

Application Report

Cold-Aisle Containment in Data Centres The smart concept for optimal energy use

Cooling requirements in data centres are continually rising, causing conventional climate control systems to be overloaded.

Switching to water cooling systems is an option, but structurally and financially this is not always possible.

During 2007, Knürr, in cooperation with one of the largest data centre operators in Switzerland, installed and monitored over several months, a highly efficient cooling solution for both new and existing data centres.

The results demonstrated that the energy costs for the output of the circulating air cooling unit (CACU) can be reduced by up to 90 %!

Within one to three months, depending on original purchase, initial expenditure will be recovered through savings generated by increased energy efficiency.

Description of application

Initial situation

The data centre under review has experienced a constant rise in demand for server capacity in recent years. The Data Centre room is 300m², 3.2m high, with a raised floor of 0.4m and has a capacity for 350 additional production servers.

The operator has provided the following information about the data centre.

- Cooling capacity of 1000 to 1500 W/m²
- Energy consumption of 1000 W/m²
- All IT-systems are installed with 100% dual power feed
- Additionally, the room has to accommodate 15 freestanding systems (Disk), LAN/SAN communication to be implemented in 14 racks.

Test conditions

The raised floor provided greater energy efficiency by directing cool air through perforated plates in the cold aisle and by sealing the cable entry in to the racks.

Knürr isolated the cold and hot zones within the server racks using infill panels. Both cold aisles were then enclosed via cold aisle containment. This process involved covering the cold aisle with transparent top covers, using double doors fitted with an automatic closer to seal the aisle.

The 282 KW power loss was simulated via fan heaters, generating 30 x 9kW, and through an addition 3 racks populated with servers generating 12kW. This information is very important when considering the energy savings which can be achieved.

The electricity supply was designed for 1500W/m² and has a 100% redundancy. It is therefore possible to obtain 420kW of power. The supply was guaranteed using two independent UPS - systems.

To provide n+1 cooling, six circulating air cooling units (CACU) were installed for every 60kW. All CACUs in operation were controlled by a specific temperature sensor within the cold zone. This guaranteed a consistent supply of air into the cold zones.

To minimise the loss of circulation caused by air resistance under the raised floor, Knürr laid all cabling (power and network cabling) along the airflow. All holes for cables through the floor were sealed to prevent hot air shortcuts.



Test areas

In reality many data centres are not fully populated, therefore knürr tested with a part load (ca. 180kW) and with a full load (ca. 280kW).

Phase 1: The initial situation (with no energy efficiency measures)

Phase 2: The raised floor was sealed allowing air to circulate through perforated plates in the cold aisle only and cable entries in the racking were also sealed.

Phase 3: The raised floor was sealed allowing air to circulate through perforated plates in the cold aisle only and cable entries in the racking were also sealed; cold and hot areas within the racking were isolated using infill panels.

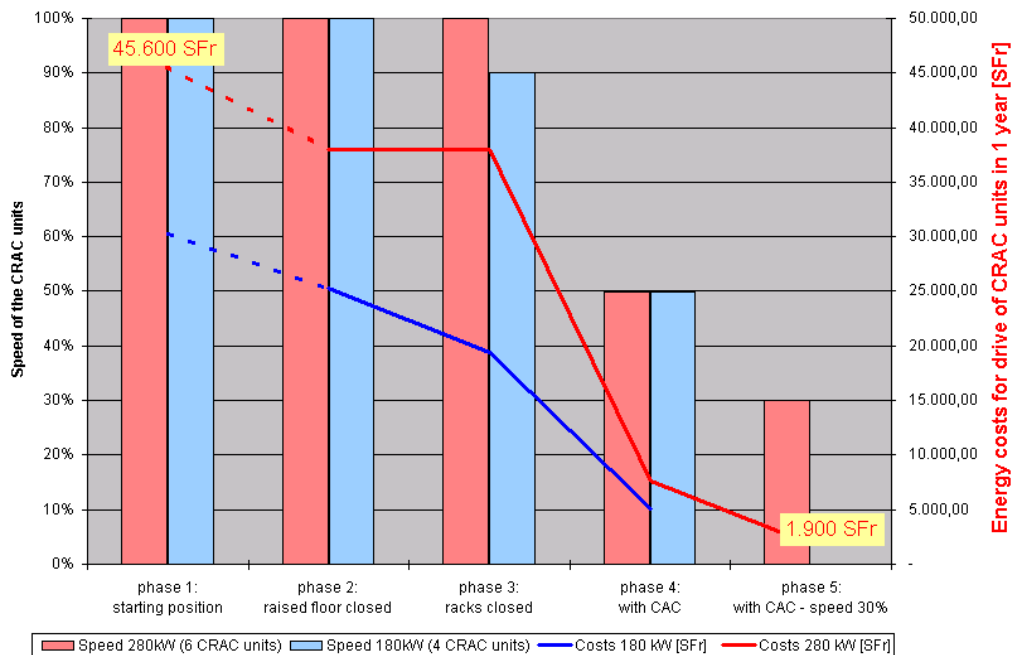
Phase 4: The raised floor was sealed allowing air to circulate through perforated plates in the cold aisle only and cable entries in the racking were sealed; cold and hot areas within the racking were isolated using infill panels and cold aisle containment constructed.

Phase 5: As phase 4, but with special software, allowing the fan air circulation cooling units to drive at speeds of 30 %.

During the entire test the temperature was 24°C in the cold aisle. This was checked and controlled via temperature probes, which were placed in the cold aisle.

