Green Data Center Achieves 20% Efficiency Savings for Large Children's Hospital

One of the ten largest children's hospitals in the country, Phoenix Children's Hospital provides specialty inpatient, outpatient, trauma, and emergency care to patients throughout Arizona and the Southwest. As a nonprofit institution, Phoenix Children's Hospital relies on donations, grants and gifts for funding. One way in which the hospital demonstrates strong stewardship of its funds is to fully pursue green initiatives that save money on energy, allowing resources to be spent on issues that directly benefit its young patients.

For its recent $538 million expansion, Phoenix Children's Hospital partnered with Kitchell Contractors Inc. and Sparling electrical engineers and technology consultants to design and create a highly energy efficient data center to comply with "Green Guide to Healthcare" principles. This was a priority to Phoenix Children's Hospital, Kitchell and Sparling. In addition to being "green," it was critical that the data center solution support the many diverse systems needed to support a complex, evolving healthcare facility. This was an opportunity to lay the foundation for many years of community healthcare support.

Kitchell and Sparling chose Chatsworth Products, Inc. (CPI) to collaborate on product specifications and customization. CPI offers premium, customized

Phoenix Children's Hospital, Photography by Blake Marvin/HKS, Inc.

products and the most energy efficient methods for thermal management, all of which give the hospital's data center an adaptable configuration that will serve it far into the future.

Challenges

The stresses placed on the existing data center were enormous. The original data center was a modest 2,000 square feet, with 22 cabinets and racks. In addition to expanding the space to 6,000 square feet and 48 cabinets and racks, the team had to address several obstacles. The first challenge was the launch of a new Electronic Medical Record (EMR) system. In order to launch the new EMR system, older systems had to be farmed out to save space and careful planning and implementation were central in bringing all of these systems online in the new data center.

Another challenge was the need for faster connectivity that would allow for quicker computing to help staff provide more tailored care and allow more time spent one-on-one with patients. Phoenix Children's Hospital would also

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Phoenix Children's Hospital Lobby, Photography by Blake Marvin/HKS, Inc.

increase their database to store valuable, life-saving information with increased capabilities to maintain patient safety and confidentiality.

The stress of continuous operating hours provides challenges as well. Hospitals are open 365 days a year, 24 hours a day, and 7 days a week and the same is true for data centers. With a tier 3 level data center achieving N+1 redundancy, the hospital's data center could easily multiply those numbers in energy costs alone. Every dollar donated to the nonprofit Phoenix Children's Hospital goes toward providing care that improves and even saves the lives of children, making it critical to cut energy costs wherever possible.

Furthermore, Phoenix Children's Hospital, Kitchell and Sparling were faced with the need to design a data center that would ensure that their energy needs be met from the first day of operation, yet flexible enough to grow with the hospital. In addition to the importance of flexibility was the importance of an eco-sustainable facility that would continue to contribute to reduced energy costs. As a company committed to minimizing environmental impact, Phoenix Children's Hospital worked together with Kitchell and Sparling to ensure the new hospital's data center was equipped with the most energy efficient design principles. After an initial hot aisle-cold aisle design, Phoenix Children's Hospital, Kitchell and Sparling sought and found increased energy efficiency by selecting the passive hot air containment solution from Chatsworth Products, Inc. (CPI) - CPI Passive Cooling®.

Solutions

Kitchell and Sparling began by laying out the entire data center envisioned as it would look in 20+ years and beyond, even though only the north half would be occupied by the end of the expansion construction. "Having the second half of the data center planned in advance provided a growth master plan for the hospital as its needs increased," said David Golner, Project Manager, Technology Consulting, at Sparling.

Additionally, it was important to pre-plan the design of the data center to accommodate future growth for further cooling and redundancy capabilities. The new UPS system was designed to provide redundant 450 kVA UPS units with the capability to grow to a second set of redundant 450 kVA UPS units. Infrastructure requirements were provided to eliminate downtime associated with the future addition of UPS units. The same modular approach was used for the CRACs, where six units were installed at the start and the infrastructure was in place to add six more when needed. This pre-planning would keep energy and future installation costs lower.

Kitchell introduced virtual construction to the team so Phoenix Children's Hospital could efficiently place and reconfigure the location of the equipment cabinets based on changing needs. The hospital ultimately used a hot aisle-cold aisle configuration to optimize the placement and operation of the perforated floor tiles providing flow of cold air. Utilizing this configuration would now simply place the fronts of two rows and the rears of two rows

Rendered image of proposed Phoenix Children's Hospital
Data Center Computer Room using Virtual Construction

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together to minimize the steps needed to provide maintenance on groups of servers.

Not only were strategic power and cooling solutions important to the overall management of the facility but also to the critical systems that a hospital the size of Phoenix Children's Hospital relies on. Due to the new EMR system that was to be implemented with the hospital's expansion, the new data center was expected to add 30 additional cabinets to the configuration and the proper power and cooling systems were a necessity to keep the system reliable.

As described by Golner, the hospital's existing data center had an old, single 100 kVA UPS in place, which was utilized more than 50% resulting in nearly 30 watts per square foot. The new data center was expected to more than double that in energy usage as high as 75 watts per square foot. "In order to fully take advantage of the hot aisle-cold aisle configuration, Sparling worked with Kitchell to begin seeking solutions to further assist Phoenix Children's Hospital in cutting energy costs and establishing a more eco-friendly footprint," said Golner.

CPI Passive Cooling® Solutions

When comparing different products that would offer these solutions, Kitchell and Sparling primarily researched CPI and American Power Conversion (APC). "In the end, CPI had more options and an ability to customize to better meet the hospital's needs," said Kitchell's Senior Project Manager, Joseph Rietman. Kitchell and Sparling then turned to CPI's Passive Cooling® Solutions. Initially a more conventional system was designed for the data center, but the advancements in thermal management convinced the design team that CPI

With no additional energy required, the cooling of the cabinets was enhanced and would actually lower the annual energy costs by 20 percent.

Passive Cooling could add tremendous value to the project. With no additional energy required, the cooling of the cabinets was enhanced and would actually lower the operational costs of the data center.

To manage the heat created by higher density computing, all CPI F-Series and N-Series TeraFrame® Cabinets were equipped with Vertical Exhaust Ducts. The ducts were all the same depth and matched to the cabinet size, with the majority being 24" wide and some 32" wide. The hot exhaust air from the equipment exits the cabinets through the Vertical Exhaust Ducts into the plenum above the drop ceiling and is returned directly to the CRACs. With the Vertical Exhaust Ducts routing the hot air into the ceiling plenum and the return air ducting to the CRAC units, annual energy costs were reduced by 20 percent, resulting in significant yearly savings.

"Because every square inch of data center floor space is so precious, Phoenix Children's Hospital needed to accommodate the high density blade servers for optimal energy efficiency and power within the available space," said Trevor Wilson, Manager, Network/Telecom Services at Phoenix Children's Hospital. The hospital had to ensure specific equipment was accommodated, such as the core network switches which have cooling that is directed side-to-side, not the front-to-back of the standard cabinet configuration. CPI customized wider cabinets with additional internal ducts to match the airflow requirements of the equipment installed in each cabinet.

Other CPI Passive Cooling components included Air Dam Kits and Snap-In Filler Panels, which were placed in all vacant rack-mount spaces to control the flow of cool air and prevent the mixing of hot and cold air within the cabinets. Rietman's final analysis, "The passive hot air containment system championed by CPI provides more efficient server cooling for less energy usage. CPI is a market leader in passive hot air containment."

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Rendering of a custom CPI TeraFrame® Cabinet with Vertical Exhaust Duct

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