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# Mission CRITICAL

*Data center and emergency backup solutions*

**2014'S**  
FRESH NEW LOOK!

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# BACKUP POWER SOLUTIONS

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# UNINTERRUPTIBLE POWER SUPPLY SERVICE CAN TAP THE POWER OF PREDICTIVE MAINTENANCE

An ounce of predictive maintenance is worth a pound of peace of mind.

**U**tility power plants have an impressive track record for uptime. They have developed predictive maintenance protocols and parts inventories that document the life of each component down to the tiniest fuse. They know when components will need replacing, and how to use each one most efficiently during its lifetime. They have service and maintenance experts checking systems all the time, waiting to find a problem. And it works — when was the last time your local power plant closed down due to parts failure?

By Jon Frank

Jon Frank is the CEO and cofounder of DC Group, which was established in 1991. Named on the Inc. 500/5000 six consecutive years, DC Group provides uninterruptible power supply service and maintenance throughout the United States and Canada.



## BACK-UP POWER NEEDS A NEW OUTLOOK

Interestingly, and despite the equal importance of back-up power, the uninterruptible power supply (UPS) industry has been slow to adopt a similar standard. Notwithstanding the high costs of this approach, we still see site managers operating on a “run until parts failure” basis, and maintenance companies allowing events and breakdowns because of faulty parts. Of course at that point a UPS service provider comes in and fixes the problem. But the damage — in terms of lost revenue and business interruption — has already happened.

## WHAT HOLDS US BACK?

The UPS service sector has been slow to adapt to our changing world. Twenty years ago, when the inevitable UPS failure happened, the traditional “guy with a toolbox” showed up, fixed it, and wrote a report. Paper reports on each incident meant there was little tracking or planning for the future because the information was inaccessible or poorly organized. Customers who relied on these local independent contractors were used to being “in the dark” about the status and condition of their UPS units. In terms of professional service, the bar was set pretty low.

Jump ahead to 2014 and the landscape is entirely different. The entire economy is built on free flowing, constantly accessible data supported by massive server arrays, which require UPS systems to smooth the flow of power coming in and back up the grid in the case of an outage. UPS site managers can no longer afford to be in the dark. UPS service has to change with the times, which requires a predictive mindset and a proactive approach that takes parts maintenance seriously.

