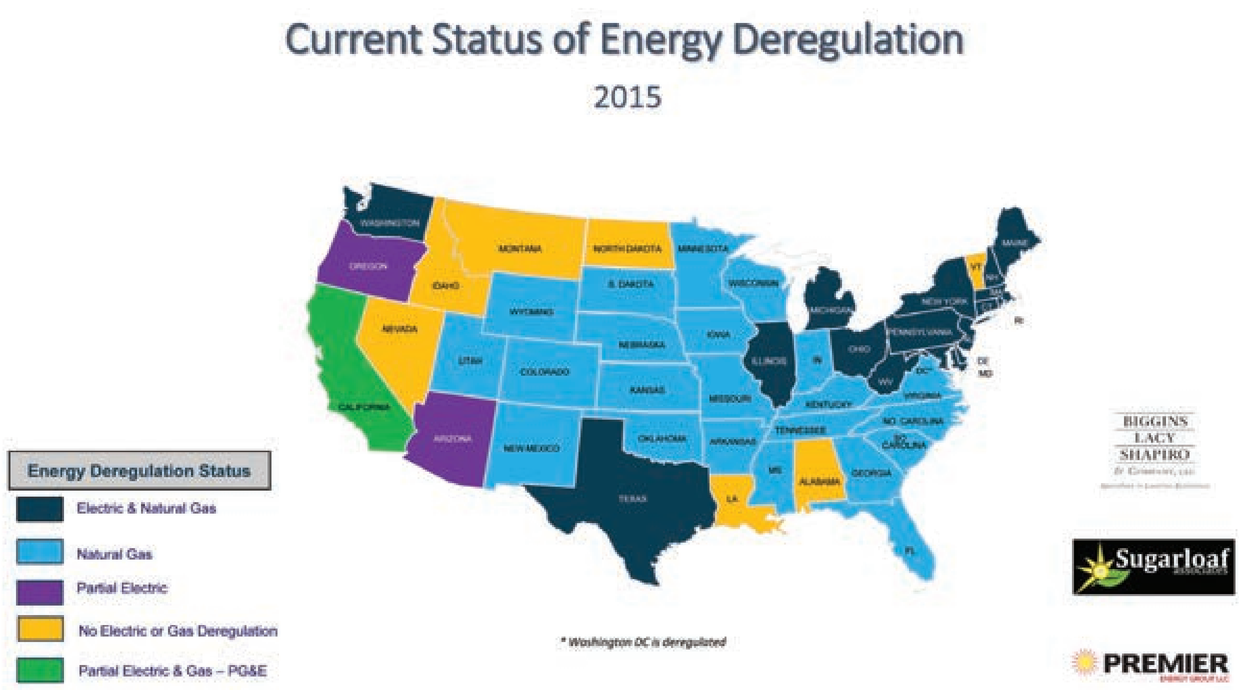
**1. A Fixed Price Agreement:** This is a common strategy that provides a customer with price and budget certainty. In this case, usage becomes the only variable that needs to be monitored and managed.

**2. A "Block and Index" Structure:** Here, a customer can fix all or a portion of the price. The pricing can be locked in blocks or percentage levels at different times. While this requires more management and oversight, it allows a company to dollar-cost-average their price, similar to what an investor would do with a stock purchase.

Given the energy factors discussed above and current market pricing for electric and natural gas, we could be faced with rising rates in the future. As a result, businesses need to look at the importance of proactively managing their energy procurement now in order to reduce the potential negative exposure that could be coming down the road.


**Graphic 1 - Natural Gas Price Trends**

*This graph shows the 12-month average future price trend for natural gas since April 2012. After reaching a 10-year low in April 2012, natural gas prices moved significantly higher over the next two years. Prices have since dropped and are now just slightly above the low reached in 2012.*




**Graphic 2 – Map of Deregulated Markets (PPT slide)**

*Tim Comerford is the SVP of Biggins Lacy Shapiro's Energy Services group and principal of Sugarloaf Associates. He can be reached at tcomerford@BLSstrategies.com*

*Joe Santo is the Principal and Director of Business Development at Premier Energy Group, LLC. He can be reached at jsanto@premierenergygroup.com*


**Every minute of downtime costs data centers an estimated $8,000.** That means accurate, reliable power system testing is crucial. ComRent Load Bank Solutions provides resistive, reactive and capacitive load banks in low or medium voltage. Our rack-mounted load banks precisely simulate high-density server loads and airflow for the best hot aisle/cold aisle testing. With ComRent, you test better.

**ComRent®**
**LOAD BANK SOLUTIONS**
**Our Knowledge, Your Power.**

***ComRent.com***
***1-888-881-7118***

# Five Reasons to Consider Prefabrication vs. Stick-Build

by **Eric Wilcox**

The IT industry is ever-changing, constantly creating the next big challenge for the data center manager. It's the nature of the beast – and it is what drives engineers, architects and technology vendors to create the next big solution.

One of today's industry challenges is the need for data centers to quickly and cost-effectively meet changing capacity demands. Prefabricated data centers are emerging not only as a viable solution, but as a fundamental change in data center construction practices.

Instead of a stick-build process, prefabrication allows for critical infrastructure systems to be assembled and tested as a complete sub-system in a manufacturing and controlled environment that are then deployed to the installation site. The result is a state-of-the-art, tightly integrated facility that can be deployed faster and at lower cost than a similar facility using traditional construction practices.

The benefits are numerous, but here are five of the top reasons data center managers should consider prefabrication vs. stick-build.


