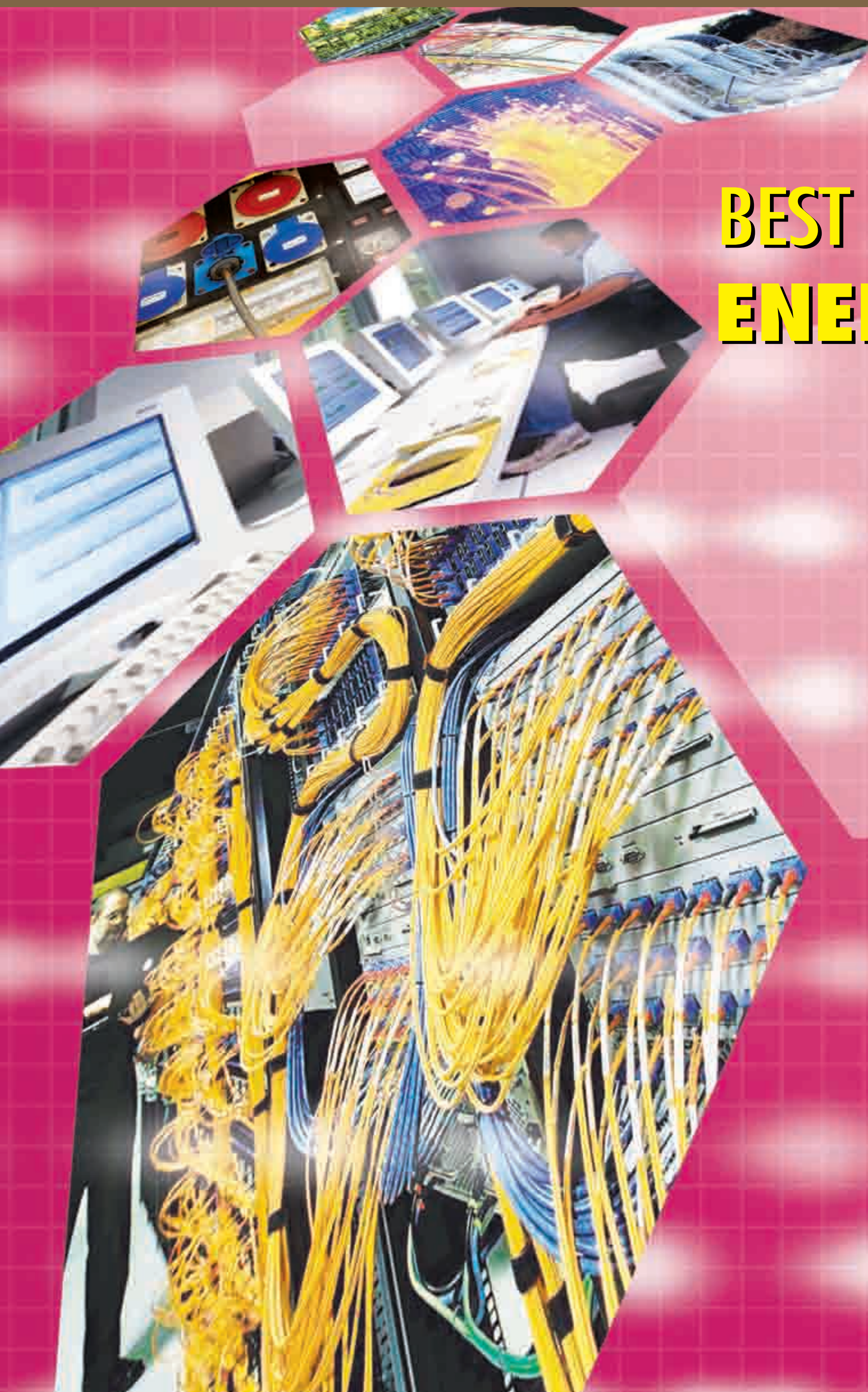
THE MAGAZINE OF 7x24 EXCHANGE INTERNATIONAL

NewsLink

FALL 2006



BEST PRACTICES FOR AN ENERGY-EFFICIENT DATA CENTER & MORE...

7x24 Exchange International

The end-to-end reliability forum.

www.7x24exchange.org

Effectively Planning for Growth and Change in Datacenters

EQUIPMENT NEEDS AS A MAJOR CHALLENGE

by Johnny Hembree, AIA

Owners and operators of 7 X 24 datacenters have no small task in planning for growth and change in their equipment needs. This is because new equipment creates new power supply issues, which in turn significantly affect heating, ventilating, and air-conditioning (HVAC) designs.

Owners can effectively design their facilities to meet these needs – today and well into the future – by adopting one of several emerging design strategies. These include water-cooled equipment racks, natural gas vs. diesel generators with potential dual fuel sources, and improved battery efficiency / maintenance / racking for decreased building square footage.

Cooling Challenges and Solutions

Watt density in modern datacenters is 400 watts per square foot – a load that won't soon decrease. The increases are the result of smaller processors, which allow more equipment to be stacked in datacenter racks. Modern blade servers, for example, fit into a 1U environment rather than the traditional 2U configuration used for older servers. While this makes it possible to double server capacities in existing footprints, a single blade server draws more watts per square foot, and puts out more heat per square foot, than the two traditional servers it replaced.

This apparent technological wonder single-handedly affects the center's power and subsequent cooling needs. A traditional hot-aisle, cold-aisle cooling strategy cannot match the increased heat with only increased cool airflow. To deal with the more intense cooling requirements, the industry has taken a cue from the water-cooled mainframe servers that characterized the 1970s and 1980s: engineers have designed water-cooled racks matched to contemporary server racks.

