Article
PCS100 Medium Voltage UPS - Data center power trends

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Data center designers are increasingly adopting the maxim that bigger is better. Driven to a large extent by the shift toward co-location, hyper-scale data centers are becoming more common. As centers have grown larger, they have also grown more generic and their product more of a commodity business.

Today, data-buying decisions, once the required availability level is defined, basically come down to price, and the prime target in driving that price as low as possible is energy. Considering the amount of power consumed, and the fact that energy is typically the largest controllable cost, data center managers are eager to squeeze every possible percent out of their electricity cost.

Energy efficiency

In the quest to reduce energy consumption, uninterruptible power supply (UPS) systems are an area of intense interest, and new technology and operating procedures are showing promise.

Eco-mode is a UPS energy-saving feature whereby the load is supplied via a static bypass line. In the past, this solution has mostly gone unused because the cost-benefit equation has not been sufficient to warrant the increased risk. A normal double-conversion UPS converts the input AC to DC. The batteries are connected to the DC source to provide continuous charging, and then the DC is inverted back to AC to power the servers. Power loss occurs during those conversions. In eco-mode, the bypass path connects the input AC directly to the output AC.

“There are several reasons operators are more likely to use eco-mode today,” said Perry Field, General Manager for ABB Power Conditioning. “First is improved technology both in the UPS and in the servers they power. UPS technology has improved to a level where operators are more confident that, during a power event, the UPS will transparently compensate. On the server side, the built-in ride through capability is well proven, reducing operator concerns about protecting power-related events.”

Another factor is that power outages are less frequent in the typical hyper-center than in smaller facilities. Larger facilities tend to be connected to transmission-level mains, where long outages are infrequent.

In the past, the one to two percent energy savings delivered by eco-mode were not worth the risk. But technology improvements have improved the risk profile and, in the ultra competitive hyper-center market, saving one percent in energy costs provides a desirable cost advantage.

Reusable energy

Often there is more talk than action in the area of reusable and renewable energy, but there is little doubt that both will become increasingly important sources of increased efficiency and reliability in the years ahead. Here, the mantra of “reduce, reuse, recycle” may be appropriate.

There are various strategies being considered to reduce the heat generated in a data center. One is the use of DC voltage to power servers. The AC-to-DC transformer in each server is a major heat generator, but by eliminating the transformer, you can greatly reduce the heat.

Widespread adoption of this approach is unlikely in the short term. In the meantime, operators are looking for ways to reuse and recycle that heat.

While some data center construction occurs in relatively remote areas in order to take advantage of low land/space costs, other projects take the opposite approach, locating their centers in urban areas. In this scenario, the heat generated from the servers can be used to warm adjacent buildings. These centers also have the benefit of proximity to major data trunks.

Renewable energy

Many data center operators are closely investigating renewable energy. This offers the potential for lower-cost energy and provides an alternative to the grid in areas where reliability is an issue. Of course, renewables have their own reliability issues. The wind may not blow and the sun may not shine, or they may do so at times when power is not really needed.

“To realize the benefits of renewables while overcoming their limitations,” Perry explains, “data centers can rely on a microgrid approach that combines multiple resources such as the grid, diesel generation, and renewables. It is no simple task but it is being done successfully, mainly in remote communities or industrial facilities where grid-delivered power is particularly expensive or unreliable.”

Technology is available today to successfully address issues related to the shifting power flows that occur in microgrids. Energy storage converters can deliver power when needed and absorb power when the renewables produce more than is currently required.

“Because of the complexity of microgrids, most data centers are better off simply identifying a low-cost power source from the local utility,” Perry observes. “However, in places where there are constraints on power sources or that do not have access to reliable electricity, people are seriously investigating these alternatives. As technology evolves to further simplify microgrid management, you will see data centers increasingly embrace the concept.”

More medium voltage

Technology does not always scale up well. The low voltage (<480 V) systems used in data centers provide a good example. Enterprise-scale centers are well-suited to utilizing low voltage power. As centers grow, though, the drawbacks of low voltage begin to add inefficiency and increase both capital and operations costs.

The capital costs of a low voltage system are higher because they require large conductors, big switchboards, and multiple circuit breakers. Maintaining all these devices increases ongoing maintenance costs. Medium voltage systems, on the other hand, provide a more centralized approach. While a low voltage system may have 10 UPS units at a lower power rating, a medium voltage system may have only two or three.

“As the current in a medium voltage system is lower, the efficiency of the whole system is extremely high. Our medium voltage UPS products provide 99.5 percent efficiency compared to the very best double-conversion, low voltage UPS systems that are in the 96 to 97 percent range. The

ABB’s PCS100 Medium Voltage UPS is designed for mega data centers

comfort level that operators have with traditional, low voltage systems means that adoption of medium voltage topology is likely to be cautiously slow. However, as industry leaders begin to make the transition, the move to medium voltage is a trend that we expect will accelerate.”

Medium voltage systems will provide benefits in very large data centers, but the benefits can extend down to smaller installations in the 5 to 10 MW region as well.

Tracking trends

In many industries, trying to predict trends is difficult. But in the data center market, some trends are easily identified. One such trend is that, for the foreseeable future, more processing will be done in hyper-centers, and these massive warehouses of computing power will relentlessly seek solutions that reduce costs and give price advantages. Increased energy efficiency through new technology, including more advanced UPS systems and medium voltage topology, provides a promising path to greater efficiency.

“Manufacturers will continue to respond to customer demand for further technology improvements, leading to even greater enhancements in energy efficiency and power quality,” Perry predicts. “Technology advancements combined with the willingness of data center operators to explore new approaches to energy management, will drive continued operational innovation and efficiency.”

To find out more about ABB’s medium voltage UPS offerings:

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