**Speed of Deployment** – The biggest driver of the move to prefabricated data centers is speed of deployment. Prefabricated data centers cut months off the project timeline and should be strongly considered by any organization seeking to accelerate data center deployment. The approach has proven to allow organizations to bring new capacity online 30 to 60 percent faster than traditional stick-builds. And since this speed is attained in a controlled manufacturing environment with the appropriate tools and expertise, quality is improved in the process.


**Scalability** – Because prefabricated data centers take a modular approach to design and fabrication, they are inherently scalable and may create opportunities to delay some portion of the capital investment required for a new data center until additional capacity is required. With a prefabricated solution, the growth plan is literally designed into the solution from the beginning. When additional capacity is needed, new modules can be added with minimal engineering and without disrupting existing operations.


**Design Flexibility** – Prefabricated data centers are not LEGO-like stacks of containerized IT, rather they are custom designed to a site and have no limitations in terms of functionality or aesthetics and can be as individualized as any business might prefer. A prefabricated data center will take advantage of the speed and economy of modular design and can be custom designed to match variables such as geography, climate, technology profile, IT applications and business objectives. It also includes an integrated approach where a lead technology vendor, architect, consulting engineer, contractor and supporting technology vendor(s) are brought together at the beginning to take a collaborative and holistic approach to the design.

**4** **Performance** – In a prefabricated data center, all systems are designed and configured in concert, resulting in a tightly integrated facility that can meet the highest standards of availability and efficiency. Assembly in a factory-controlled environment enables more control over the fit, finish and quality of workmanship, and supports more thorough pre-testing and optimization prior to delivery.

**5** **Cost** – One of the most powerful benefits of a prefabricated data center is that it does not require the value of faster deployment to be weighed against the additional costs commonly associated with faster delivery. Prefabricated data centers leverage economies of scale and streamlined processes made possible by offsite assembly to enable faster deployment at a lower cost.

In some situations, the economics may even change the cost-benefit analysis of expanding an existing facility or choosing a new build. A prefabricated data center may enable an organization to move a data center to a more desirable location at about the same cost as expanding and updating an existing facility.

Organizations have realized these benefits of prefabrication in limited sizes and configurations for years. Now, facility-scale, fully customizable data centers can benefit from the same approach.

Facebook is a recent example of how the process can shorten the time required to bring new data centers online. The company recently pioneered an innovative approach to data center construction called "rapid deployment data center" – prefabricating modules for an entire custom-designed, freestanding facility and then assembling those modules on-site.

While this example is specific to a hyperscale data center, that doesn't mean the prefabrication process is limited to that environment. It is viable for new builds of all shapes and sizes.

---

*Eric Wilcox is the Vice President of Engineering and Operations, Hyperscale Solutions at Emerson Network Power. He can be reached at Eric.Wilcox@Emerson.com*

# CALCULATING YOUR COOLING CAPACITY FACTOR: THE NEXT METRIC IN DATA CENTER COOLING

by **Lars Strong**

There is a global epidemic of excess cooling capacity in data centers. The average computer room today has cooling capacity that is nearly four times the IT heat load. To reduce energy use and save money, it is important to know your utilization of computer room cooling capacity. By calculating your data center's Cooling Capacity Factor (CCF), you can determine how well you're utilizing your cooling infrastructure and begin to identify potential gains that can result by making airflow management (AFM) corrections and controls adjustments. Surprisingly, while a great deal of focus is placed on improving computer room cooling efficiency, the average data center could still reduce their operating expense by $32,000[1] annually simply by improving airflow management and making adjustment to controls.

AFM improvements increase cooling effectiveness, efficiency and capacity, which results in greater IT equipment reliability and opportunity for operating cost savings. As cooling represents approximately half of data center power consumption, Power Usage Effectiveness (PUE) improves as well. With a reduction in energy usage, everyone benefits, as carbon emissions are also reduced.

The same AFM improvements also release stranded cooling capacity, which enables companies to increase server density without the capital cost of additional cooling equipment. Improved cooling utilization may also extend the life of a site, deferring capital expenditure required to add capacity to an existing site or even delay the need to build a new data center.

Numerous solutions are designed to improve cooling efficiency, ranging from something as simple and important as installing blanking panels to making an investment in a complete containment system. When your site eventually settles on a new cooling product or method, the question always remains: "What is the potential to truly make a difference?" After implementation, can more IT equipment be deployed? Will hot-spots be eliminated and/or reduce the PUE for your data center? How much of a difference will improved AFM make at the site? Or simply, are there too many cooling units running? To make informed decisions about investing in additional cooling capacity or AFM initiatives, you should first determine how well your current resources are being utilized.


"The financial world never stops, so having a dependable power source for our data center is critical. Our system was built to be redundant so we can perform maintenance without interrupting power. Effective and efficient, our Cat® C32 diesel generator sets give us 2 MW of power that seamlessly step in. We've had outages that didn't slow us down for a second and went largely unnoticed. Backed by Cat power, we've designed and built one of the most efficient data centers in North America."

**BUILT FOR IT.™**

**Learn more at www.cat.com/globalrelay1**

CAT®

© 2015 Caterpillar. All Rights Reserved. CAT, CATERPILLAR, BUILT FOR IT, their respective logos, "Caterpillar Yellow", the "Power Edge" trade dress as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.