## A PREDICTIVE ATTITUDE ADDRESSES THE PRESENT AND THE FUTURE

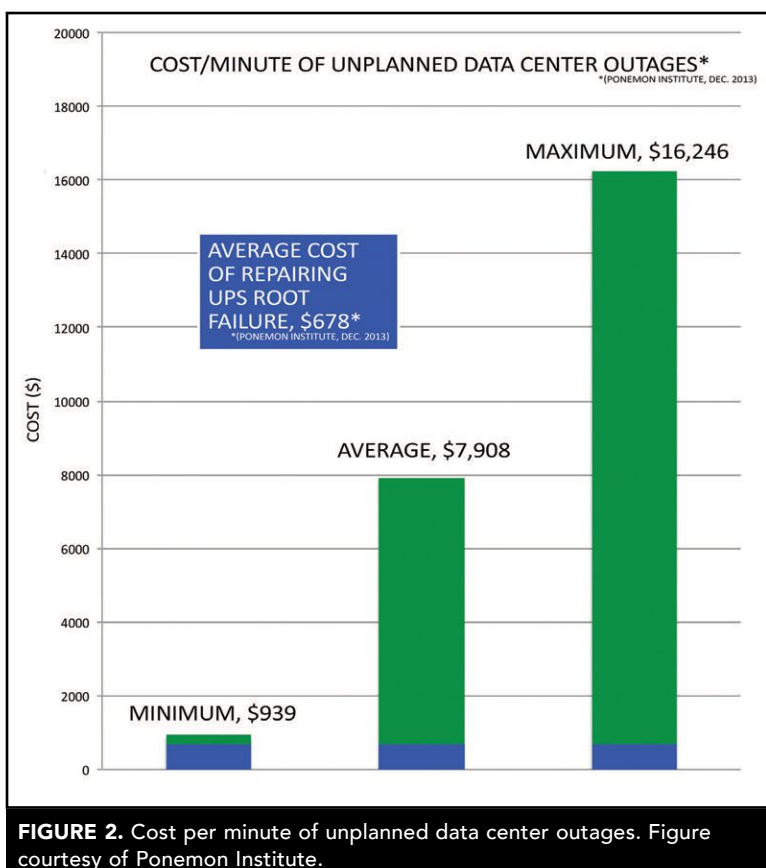
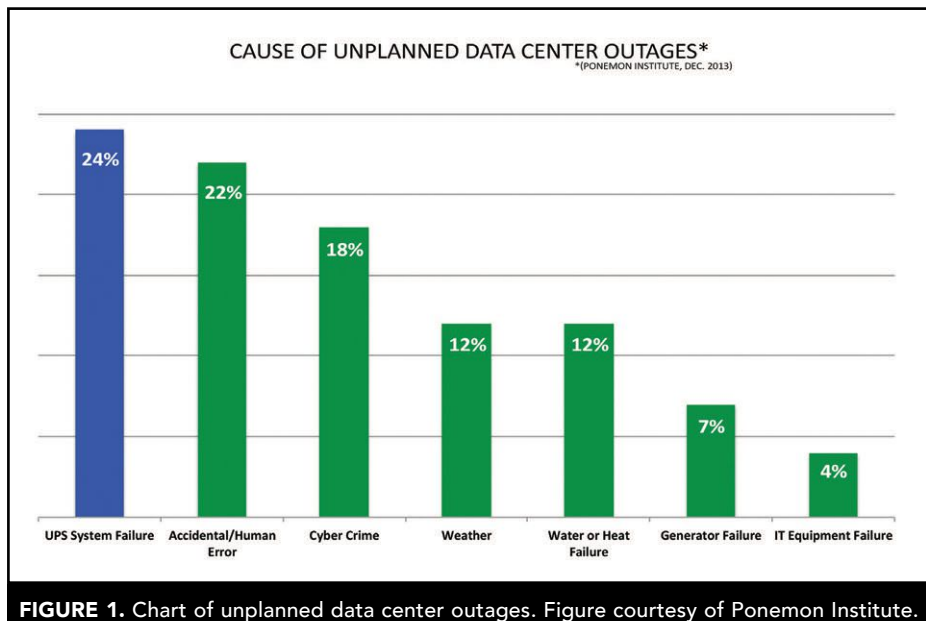
A proactive service plan will be customized to the age, condition, and environment in which a UPS system operates, as well as the timing needs of the site. Planning considerations are numerous and include factors such as humidity, how often the UPS receives transient spikes, and if the UPS unit is potentially subject to chemical spills and leakage, or ultra violet light. Good operating and cleaning practices, or the lack of them, have a significant impact on proactive maintenance scheduling. As far as timing, planned shutdowns for expansions, rebuilds, inventories, and vacations also dictate when the more involved proactive work can be accomplished.

In addition to regular ongoing service, a rigorous, proactive maintenance plan makes room for ongoing changes and improvements to tasks as part of an overall continuous improvement effort. Taking measurements and documenting changes, and determining why and how a component failed is the first step in determining how to prevent subsequent failures.

Ultimately, a proactive approach will give managers an improved mean time between failure (MTBF), the measurement of UPS system behavior and reliability. MTBF uses the number and types of failures that UPS equipment actually experiences in the real world, with calculations assuming that a system is renewed after each failure. A recent power quality industry study found that with regular proactive maintenance, the MTBF of critical systems rose by 27%.

## A PROACTIVE APPROACH TO COMMON COMPONENTS

There are three parts of a UPS unit that require regular replacement. These components do the heavy lifting when it comes to keeping your UPS unit functioning at optimum efficiency and preventing failures.