Results / Conclusions

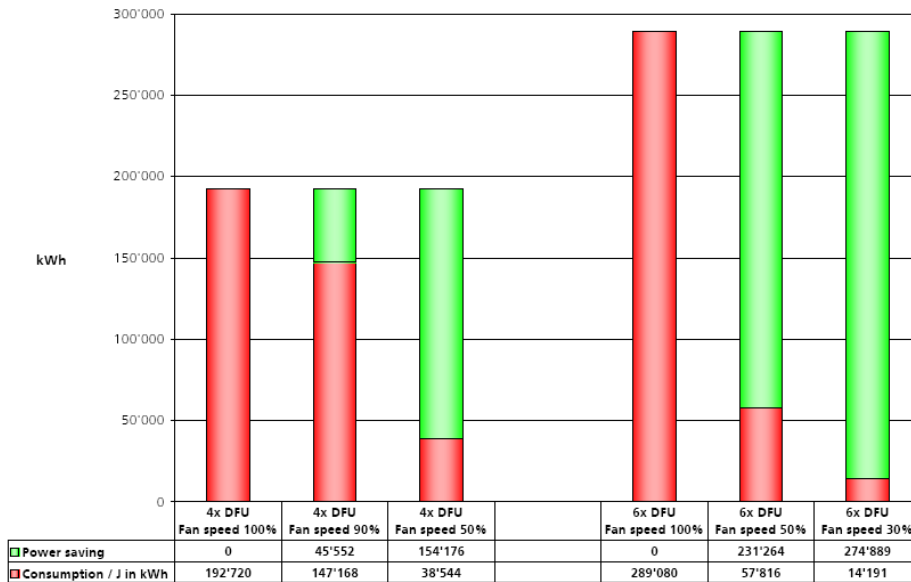
In full collaboration with the data centre operator, Knürr successfully demonstrated that cooling efficiency is considerably increased if the air flow in the cool and warm zones is regulated. The efficiency of the cooling process is greatly increased where there is a significant difference in air temperature entering and exiting the circulating air cooling units (CACU). This is achieved through cold aisle containment as the warm and cold zones are physically and constantly separated, preventing air flow short cuts.



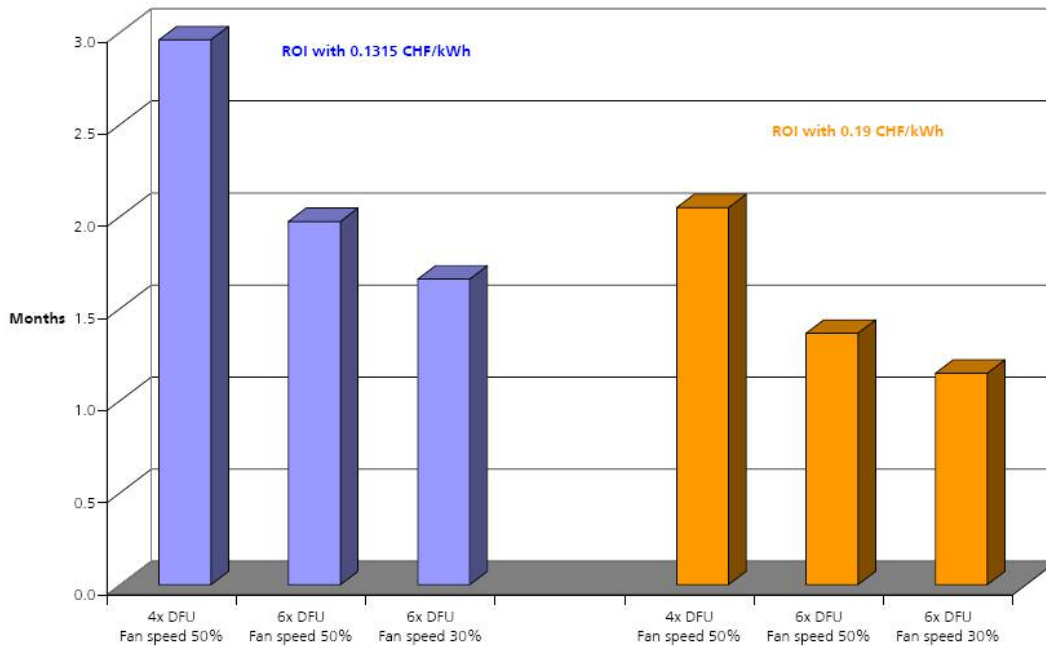
These tests demonstrate that energy costs for powering the circulating air cooling units(CACU) could be reduced from 45.600 SFr to 1.900 SFr per annum(ca. 95,8 % reduction). It is important to note that during this pilot project, fan heaters were used to demonstrate the cooling capacity. Fan heaters will only simulate the heat generated by servers, as they have a lower flow volume across the server. However when used in a fully operational data centre Knürr calculated that energy efficiency could still be increased by up to 70%.

These results also reveal that CACU redundancy can now be considered 2n instead of n + 1. The purchase of additional circulating air cooling units can be recovered within a short time period, depending on initial expenditure, as the air circulation cooling units can run on a lower speed, increasing energy efficiency.

Power saving per year



Return on Investment



In the pilot project between Knürr and customer, the design was to reduce energy costs and increase energy efficiency. The secondary focus was to demonstrate that further power savings could be built into the racks, saving up to 10 kW per rack

Pictures of test site



Services provided

Using trained service personnel, Knürr is able to provide the following services:

- Consulting, calculation, and simulation of a solution.
- Simple installation into existing racks (dependent of make of rack).
- Integration and installation without the need for down time.
- **Data Centres Thermal Assessment**
 - Review of thermal and air flow within the data centre
 - Thermal imaging of the computing centre, several aisles and/or racks
 - Consideration of cost effective measures
 - Complete report with achievable improvements
- **“Cold Aisle Containment” implementation of the solution**
 - Oversize locally (inclusive demarcation of project specific items, especially competitor racks)
 - Creation of project plan
 - Detailed pricing offer

Consider

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