# Ensure facility readiness before critical equipment arrives.

**The Avtron® advanced SIGMA™ control system enables you to daisy chain 14 load banks and operate them all with a single, hand-held terminal. One operator controlling multiple load banks increases overall test capacity and efficiency... saving time and money.**

Avtron load bank features:

- Full range of portable load banks - 100 thru 700 kW
- Lightweight portability - transports easily
- Simplicity - easy to operate and read graphic display
- Local load control - with station select switch
- Support and service - global availability


Load control is provided by Intelligent Hand-Held Terminal (standard) or by PC software (optional).

www.EmersonNetworkPower.com/loadbank • 216-573-7600

**Avtron Load Banks.**
**Just another reason why Emerson Network Power is a global leader in maximizing availability, capacity, and efficiency of critical infrastructure.**

AVTRON

EMERSON
Network Power

Emerson is a trademark of Emerson Electric Co. or one of its affliated companies; Avtron is used under license. ©2015 Emerson Electric Co.

## THE COOLING CAPACITY FACTOR

The Cooling Capacity Factor is calculated by dividing the total rated cooling capacity (kW) by 110% of the IT critical load (kW).

**COOLING CAPACITY FACTOR (CCF)**

$$CCF = \frac{\text{Total running Cooling Capacity}}{\text{UPS Output}} \times 1.1$$

The total rated cooling capacity is the sum of the running cooling units' rated capacities. If all cooling units are running, then this will be the same value as the total installed rated cooling capacity. For example, if there are 10 cooling units installed with a rated capacity of 30 tons each and seven are running, then the total running cooling capacity is 739 kW (7 x 30 tons = 210 tons, 210 tons x 3.52 = 739 kW). To convert tons to kW, multiply tons by the constant 3.52.

The IT critical load in the room is equal to the Uninterruptable Power Supply (UPS) output(s) for the room. Ensure that the UPS output used is only for the room being calculated. If the UPS feeds other rooms, then those loads must be subtracted from the total UPS output. To account for typical room load not reflected in the UPS output, add 10% for lights, people, and building envelope.

Cooling units are typically referred to by the manufacturer's stated capacity, such as a 30-ton or 20-ton cooling unit. If the manufacturer's stated cooling capacity is unknown, record the model number on the cooling unit nameplate and search online or call the manufacturer.

It is important to know that the manufacturer's stated capacity refers to the unit's total capacity at standard conditions, which refer to the temperature and relative humidity of the air returning to the cooling unit. Typically, the standard conditions are 75° F (24° C) and 45% relative humidity (RH). If the return air conditions differ, the unit will have a different cooling capacity. If the return air is cooler and/or moister than the standard condition, the unit will deliver less than the stated capacity. If the return air is warmer and/or drier than the standard condition, the unit will be capable of more than the stated capacity.

Calculation of CCF uses the manufacturer's stated cooling capacity because if the room layout is good and airflow management (AFM) best practices have been implemented well, then it will be possible for the unit to deliver at least the rated capacity. However, in their current state, many cooling units have a lower return air temperature set-point than the standard condition. The difference between the delivered capacity at current conditions and the potential capacity at the standard condition, or higher return temperature, is a form of stranded capacity.

## HOW TO INTERPRET YOUR CCF AND DETERMINE THE AMOUNT OF OPPORTUNITY AT YOUR SITE

For rooms with a CCF of **1.0** to **1.1**, there is little to no redundant cooling capacity. It is critical that AFM fundamentals be thoroughly implemented in these rooms to make available any redundant capacity and keep IT intake air temperatures as low as possible. It will likely be necessary to install an additional cooling unit(s) to have redundant capacity. AFM improvements will likely improve IT equipment intake temperatures and create an environment where cooling unit set-points can be raised, which increases cooling unit efficiency and capacity. However, there is no opportunity to turn off cooling units or reduce fan speeds.

For rooms with a CCF of **1.1** to **1.2**, the number of running cooling units is very closely coupled to the heat load in the room. If IT intake temperatures are not outside of the ASHRAE recommended range then AFM fundamentals have been thoroughly implemented. There is approximately one redundant cooling unit for every 10 units running. In some cases, this is sufficient to maintain the room temperatures if a cooling unit fails. Cooling units should not be turned off unless the room has 24-hour-by-forever monitoring and staffing.

For rooms with a CCF of **1.2** to **1.5**, there is moderate opportunity to realize savings from turning off cooling units or reducing fan speeds. This can often only be done once AFM improvements have been effectively implemented. This does not require full containment strategies, but does require thorough sealing of raised floor penetrations and open spaces in racks, and best practice placement of perforated tiles and grills.

A CCF of **1.5** to **3.0** is most common. These rooms have substantial opportunity to reduce operating cost, improve the IT environment, and increase the IT load that can be effectively cooled. Rooms in this range often have significant stranded cooling capacity that can be released by improving AFM.

Rooms with a CCF **greater than 3.0** have great potential for improvement since the total rated cooling capacity of running units is at least three times 110% of the IT load.

## THE COMMONALITY OF OVERLOOKED AFM IMPROVEMENTS

As the industry evolves, data center managers are challenged by ever-increasing IT equipment densities, and pressured to reduce operating expenses. Often, managers turn to advanced AFM solutions such as full containment. However, in many circumstances the expectations of these efforts are unmet because AFM fundamentals have been overlooked. Even if expectations are met, the full benefits of these solutions will not be realized unless basic AFM practices are addressed as well.

Figure 1

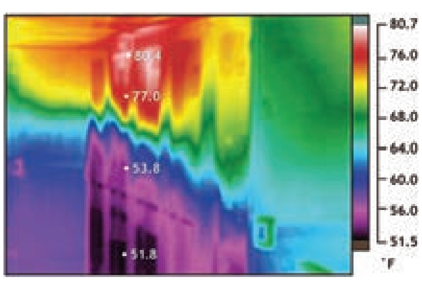



**Figure 1** shows a dramatic difference in the intake temperatures of IT equipment located in the bottom of cabinets versus the top in a fully-contained cold aisle. This is the result of an insufficient volume of conditioned air being delivered to the contained space due to unsealed cable openings throughout the raised floor. Compounding this, the contained aisle has open spaces between IT equipment in the cabinets that allowed conditioned air to flow out of the space and exhaust air to flow in. As a result, even though cold-aisle containment had been installed and the site had a CCF of 3.8 (380% more rated cooling capacity than heat load), IT equipment intake temperatures were not improved. A more cost-effective solution would have been to address AFM fundamentals throughout the site.