**Fans.** Faulty fans can cause significant temperature problems, load loss, or even complete operations failure. Some fans fail because of their own electrical or mechanical limitations, some fail when their bearings become dried out. Other fans may perform well for more than 10 years of continuous use.



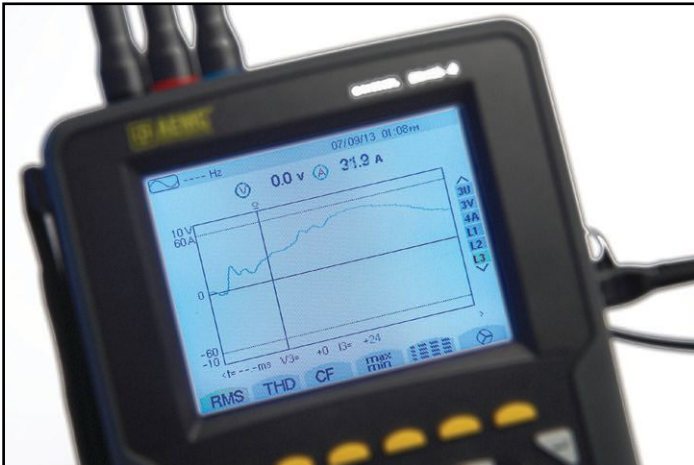


FIGURE 3. An example of a UPS testing meter.



FIGURE 4. Typical UPS units.

Fans dissipate heat from SCRs, insulated gate bipolar transfers (IGBTs) and power modules, cooling heat sinks from the rectifier, and inverter assemblies. A regular check is the only way to predict whether a fan is likely to stop working.

**Batteries.** Batteries are the heart of any UPS unit and they require inspection and maintenance regardless of their age or warranty status. Studies show that up to 20% of UPS unit failures can be attributed to batteries. Luckily, data can be obtained from the batteries thorough testing procedures that trace the battery performance and identify any potential internal failures.

**Capacitors.** A typical UPS unit contains a dozen or more capacitors of different types and sizes, which smooth out and filter fluctuations in voltage. Like batteries, electrolytic capacitors degrade over time, but like fans their lifetimes may vary. A capacitor might be rated for five years of constant use, but it could potentially deliver up to 10 years of useful life under favorable conditions. When a capacitor fails, there might not be any visible effects, but other capacitors must compensate for the additional workload, which shortens their useful lives. Poorly performing capacitors affect harmonics, resulting in higher utility bills. Equally concerning is the fact that capacitor failure may ruin battery strings resulting in an additional expense. Regular and thorough inspection of capacitors helps enhance their lifespan and allows for a more precise estimate of when they might fail.

There are more than 30 steps involved in proactive maintenance parts checks. In addition to monitoring the environment

### Toward a Predictive Mindset: Essential Factors for a Predictive Approach to UPS Service

Outlined below are key factors that facilitate a predictive mindset for UPS service.

- **Service before sales.** Service plans should be customized to each site and designed to maximize the service life of UPS units, not to replace them.
- **Technology.** Comprehensive tracking of components, events, multiple power sites across the country, budgets, and maintenance scheduling requires sophisticated data organization. Ideally, that data is organized proactively vs. passively to keep you on track and on schedule. Your data, past and present, is key to getting the most from your equipment and your proactive maintenance plan.
- **Communication.** The best service and documentation can be rendered worthless without effective communication between field tech engineers, account managers, and site managers. Together they should operate as a team to maximize efficiency, trend and forecast maintenance/parts replacement, and deliver the best results for your UPS budget.

around the UPS unit, a proactive check will assess all parts, filters, relays, motor operators, and the status of the firmware. Every element has to be inspected because, like the data center itself, a UPS system is only as reliable as its weakest part.

