

Hot aisle/cold aisle layout for data center racks

Energy Efficiency for your data center – Application Sheet.
Data center solutions from Siemens for the factories of the 21st century.

Siemens analyzes data center energy efficiency and develops a solution-specific monitoring and energy controlling approach. Pre-/post-performance is evaluated using heat maps based on building management and Navigator.

Customer challenge

Hot aisle/cold aisle layout for data center racks builds on the achievement of airflow management and is therefore the next step toward even higher energy efficiency. The design uses air conditioners, fans and raised floors as a cooling infrastructure and focuses on the separation of the cold inlet air and the hot exhaust air. In this layout, the cabinets are set up in a series of rows, resting on a raised floor. The fronts of the racks face each other and become cold aisles due to the front-to-back heat dissipation of most IT equipment. Computer room air conditioners (CRACs) or computer room air handlers (CRAHs) positioned around the perimeter of the room or at the end of hot aisles and push cold air under the raised floor and through the cold aisle. Perforated raised floor tiles are placed only in the cold aisles, concentrating cool air in front of the racks to get sufficient air to the server intake. As the air moves through the servers, it is heated and eventually dissipated into the hot aisle. The exhaust air is then routed back to the air handlers.

The efficiency of the described solution can be increased by containing the cold aisle and forcing the cold air to flow through the front doors of the racks and be exhausted at the back doors into the data center room where it is sucked in by the CRACs or CRAHs. This setup leads to a complete separation of the cold and hot air and prevents the cold air from being mixed with hot air before flowing

through the racks. This solution is known as cold aisle containment and combines high energy efficiency with maximum flexibility.

In contrast, for hot aisle separation the CRAC units and the cold air outlets are separated from the data room via containment. Racks are situated in the data room with a hot aisle separating the rear sides of the racks. As a result, the cold air flows from the outlets in the raised floor via the cold aisle containment through the front doors of the racks and is circulated throughout the data room back to the CRAC units.

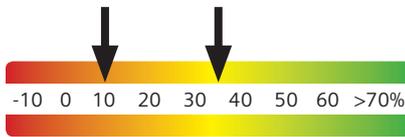
The cold aisle containment approach is easier to implement as a retrofit while the hot aisle approach requires more extensive structural adjustments. Containment solutions are also used for specific high-density rack layouts where high cooling power loads are required. In that case, the containment combines the racks as well as the precision cooling equipment (CRAC function). In such constellations, rack loads are typically higher than 10kW.

The overall objective of containment is primarily to avoid an unnecessary mix of cold and hot air, which ultimately results in improved efficiency.

Siemens solution

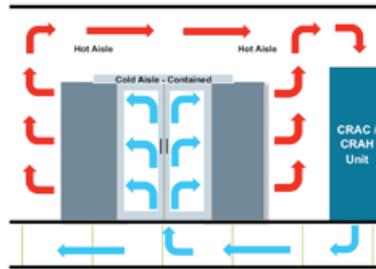
Sound, integrated designs are essential as all of these parts must work in tandem to maintain the data center's environmental

Estimated Savings Potential

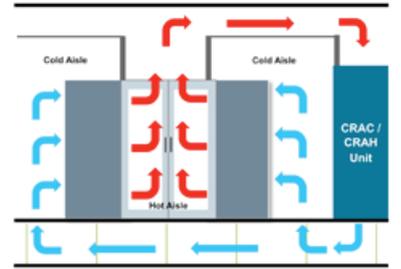


These values are guidelines only based on data from actual Siemens projects. The energy savings potential must be calculated individually for each project.

Cold aisle containment



Hot aisle containment



settings. The heat removal capacity of the design is influenced by the raised floor height, tile placement and perforation, air handler locations and room architecture. For cold/hot aisle solutions, the temperature sensors of the building management system will be the basis for mapping the heat in the cold/hot aisle, detecting potential hot spots.

The building management system acts as an overall consolidation layer for the information provided by the different sensors. It is therefore able to monitor and control the required airflows. In case of dedicated row cooling, it will be possible to control each of the aisles separately in a closed cold/hot aisle environment and to optimize the cooling power consumption for each aisle according to the specific demand. This may lead to additional energy efficiency.

It is essential to collect long-term data via an energy bookkeeping solution to analyze pre-post measure system performance. In addition to the capabilities provided by

the building management system, Siemens offers Navigator, a tailor-made solution to maximize efficiency, minimize cost and reduce environmental impact. Navigator is a cloud-based data management platform designed to help you optimize the overall performance of your data center so you can create awareness, define goals and achieve your energy, sustainability and system performance targets.

Customer benefits

After starting with airflow management, hot/cold separation should be the next step to achieve additional increases in energy efficiency in data centers. With provisions at the enclosure (blanking panels, air dams), the investment in hot/cold separation will be even more valuable. For this reason, hot aisle/cold aisle separation is a widely accepted solution. Some types of cabinets are taking this premise even further, making the goal of complete air separation (or containment) a reality for data centers.

Highlights

- 10% to 20% chiller plant energy savings , overall up to 35%
- Reduced maintenance and operating costs
- Improved performance, redundancy and availability
- Enhanced monitoring, management and controlling capabilities
- Additional savings in UPS and battery system due to reduced electrical demand of chiller plant and reduced load/number of air handling units