Purdue University's Rosen Center for Advanced Computing selects water cooling over air cooling to meet their power and cooling requirements

Industry:
Higher Education

Coolcentric products & Services:

50 Rear Door Heat Exchangers (RDHx)
6 150 kw Coolant Distribution Units (CDU)
Installation, Commissioning and ongoing Service Support

Customer Challenges:

Cooling Constraints
Power Constraints
Space Limitations
Fast Track Implementation Schedule

Competition:

APC

Key Benefits:

- Ability to handle Heat loads of up to 18 kw per rack
- Eliminated need to provide secondary pump system for condensate
-Scalable and flexible cooling
-Eliminated need for major data Center construction project
- Noise reduction

Purdue University is a public, doctoral-granting research university. Its main campus is in West Lafayette, Ind. Purdue's statewide system includes five campuses and numerous teaching and research sites throughout Indiana.

Purdue provides its faculty with unrivaled campus computing resources for research, with three cluster supercomputers placed in internationally-ranked by Top 500.org; DiaGrid, the world's largest distributed university computing grid; and the largest number of science gateway portals (more than 20), built on Purdue's HubZero platform.

The Rosen Center for Advanced Computing provides high performance computing and storage for cutting-edge science, engineering, and social science research across the University and the nation.

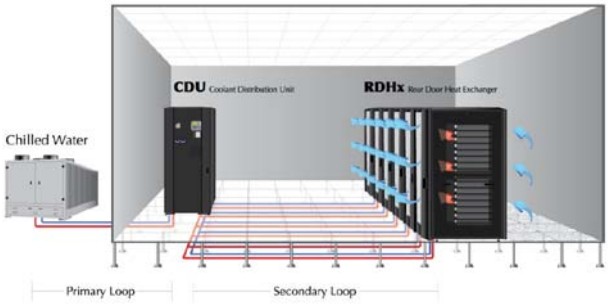
Purdue needed additional cooling capacity and power distribution to support a 1500 node expansion to their Steele HPC cluster. Data center power, space and chilled water capacity constraints eliminated the option of selecting traditional precision air conditioning as an alternative.

In addition, Purdue was on a very tight schedule for implementation. RFPs were issued with a bid response in nine days. APC was Purdue's incumbent rack, power and cooling vendor and had previously submitted a cooling study, a solution design and a bid for this project directly to Purdue.

The Cooling Solution

Coolcentric's LiquiCool™ Rear Door Heat Exchanger (RDHx) technology was used as the basis for the cluster expansion cooling solution. The design consisted of 40 Coolcentric RDHx units which act as passive radiators to cool the exhaust air from each enclosure. Since the RDHx only consumes 6.6" of additional floor space at the back of each rack, hot aisle widths were not impacted. The RDHx units were connected by pressure tested flexible hoses to four 150 KW Coolant Distribution Units

(CDUs) and the CDUs transferred the heat to the building's primary chilled water loop. A simplified diagram of the solution is shown below.



Vette Corp's Coolcentric division engaged on December 30, 2008 and proposed using its LiquiCool solution for the Rosen Center. Coolcentric demonstrated its capacity to provide complete cooling using results of the Silicon Valley Leadership Group Chill-Off competition in which Coolcentric led other solutions by a ten to one margin.

Coolcentric also provided several custom financial analyses as well as technical data that convinced Purdue that its RDHx solution was the most energy and space efficient solution for its Data Center.

The Details

According to Michael Marsh, Senior Infrastructure Engineer, ITaP, the Center faced a number of challenges when evaluating cooling methods. First, the facility is located below-ground, with no overhead space, and shared chiller resources. The center does not have raised floors and that the air is delivered from the ceiling. This cooling method was not uniformly distributed. Before increasing the server density the Rosen Center was consuming 500 KW, not including the power to run the 12 traditional 20 and 30 ton computer room Liebert air conditioners needed to cool the data center. This cooling method was not uniformly distributed. Once densified, the Rosen Center was able to increase the heat load to 888 KW of compute power even though three of the room air conditioners were removed from the area where the Vette RDHx units were installed.

Couple that with a limited budget, a burgeoning compute load and the need to maximize its equipment configuration, and the Rosen Center needed to find a solution that was cost, space – and energy – efficient. In addition, alternative solutions that required fans and blowers brought the facility close to the maximum allowable noise levels – 85 decibels before adding more cooling.

The floorplan for the Rosen Center is below:

Given the environment, there was only one choice to cool the heat loads from the new servers: *water*. Air flow through the server moves heat through the coil and fin radiator in the rear door. Each rack exhausts 10.5 kw of heat, which is completely neutralized by Coolcentric's rear door heat exchangers (RDHx). In fact, when the temperature was compared from the front door to the rear door, the temperature leaving the enclosure was actually a few degrees cooler than the air entering the server. The heat exchangers were cooling the room as well as the server, which was an added benefit since the data center now uses the CDUs for additional room cooling in the summer. During the winter, the chilled water temperature from the power plant increases by a couple of degrees, allowing the Center to raise the secondary set point since it didn't need as much room cooling.

Since the rear door heat exchangers operated at above dew point, the selection also eliminated the need for additional pumps and systems to remove condensate. And the passive rear door heat exchangers require no fans, eliminated the noise issue. The CDU expends little energy, consuming only 2.5 kW. From a cost perspective, at a cost per kilowatt to operate the CDU of $.05 KWH, the Rosen Center will save over $130,000 in operating expenses over a five year period. With utility prices increasing, the operating expense savings could top $200,000 in ten years. Retrofitting the existing data center dropped the capital expense from a potential $60M for a new data center to under $1M for the retrofit.

Because the Rosen Center relies on shared chiller resources with the university at large, another major issue was water quality. Water supplied from the chillers was delivered in pipes that in some areas were nearly 100 years old. Other liquid cooled solutions required water that was at least two-times cleaner than the water delivered to the data center. Coolcentric employs two separate water supplies – one from the chiller to the Coolant Distribution Unit (CDU) – and a closed loop of treated water from the CDU to the RDHx units, eliminating the threat of water contaminants.

Liquid cooling offered a level of flexibility which provided Purdue with the option of easily reconfiguring its center down to the rack level. There is no need for containment aisles or curtain systems that make moving equipment difficult and expensive. And RDHx units can be easily installed and removed without powering down servers, eliminating downtime for service.