However, the technology that can support heat gains and increased watt densities creates another problem: water, a silent but very destructive foe for the datacenter environment. Given the potential damage that a water leak might cause, designers must answer serious engineering questions about leak detection, containment, and emergency procedures before they adopt this technology – but the problem is not insurmountable, as long as the solution is properly designed.

Another issue involves the end users' ability to manage the active data floor as they add, move, and change servers in the system, because inevitably, they will also need to add, move, and change racks. The industry must think through the procedures for making such changes in a water-cooled environment on a live data floor.

The aeronautics industry offers some direction toward solutions. The harsh environment of outer space requires technology that ensures against fluid and air leaks during quick equipment connections and disconnections. Water-cooled datacenter racks could use similar connection technology. This would allow the end user to react to ever increasing business demands for adds, moves, and changes without fearing a liquid catastrophe.

However, if designers and industry experts cannot adapt systems to this new technology in a controlled environment, then they must rethink the existing cooling units relative to footprint and cooling tons available. The real reason for the raised floor is for servers, not infrastructure. So, as more units are added to raised-floor environments, more square footage is lost for rack/server placement.

An innovator of internet banking technology, S1 Corporation required a state-of-the-art datacenter with on-site operations command. The facility includes 1,000-SF control center featuring three 100 inch rear projection screens and custom consoles in a raised access floor environment.

12,000-SF datacenter on a 12-inch raised floor with N+1 redundancy for cooling and electrical infrastructure.

Norcross Technology Center, Norcross, Georgia
Photo Credits: John Grunke

Left unaddressed, this could lead to the demise of the mega-centers that corporations need. Their need for cooling systems that support continuing growth in watt density means that the building square footage devoted to infrastructure is surpassing that of the raised floor for server racks. Thus, at a time when investors are driven by profits and not shortfalls, the ultimate project cost cannot be dealt with in the basic pro-forma.

Natural Gas vs. Diesel Generation: can they work together?

Increasing datacenter power requirements also demand more powerful generator backup systems. In today's large facilities, end users have taken to installing 2-megawatt diesel backup generators rather than natural gas generators that cannot match such a megawatt output.

Diesel generators have their own inherent problems. Compared to natural gas, diesel fuel can sometimes fall into short supply. Thus, facilities must store sufficient supplies – enough to keep the generators running for 24, 48, or even 72 hours. Facility owners must then determine how much fuel to store, how to store it, and how to address the fire hazard. Some owners or facilities may desire to deal with these issues by burying the tanks, which necessitates EPA regulations.

The S1 Technology Center in London required a state-of-the-art datacenter with on-site, 24/7 operations control center for European operations. Features of the facility include redundant power with UPS and generator backup, dual fiber optic feeds and interconnectivity between the Norcross, Georgia and London datacenters allowing for dual control of network traffic, adding another level of redundancy. Client server racks are located on the main level, while network racks are located on the mezzanine level providing separation of Internet and Intranet traffic.

S1 London Technology Center, London, UK

Designers should challenge generator manufacturers to do two things:

1. Increase natural gas generators' technology such that they, too, can reach the increasing wattage needs of 2 megawatts and beyond.
2. Design a generator that can utilize a duel fuel source. Such a system would use natural gas as its base line, which would provide for a much longer run time without the need for refueling. A failsafe diesel fuel day tank would provide 24 hours of run time in case the natural gas supply is interrupted.

With these two approaches, datacenters could sustain themselves longer than ever imagined during a catastrophic event.

Battery Power

When a datacenter loses power, the uninterruptible power supply (UPS) system sees to it that backup batteries take the load immediately. Meanwhile, the generators come up to full load to support the facility coming back on line. As long as the end user can access diesel fuel, the facility can continue to operate. The batteries need only supply power for a few seconds.

In light of today's worldwide political turmoil, however, it is not impossible to imagine a power outage caused by some interruption to oil – and thus, diesel fuel – supplies. In this event, batteries may have to provide longer run times of four, eight, and 12 hours – enough to give managers additional flexibility in locating emergency diesel fuel supplies.

The Need for Improved Battery Technology

Datacenters have traditionally used wet cell batteries for backup power. Dry or gel cells cost less up front, but only last five to seven years, compared to a wet cell's lifespan of eight to ten years. If gel cells could be made to match wet cells' life expectancy, however, they might lower battery backup costs by an acceptable amount – given wet cells' maintenance requirements.

Wet cells require regular attention. Facility managers must constantly monitor them, periodically adding electrolites to ensure continued electrical charges. Wet cells not only require this labor, they also take up valuable real estate. Typically, they are stacked in two-tier racks. More recent designs, in an effort to increase battery backup run time, have added a third tier to these racks. End users have resisted this change, though, because it adds to maintenance expense and increases safety risks to technicians.

Enter gel cells. Not only do they cost less than wet cells, but also do not require the same amount of maintenance. Thus, they cut labor costs, allow users to save square footage, and reduce overall building costs because they are more easily stacked into this 3-tier environment.

In order for such a plan to work, battery manufacturers must find ways to boost gel cells' life expectancy to match wet cells'.

In Closing

Water-cooled racks, natural gas/diesel-powered generators, and improved back-up battery technology/racking strategies are three potential ways that datacenter designers – and the entire industry – can support increasing cooling needs due to power demands. These solutions can also reduce costs associated with the increasing building square footages that larger infrastructures demand. As time passes, engineers may develop additional techniques, and one or two measures will emerge as viable alternatives to the others. Ultimately, such strategies will support increasing datacenter power and cooling requirements while remaining cognizant of the spiraling costs that affect companies' profits, and their datacenters' validity, around the world.

Johnny Hembree, AIA is Principal of Pieper O'Brien Herr Architects Ltd. He can be reached at johnny.hembree@pobarchitects.com.