Another solution that is often inappropriately incorporated into computer rooms is fan-assisted perforated tiles, which are meant to address an insufficient volume of conditioned air to cool adjacent IT equipment. While fan-assisted tiles deliver more conditioned air, they do so at the cost of reducing the conditioned air flow rate coming out of perforated tiles in the surrounding area and increasing the electrical load in the room. In most cases, simply sealing unmanaged openings in the raised floor will enable existing perforated tiles to produce sufficient volumes of conditioned air. This solution has other benefits, such as increasing conditioned air volumes through all perforated tiles in the room, reducing or eliminating hot spots, and enabling the raising of cooling unit set-points. Calculating a room's CCF quickly identifies the potential for solving cooling problems. Obviously, there are appropriate applications and benefits of fan-assisted tiles: when raised floor heights and/or obstructions limit conditioned air volume in an area of a room, or high-density cabinets require more cooling than standard perforated tiles or grates can deliver.

The profound insights that can result from calculating a site's CCF and making fundamental AFM improvements is shown in the following case study of a 9,000-sq. ft. computer room.

The room had 170 cabinets drawing a total load of 240 kW and was cooled by seven cooling units, six rated at 70 kW each and one at 85 kW. Electricity cost is $0.10/kWh. As is often the case, the site manager was struggling to maintain appropriate IT equipment intake air temperatures even though the computer room CCF was 2.2. In other words, the running cooling capacity was 220% of the room's heat load, indicating that the site's cooling challenges were due to poor AFM and not insufficient cooling capacity.

To "right-size" the cooling infrastructure, simple improvements were made to the room, including:

- Sealing cable openings
- Installing blanking panels
- Adjusting both the number and location of perforated tiles
- Adjusting the position of a few cabinets
- Sealing spaces where cabinets were missing in a row

By making these low-cost improvements, we were able to eliminate all IT equipment hot spots and allowed for two cooling units to be turned off, which resulted in a savings of $21,900 per year and a payback period of less than eight months.

## REMEDIATION IMPROVING COOLING CAPACITY FACTOR

Calculating the CCF for a computer room reveals excess cooling capacity and opportunity for improvement. Following a practical, impactful, and cost-effective sequence of AFM initiatives that start with the raised floor, then move to the rack and eventually the row will save both time and effort and ensure that the full benefits of each effort are realized. After implementing AFM improvements, changes at the room level need to be made to reduce operating costs and improve efficiency. After each significant adjustment to the cooling infrastructure the CCF should be recalculated to check progress towards the CCF goal. As more improvements are made, this cycle needs to be repeated.

# IS YOUR UPS A
# WEAK LINK?

# DON'T LET IT BE.

Get the UPS that is proven to reduce the risk of failure by 80% versus a battery UPS.

When electrical interruption is not an option, reliability is key. Active Power's CleanSource® HD UPS is driven by motion: it replaces the weak link in traditional UPS – the batteries – with our integrated flywheel technology, ensuring backup power is available when you need it and improving the reliability of your electrical system.

DRIVEN BY MOTION
ACTIVE POWER®
UPS Systems | Modular Infrastructure Solutions

**Visit www.activepower.com to learn more.**

©2015 Active Power Inc. All rights reserved. Reliability statement based on published whitepaper *Mitigating Risk of UPS System Failure (#115).*

Throughout this process, it is important to utilize the "4Rs" in their proper sequence:

## 1: RAISED FLOOR

The first step is to seal all unmanaged openings in the horizontal plane of the raised floor. A thorough effort is required to identify and seal all raised-floor penetrations. Electrical equipment such as power distribution units often have large openings that need to be sealed. This task must be seen to completion because as each hole is sealed, the remaining holes release increasing volumes of valuable conditioned air. In some cases cable openings indirectly provide cooling by reducing the temperature of exhaust air flowing from the hot aisle through openings in cabinets such as missing blanking panels or open spaces between mounting rails and sides of the cabinet. In this condition, sealing cable openings may cause IT intake temperatures to increase. This can be easily remedied by sealing the openings in the cabinet. Adjust perforated tile and grate placements to make all IT equipment intake air temperatures as low and even as possible. This will include replacing perforated tiles or grates with solid tiles in areas where excess conditioned air is being provided, and adding perforated tiles to areas where intake temperatures are the highest. All perforated tiles and grates located in dedicated hot aisles and open spaces should be replaced with solid tiles.

## 2: RACK

The second step is to seal the vertical plane along the face of IT equipment intakes. Blanking panels that seal effectively (no gaps between panels) need to be installed in all open spaces within cabinets. The space between cabinet rails and cabinet sides need to be sealed (if not sealed by design). And open areas above the highest U spaces and below the lowest U space must also be sealed.

## 3: ROW

The third step is to manage airflow at the row level. Spaces between and under cabinets need to be sealed to retain conditioned air at the IT equipment face and prevent hot exhaust air from flowing into the cold aisle. Any locations where cabinets are missing in the row due to structural columns or decommissioning need to be filled. For high-density rooms and rooms with layout challenges (e.g. low ceilings, cabinet and/or cooling unit placement), partial or full containment strategies may be warranted. Doors on the ends of the rows are the first element of aisle containment to install.

