HITEC Power Protection

WHITEPAPER | DATA CENTER

Optimizing the Medium Voltage Data Center

How to attain infrastructure reliability and reduce energy usage

Introduction

In this data-driven business environment, companies are keeping a watchful eye on their IT infrastructures – ensuring they can effectively support and grow alongside the business.

But attaining full infrastructure reliability and availability is not an easy proposition. It requires companies to track not only capital expenditures but also costs associated with powering these infrastructures.

And as energy prices continue to rise, harnessing power-related costs has never been more essential. Now is the time for companies to take a closer look at those tools specifically engineered to ensure data centers maximize their power needs.

The ever-growing demand

Despite the economic slowdown, one area of business investment that continues to post strong growth, year in and year out, is data center-related hardware and software – which inevitably increases the infrastructure's size.

Contributing to these enhanced footprints is the sheer volume of information generated by businesses; now that more people are working and being educated at home, the volume of internet traffic is incredible. Consider the normal amount of data used by companies and individuals on a daily basis: Everyone now wants their Netflix to stream immediately, the Amazon purchase to go without a hitch, real-time education software, a video chat with Grandma, not to mention everyday email with files attached. Once created, this information must be stored and managed. Today's user wants their information immediately, but they do not always understand and appreciate the immense infrastructure associated with how all this information is stored or moves across the globe.

Analysis reports note that the data center's demand is being driven by such forces as storage, virtualization, and cloud: "The cloud holds nearly endless possibilities for users, including the ability to store important information for business continuity, as well as the accessibility sought in the mobile workforce. As more organizations leverage the cloud for a variety of purposes, this adoption is creating increased demands in the data center sector, as well as a need to ensure that systems supporting the cloud function properly."

The cold reality is that larger data centers mean greater costs, increased power usage, and more resources necessary to harness these infrastructures. The question is, can these costs be better controlled? The quick answer: Yes!

What does it take to keep the world connected?

Ask data center managers what keeps their peers up at night and you will likely receive a common response: "Infrastructure failure". For today's data-rich companies, infrastructure uptime and reliability are a priority – as any outage can translate into major loss in revenue, as well as impacting daily lives. The root cause of downtime can often be traced to the supporting power infrastructure.

As the complexity associated with processing business-critical information increases, energy resources are being strained and failure is becoming more commonplace. That is why technologies such as uninterruptible power supply (UPS) are taking center stage to preserve uptime.

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The goal is "uninterruptible" power

Essential to any supporting power infrastructure is the backup necessary to limit damage. At the very core is a reliable uninterruptible power supply (UPS) solution along with an alternate power generator. UPS, often referred to as "battery backup", is a device that enables data centers to remain operational while transferring to a generator or other reliable power source. The system typically contains a bank of batteries that are activated when the primary utility source fails. Once activated, a UPS can guard against data loss.

But not all solutions are created equal. While many UPS systems rely on battery-based backup, facility managers are finding this a short-term solution to a long-term problem. Unfortunately, the very system designed to protect the infrastructure is often the biggest reason for failure and cost.

With this loss of data in mind – and a very real possibility – infrastructure is built with many layers of redundancy and thus stranded capacity, which quite often leaves facility owners with less than 50% utilization for the money they have invested in the security.

Where do you compromise and maximize the investment?

One of the biggest data center costs relates to space. With so many millions of square feet of data center facilities, combined with a minimum start-up cost of $1,000 per sq ft, this is no small investment. Making matters worse, battery UPS systems require a considerable amount of space.

It is estimated that a five-minute battery supporting a 400 kW load requires about 200 sq ft of additional space. This translates into an additional $200,000 in construction costs to house power backup alone.

Construction totals versus utilization results

Owners are building extra space and infrastructure for redundant systems, plus additional space for battery-based backup, and having customers lease white space at less than 50% power capacity.

This results in considerable stranded capacity and much higher long-term investment, and requires a much greater real estate or construction investment before they can see returns.

How much is enough?

When investigating UPS systems, companies typically gravitate towards static systems – believing that their battery-backed systems provide the most reliable source of power during a utility outage. Most companies are convinced that additional battery storage and ride-through time equate to reliability and uptime. But they are often mistaken.

Most analysts unanimously point the finger at battery UPS as the primary cause of prolonged failures. Recently, the Ponemon Institute backed up this theory. Its survey of data-center outages found that 91% of respondents had experienced an unplanned data-center outage, with the top causes being UPS battery failure (not the UPS itself) and human error. Searchdatacenter notes that poor design or inferior technologies often cause UPS systems to crash: "One of the most deceptive designations of all time is the uninterruptible power supply. The false sense of security this name implies has trapped many uninitiated … When everything works right, the UPS really does live up to its name. But when it does not, it can be a solid barrier between your equipment and perfectly functioning building or generator power. Try explaining this one to management! The lights are on, but your data center is down because that expensive UPS you wanted is out of commission." Quite often, a battery-backed UPS is not a long-term answer. That is when companies begin to explore their options.