## PREDICT A BUDGET, SAVE MONEY

A proactive maintenance plan allows managers to predict a budget, not just a failure. By assessing what parts need replacing and when, a forward-looking shopping list can be created and implemented into an annual budget. As an added benefit, regular parts replacement helps equipment run more efficiently, which leads to more savings. Replacing capacitors on time, for example, can lower utility bills. Replacing fans can prevent extremely costly damage that results from overheating.

As part of planning that budget, a proactive maintenance strategy should also include an understanding of where an organization is headed, as well as its priorities for continuous operations. For example, is the UPS system currently lightly loaded? Is the business experiencing growth whereby those UPS units will soon be under much more severe usage? Is the organization planning on expanding and installing more UPS units? How resilient must the operation of the mission critical system be, and what does the organization consider a fast response? How much will an outage incident cost today and how much could it cost in one year?

## SMART TECHNOLOGY POWERS: A PREDICTIVE APPROACH

Now and into the future, managers of critical systems need to be able to monitor the maintenance status of all of their UPS components and technology makes it possible. For example, the D-Tech system allows site managers to predict when their UPS consumable parts will need replacing through screens for tracking, budgeting, and forecasting parts replacement up to 10 years. This technology is a necessary tool for mission critical site managers to increase their effectiveness and ensure facility uptime. D-Tech also allows for streamlined communication between account managers, field tech engineers, and site managers to ensure seamless proactive planning and budgeting.

A large data center with multiple UPS units across a number of sites all over the country cannot be maintained proactively without a smart system behind the scenes. All parties need access to the key data all the time. In short, technology makes a predictive maintenance approach possible.

## PROACTIVE PAYOFF

Transforming to a predictive maintenance mindset is an investment. It may require hiring additional expertise, or purchasing more parts upfront. But it's an investment that pays because the alternative — UPS system failure — can be financially catastrophic. In December 2013, the Ponemon Institute released a study exploring the costs of data center outages. They found that, in 2013, on average, a single outage cost organizations more than \$627,000.

## Tactical Advice: Proactive UPS Maintenance Protocols Include the Following Steps

Ensure that your UPS maintenance is proactive and includes the items below.

- **Audio visual inspection.** A technician inspects the UPS environment for dirt, debris, cracks, corrosion, and other potential operational hazards and also listens for anomalous sounds that indicate a bent fan, worn bearing, or lack of synchronized operations.
- **Capacity check.** With UPS operating in normal condition, a technician measures Rectifier Input Voltage and current, bypass input voltage and current, bypass frequency, UPS output voltage and current, UPS output frequency, Delta voltages, rectifier ripple, and battery ripple.
- **Battery assessment.** A technician checks and records DC charging current flowing through each battery string, AC ripple voltage, and AC ripple current of each string. Verifies battery voltages and records. Checks and records the voltage from positive to ground as well as negative to ground.
- **Bi-directional load tests.** A technician places the UPS in by-pass and transfers critical load(s) and verifies proper transfer of load. The technician then retransfers load(s) to UPS and tests UPS to ensure proper operation per OEM specifications.
- **Technician training.** A technician ensures that field technicians are up-to-date in their knowledge of all the makes and models they support so that they can work safely and efficiently.

event, averaging approximately \$9,000 per incident. As this equipment manufacturer outlined: "The residual, downstream effects of a data center outage often are far more costly than the costs to detect and remedy the root cause of an outage after it has already occurred." Clearly, it pays to adopt a predictive mindset.

## THE WAY FORWARD

The idea of investing in a sophisticated system of maintaining UPS systems is daunting, but taking a wait-and-see attitude and operating on the "run until parts failure" basis doesn't cut it in a 24/7/365 world. Mission critical facilities are expected to deliver more while increasing efficiency, eliminating downtime, and adapting to constant change. Site managers must push past any resistance and adopt a predictive maintenance mindset. Working with the right maintenance plan, with the right experience, technology and support for your site, will justify itself in a matter of months. ■

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