## 4: ROOM

A common misconception is that AFM initiatives reduce operating expenses. In most cases, even with high percentages of excess cooling capacity running, the first three fundamental steps of AFM must be implemented before changes can be made at the room level to reduce operating expenses. Improving AFM will improve IT equipment reliability and free stranded capacity. However, to realize operational cost savings and defer capital expenditure of additional cooling capacity, changes must be made to the cooling infrastructure, such as raising cooling unit set-points, raising chilled water temperatures, turning off unnecessary cooling units, or reducing fan speeds for units with variable speed drives (VSD).

# CONCLUSION

Improving AFM is fundamental to maximizing cooling efficiency and improving IT equipment reliability in data centers. If your site has no IT equipment intake air temperature problems then determining your Cooling Capacity Factor will reveal if efficiency improvements and cost savings are possible. If your site does have intake air temperature problems, then calculating your CCF will reveal if problems are a result of a lack of capacity or a lack of AFM. By starting with CCF, you can understand the potential benefits and data center cost savings before investing in cooling solutions and/or AFM initiatives, helping to avoid the possibility of implementing an expensive solution that won't fit your needs.

*[1]$24,000 from turning off 4 cooling unit fan motors + $8,000 from reduced maintenance costs for the 4 units.*



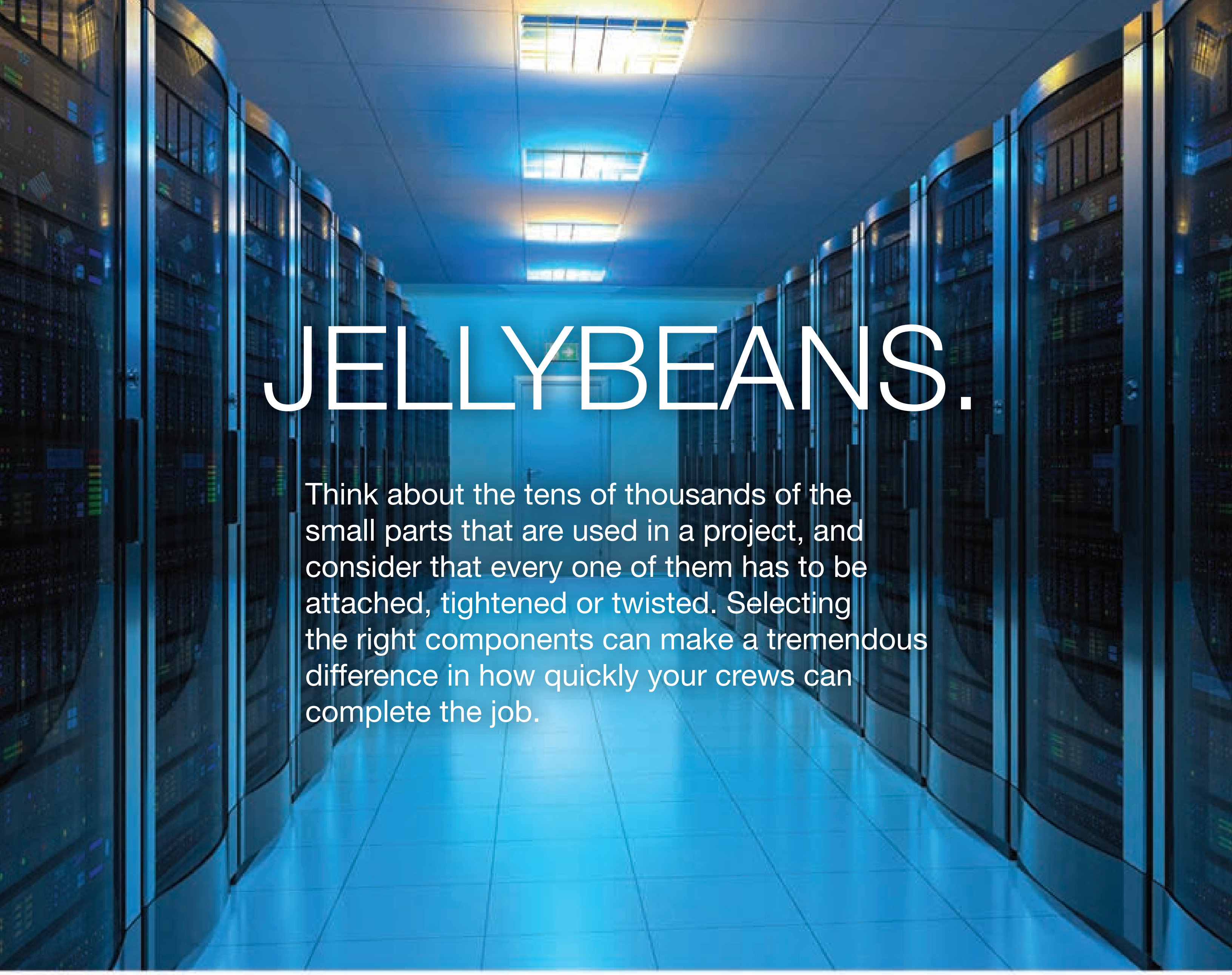
- ISO-9001 Certified
- 70,000 ft² of manufacturing space
- Strategically located for domestic and worldwide markets
- Over 65 years of experience
- Turn-key systems available
- Available Certified IBC Seismic Compliance
- Professional sales and engineering staff
- High performance, maintenance free materials
- Unparalleled customer service
- Expertise in code compliance, extreme sound attenuation and challenging applications

Like Us

BALTIMORE, MD

800.231.2258
WWW.PRITCHARDBROWN.COM


*Lars Strong is the Senior Engineer at Upsite Technologies. He can be reached at lstrong@upsite.com*



# JELLYBEANS.

Think about the tens of thousands of the small parts that are used in a project, and consider that every one of them has to be attached, tightened or twisted. Selecting the right components can make a tremendous difference in how quickly your crews can complete the job.