With the wide range of costs associated with smooth data center operation, it would seem a highly efficient infrastructure is unattainable. Not so fast. Diesel rotary-based systems – which have been around since the 1960s – are opening up a whole new world for data centers, putting energy efficiency and maximum utilization of space and power front and center.

Going "old school" – defining a typical infrastructure

Typically, an "old-school" electrical distribution system mandates a series of power transformations – meaning energy must be stepped down accordingly. Power is often received from the utility at medium voltage (2400 V–35,000 V) and transformed to 480 V for distribution. Specifically, distribution across the infrastructure consists of several core steps:

- **Utility/Power source: Supplies power to the data center at medium voltage.**
- **Distribution: Power is stepped down to "distribution voltage" (480 V) at the sub station transformer.**
- **UPS: Power is then fed through the uninterruptible power supply (UPS), which conditions the power and backs up the infrastructure in case of an outage.**
- **PDU: The power is stepped-down yet again to 280/120 V by a power distribution unit (PDU), which is then stepped down to 12 Vdc – the operating voltage for IT equipment.**

Unfortunately, this model only adds layers of costs and greater inefficiencies into the power infrastructure. What is required is a system capable of accepting and distributing energy at medium voltage.

A new generation of power

In the truest sense of the word, a diesel rotary uninterruptible power supply (DRUPS) is the only system with the ability to provide continuous and conditioned power at the medium voltage level. Batteries can only store a limited amount of energy, meaning they are suitable for only minutes once power goes down. How many minutes depends on what the owner decides to buy and install – again, balancing cost versus space of the facility.

However, DRUPS devices can provide the correct amount of stored energy integrated with a diesel engine, designed with redundant starting features, thus ensuring continuous conditioned power backup when needed. This reduces footprint, real estate, and construction costs, and gives owners a much more attractive offering for their tenants, or to their CFOs in controlling costs.

Maximize your infrastructure – harness medium voltage

One obvious benefit to transitioning into a medium voltage system is found in actual physical cost savings. For example, a 480 V power distribution system mandates greater use of distribution materials, such as copper conductors. This is particularly frustrating as copper prices continue to rise exponentially. Medium voltage systems require smaller and fewer conductors, thus avoiding the excessive cost of copper.

Another issue created by 480 V systems is “voltage drop”. The term describes the way supplied energy of a voltage source is reduced as the current runs through a circuit. Higher voltage drops mean greater inefficiencies in lost power – as well as poor operational performance and potential damage to equipment.

Heat and its associated costs are also drawbacks to a lower voltage system. Under typical construction, a lower voltage infrastructure is comprised of conductors operating in groups. But medium voltage systems offer more power, meaning fewer clusters and less heat. The resulting drop in associated cost is significant.

Based on these arguments, it would seem logical to transition into a more modern distribution infrastructure – fully leveraging the benefits of medium voltage. Unfortunately, it is often restricted by the core “old school” infrastructure components, such as the uninterruptible power supply (UPS) and multiple transformations, as described above.

The "new school" – optimized medium voltage distribution

The DRUPS solution ignores "old school" limitations and allows the infrastructure to be built at the medium voltage level and then allows distribution throughout the facility at this same medium voltage using the much smaller copper conductors. It also provides versatility with the facility to allow the users of this power to optimize the voltage level for the cooling infrastructure, as well as the diverse tenant applications within a data hall. For example, the facility cooling may operate more efficiently using 4160 V motors, but a tenant may have a better operating system using 415 V/240 V servers, and another tenant may be operating 480 V/208 V servers. Simply distribute the medium voltage to its point of use, and step down as needed.

In the case of medium voltage systems that have been properly designed for redundancy, if one tenant uses less than 50% of the power available, that power can be distributed elsewhere through the facility to keep utilization at a level much greater than 50% – and quite possibly greater than 75%.

Additionally, compared to static systems, the life expectancy of a properly maintained DRUPS system is over 25 years. This means significant time and cost savings – putting valuable dollars back into the annual budget. Also, users need not worry about the environmental impact of toxic battery chemicals upon disposal.

A DRUPS system is specifically designed to drive uptime and reliability. Its ability to provide immediate power also gives an added layer of protection to a UPS system. Furthermore, by supplying high, short-circuit current to activate load protection fuses, the DRUPS systems reduce the risk of damage due to a short circuit.

The next step

Cost efficiency of data centers is one of the biggest challenges for businesses today. It is a data-driven world, and few companies can afford to be without a reliable IT infrastructure. This makes power efficiency and reliability a priority – and companies must look long and hard at the power sources feeding their infrastructures. While static UPS is often the most logical choice, it is not always the best. Now is the time to look at rotary-based UPS – including those backed by diesel.

When you dig deeper, DRUPS could mean the difference between efficiency and squandered resources. To learn more visit hitec-ups.com or call our sales team for more information:

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