

Battery - UPS Systems in Data Centers

Design Considerations

Vincenzo Ceccarelli Grimaldi

March 20, 2024

Introduction to UPS Systems

- Power grids' instability has increased over the last 40 years.
- Factors include lack of infrastructure upgrades, renewable energy integration, and extreme weather.
- UPS and generators are critical for backup power in data centers.
- Power anomalies can disrupt operations, causing significant financial and reputational damage.
- A UPS serves as a bridge power source until generators can take over.
- The design of UPS systems directly impacts data center reliability and efficiency.

Key Factors Affecting Power Stability

- Aging power grid infrastructure with minimal upgrades.
- The complexity added by renewable energy sources to the grid.
- Increased frequency of catastrophic weather events.
- Growing reliance of businesses on onsite backup power systems.
- Importance of seamless power transition to avoid data loss.
- Need for high UPS and generator investment to ensure business resilience.

Critical Success Factors for Power Backup

- UPS systems' design must balance capital costs and power availability.
- Critical loads in data centers demand uninterrupted power supply.
- Cooling systems are often only generator-backed, posing a risk during power transition.
- High-density racks in modern data centers increase the need for UPS-backed HVAC.
- Redundancy is key to reliability but increases costs.
- The UPS battery runtime depends on risk tolerance and IT application resiliency.

Designing for UPS Reliability and Availability

- All systems eventually fail; design must aim for maximum reliability.
- Data centers utilize redundancy (N+1, 2N designs) to enhance uptime.
- The challenge lies in optimizing design for both cost and reliability.
- The choice between N+1 and 2N designs affects both CapEx and OpEx.
- Proper design ensures UPS systems support critical loads effectively.
- Redundancy levels directly influence data center operational resilience.

UPS Battery Technology Choices

- Traditional VRLA batteries have been the standard for UPS systems.
- New lithium-ion technologies offer significant advantages over VRLA.
- Lithium-ion batteries feature longer life expectancy and lower TCO.
- The choice of battery technology impacts operational risk and maintenance costs.
- Each technology has its specific application scenarios in data centers.
- Transitioning to lithium-ion can offer long-term cost savings and reliability improvements.

Overcoming Power Anomalies

- Data centers face both brief and extended power anomalies.
- UPS systems are crucial for bridging short power interruptions.
- Generators provide long-term power backup during extended outages.
- Efficient design and deployment of these systems mitigate operational risks.
- Power backup solutions must be tailored to the specific needs of each data center.
- Collaboration with solution architects can optimize power backup strategies.

Conclusion

- UPS systems are critical for maintaining data center operations during power outages.
- Design considerations must balance reliability, cost, and operational efficiency.
- Emerging battery technologies offer opportunities for enhanced UPS performance.
- Strategic planning and design are essential for deploying effective UPS solutions.
- Continued innovation in UPS technology will drive future improvements in data center resilience.
- Proactive investment in advanced UPS systems can safeguard against evolving power challenges.

Thank You for Your Attention!

Questions?