## What are we doing differently?

### Better connections.

We use the faster, simpler and cleaner compression method rather than the exothermic process. Connector costs are comparable, and the cost of the press can be quickly recouped from time and material savings. In a data center, major problems can hide in the power connections. T&B uses a special color-coded system that allows electricians to confidently and consistently use the correct parts together to allow for the best connection. Our color-coded system makes electrical connects as easy as matching colors.

### Quicker cable.

Our prefabbed cable trays allow for easy installations that save time and money for the end user. We eliminate all the measuring, cutting and fitting and allow for an installation that can be done with just one hand!

Thomas&Betts
A Member of the ABB Group

# INSIDE 7x24

GULF OF MEXICO
MEXICO
Mexico City
Puerto Vallarta
Los Angeles
Houston
Havana
CUBA
JAMAICA
HAITI
BELIZE
HONDURAS
NICARAGUA
GUATEMALA
EL SALVADOR
COSTA RICA
PANAMA
COLOMBIA
Quito
ECUADOR
GALAPAGOS ISLANDS
OCEAN
LEGEND
National Capitals
Other Cities

# 2015 SPRING CONFERENCE

**END-TO-END RELIABILITY: MISSION CRITICAL FACILITIES**


## SAVE THE DATE!


### Fall 2015
### Commitment to Excellence

November 15 - 18, 2015

JW Marriott San Antonio Hill Country

San Antonio, TX

### Spring 2016
### Navigating the Future

June 5 - 8, 2016

Boca Raton Resort & Club

Boca Raton, FL

For information about sponsoring a 7x24 Exchange event please contact Brandon Dolci, CMP at (646) 486-3818 x108

## INTERESTED IN PRESENTING AT THE FALL CONFERENCE?

Visit www.7x24exchange.org and complete the Call for Presentations or call 646-486-3818 x104

DEADLINE: **JUNE 19, 2015**



## SUBMIT AN ARTICLE FOR THE FALL ISSUE OF 7x24 EXCHANGE MAGAZINE

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

DEADLINE: **JULY 17, 2015**

CONNECT
COLLABORATE
DELIVER

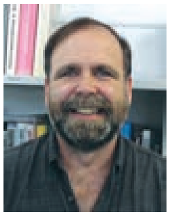
# 2015 SPRING CONFERENCE

**END-TO-END RELIABILITY: MISSION CRITICAL FACILITIES**

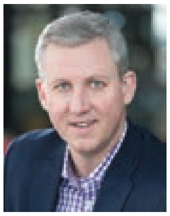
# 2015 SPRING CONFERENCE HIGHLIGHTS

The Fall Conference themed **"End-to-End Reliability – Connect, Collaborate, Deliver"** will be held June 7-10 at the JW Marriott Orlando Grande Lakes in Orlando, Florida. The Conference will feature compelling keynotes, high level speakers, concurrent sessions, an end user only forum, a women's forum, a spouse shopping shuttle, another spectacular sponsored event and more...

Captain Mark Kelly, Commander of the Space Shuttle Endeavour's Final Mission will kick off the conference with a keynote address entitled ***"Endeavour to Succeed"***. On January 8, 2011, Captain Mark Kelly would face the toughest challenge of his life when an assassination attempt was made on his wife, former Congresswoman Gabrielle Giffords. His dedication to family and Giffords' road to recovery would captivate the nation. For Mark Kelly, focus equals success–even in the face of adversity. Personifying the best of the American spirit, Kelly is a homegrown hero who was a combat pilot in Iraq, an astronaut on four space shuttle missions, and commander of the final flight of Space Shuttle Endeavour. He has combined teamwork, leadership, communication, and family in an unwavering commitment to succeed. Kelly shows audiences how to accomplish their mission while maintaining the love and devotion to family that is the foundation of true success.



Our second day will open with a Keynote entitled ***"Class – A Reliability Metric for Mission Critical Facilities"*** by Steve Fairfax, President of MTechnology.

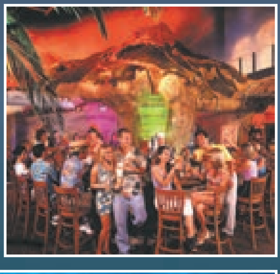


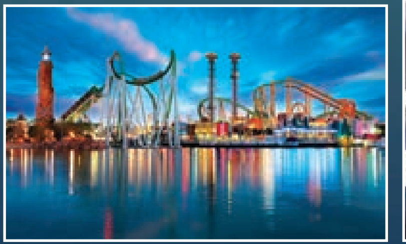
The closing keynote is entitled ***"How We Built A Fully Prefabricated Data Center"*** and will be delivered by Peter Ritz, CEO, Director & Co-Founder of Keystone NAP and Jason Walker, Director of Data Center Service Provider Segment, Schneider Electric.

## SESSIONS INCLUDE:

- Full Stack Optimization at GoDaddy
- Common Design of Colocation Data Centers in Diverse Climates
- PANEL: Achieving Efficiency Goes Beyond Technology
- Verizon – Leveraging Modular Infrastructure
- Data Center Leadership in the Better Buildings Challenge
- PANEL: The "Class" Act
- NWSC: A Reliable, Green Supercomputing Research Center
- Walking the Tightrope of a Colocation Service Provider

UNIVERSAL Orlando RESORT






## An Evening at Universal Orlando®
## 7:00 PM – 11:00 PM

Get ready for one of the most incredible events 7x24 Exchange International has ever thrown – a huge bash that fills three different venues and spills out into the streets of Universal CityWalk® followed by a street party in the middle of Marvel Super Hero Island® at Universal's Islands of Adventure® theme park just for you!

Strike out your hunger with classic hot dogs from ballparks around the country at the Hot Dog Hall of Fame®. Head south of the border for a taste of Mexico City at Antojitos Authentic Mexican Food. And enjoy the laid back island attitude of Jimmy Buffett's® Margaritaville®.

Then, you will be escorted to Marvel Super Hero Island® at Universal's Islands of Adventure® theme park where you'll have unlimited access to incredible rides and attractions. Battle villains high above the streets in 3-D on The Amazing Adventures of Spider-Man®, feel the rage of The Incredible Hulk Coaster®, and take fear to new heights on Doctor Doom's Fearfall®.

It's an entire evening of action and thrills – and it's all yours!

*© 2015 MARVEL. Hot Dog Hall of Fame is a registered trademark of Creative Attractions, LLC. Jimmy Buffett's® Margaritaville® Jimmy Buffett. Universal elements and all related indicia TM & © 2015 Universal Studios. © 2015 Universal Orlando. All rights reserved.*

ANTOJITOS Authentic Mexican Food | Universal CityWalk Orlando | Hot Dog Hall of Fame | Islands of Adventure | Margaritaville

**SPECIAL THANKS TO OUR PARTNERS THAT MADE THIS EVENT POSSIBLE:**

ABB · ActivePower · ASCO · Caterpillar · Clune Construction Company · ComRent · Cummins Power Generation · dataaire · DPR Construction · Ehvert · Electronic Environments · Gamatronic · GE Critical Power · Generac Industrial Power · IEM Industrial Electric Mfg · Miller Electric Company · Page/ · PDI · QTS · Raritan · Russelectric · S&C · Saft · Siemens · Sika Sarnafil · Simplex · Staco Energy Products Co. · Starline · Stulz · Syska Hennessy Group · marathon Thomson Power Systems · Whiting-Turner

SPONSORED EVENT – TUESDAY **JUNE 9TH**

7x24 Exchange International – The end-to-end reliability forum.™

CONNECT
COLLABORATE
DELIVER

# 2015 SPRING CONFERENCE

**END-TO-END RELIABILITY: MISSION CRITICAL FACILITIES**

## 2015 SPRING CONFERENCE CORPORATE LEADERSHIP PROGRAM PARTNERS (at press time)

### MARQUIS PARTNERS

Ehvert
SIEMENS

### GOLD PARTNERS

Clune Construction Company
PDI
Sika Sarnafil
Syska Hennessy Group

### SILVER PARTNERS

ABB
Active Power — Driven by Motion
ASCO
Caterpillar
ComRent
Cummins Power Generation
dataaire
DPR Construction
Electronic Environments — Infrastructure Solutions
Gamatronic — Our Power Your Confidence
GE Critical Power
Generac Industrial Power
IEM — Industrial Electric Mfg
Miller Electric Company — "Quality Service Since 1928"
Page/
QTS — Data Centers Powered by People
Raritan — Know more. Manage smarter.
Russelectric — Power Control People You Can Rely On
S&C
Saft
Simplex
Staco Energy Products Co.
StarLine
Stulz Air Technology Systems, Inc.
marathon Thomson Power Systems
WT Whiting-Turner

### BRONZE PARTNERS

AEP American Electric Power
Anord Critical Power Inc.
Armstrong
BTech
Carastro & Associates, Inc. — Mission Critical Engineers
Daikin
EastPenn
JE Dunn Construction
Nalco — An Ecolab Company
Purkay Labs
RF monitoring services
SEL Schweitzer Engineering Laboratories
Server Technology — Quality Rack Power Solutions
Siemon
Toshiba — Leading Innovation
UMP Data Center Cooling

### MEDIA PARTNERS

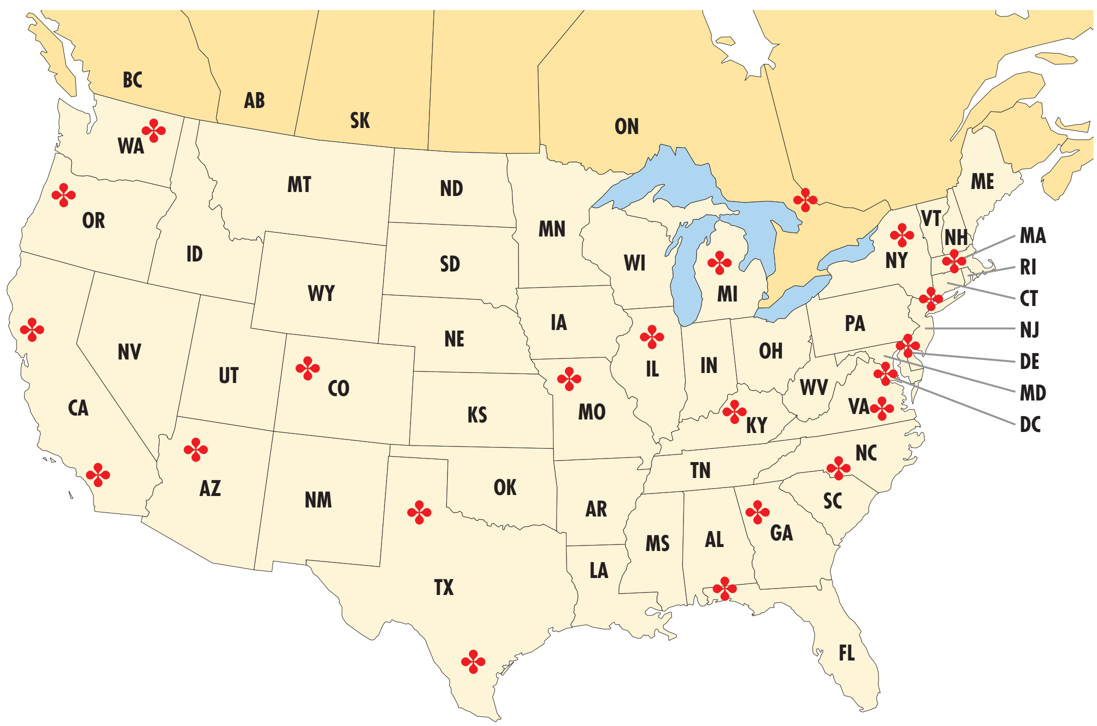
American Builders Quarterly
The Data Center Journal
Mission Critical

# BECOME INVOLVED IN YOUR LOCAL 7x24 CHAPTER

7x24 Exchange INTERNATIONAL

The end-to-end reliability forum.™

## INTERNATIONAL CHAPTERS

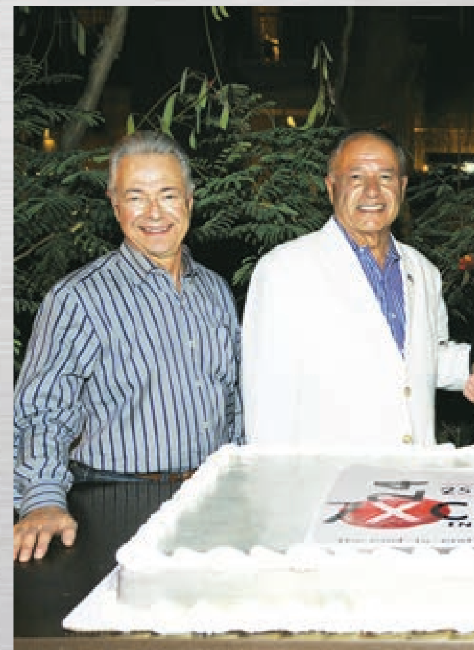



✤ = 7x24 Chapter

- Arizona
- Atlanta
- Bluegrass
- Canada
- The Carolinas
- Central Virginia
- Delaware Valley
- Empire State (Albany)
- Europe
- Greater Florida/Alabama
- Greater Washington DC Area
- Lake Michigan Region
- Lone Star (Dallas)
- Metro New York
- Midwest
- New England Area
- Northern California
- Northwest (Seattle, WA)
- Oregon & SW Washington
- Rocky Mountain
- Southeast Michigan
- Southern California
- Texas South

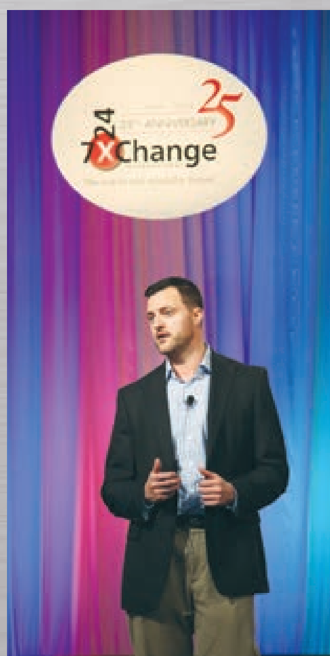
**VISIT WWW.7x24EXCHANGE.ORG TODAY TO PARTICIPATE IN YOUR LOCAL CHAPTER**

# 7x24 EXCHANGE INTERNATIONAL CELEBRATES ITS SILVER ANNIVERSARY




25th ANNIVERSARY
7x24 Exchange


ANNIVERSARY
hange


25th ANNIVERSARY
7x24 Exchange


The kill chain
THE ANATOMY OF A BREACH
25th ANNIVERSARY
7x24 Exchange
158

# SAVE THE DATE


**NOVEMBER 2015**

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | | | | | |

JW Marriott San Antonio Hill Country
San Antonio, TX

WWW.7X24EXCHANGE.ORG

Clune Construction Company


AN AWARD-WINNING GENERAL CONSTRUCTION FIRM — SERVING CLIENTS THROUGHOUT THE USA

Chicago | Los Angeles | New York | San Francisco | South Florida | Washington, DC

clunegc.com

SIEMENS

# Making data centers work smarter, in more ways than one

## Siemens: Your partner for comprehensive solutions that deliver maximum uptime, reliability and efficiency

© 2014 Siemens Industry Inc.

Integrated Data Center Management

The demands placed on data centers are as numerous as they are critical. Energy efficiency, reliability, security and scalability are just a few. Data center managers need an infrastructure partner they can trust to see the big picture. That's why more are turning to Siemens.

Our data center experts are there every step of the way. From planning to implementation to service, they deliver answers that improve the safety, security, efficiency and performance of data centers of every type.

We provide reliable power distribution with management tools that keep equipment online and improve efficiency. Our energy-efficient building automation, cooling and HVAC products control both consumption and costs. And with our Datacenter Clarity LC™ DCIM solution, performance can be monitored at-a-glance, allowing for smarter decisions and optimized total data center efficiencies.

With more solutions addressing the most critical needs, Siemens is the infrastructure partner data centers rely on.

www.usa.siemens.com/datacenters