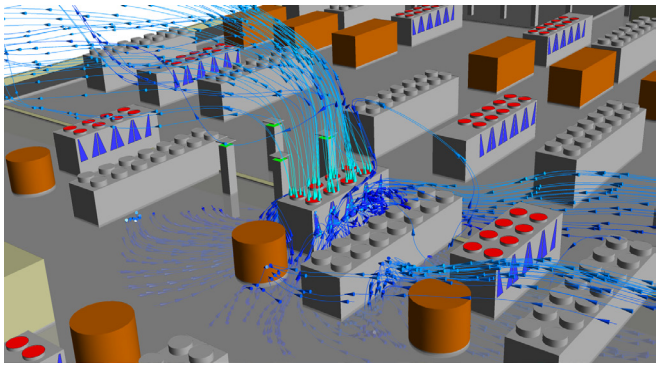
Datacentre roof Equipment efficiency

Fluid dynamics

Introduction

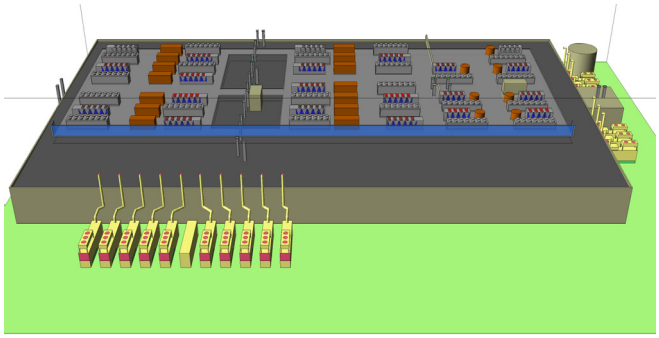
Datacentre cooling is essential for its operation reliability and should always be available during all different climate conditions. Cooling generation equipment is mostly installed on the roof of the facility, next to exhaust systems for generators, air handling units etc., all generating heat on top of the building.

Recent studies showed that heat dissipation from the different sources on the roof as well as solar irradiation does influence the efficiency of the cooling equipment on the roof, affecting negatively the cooling supply of the datacentre as well as the power demand of cooling equipment due to decreased system COP. Air inlet temperatures to chillers, hybrid dry coolers and cooling towers differ from normal design conditions due to these heating effects, thus causing the negative effects on datacentre cooling and related power systems.



Overall energy efficiency

Initially the roof design and its equipment can be optimized, assessing the worst case weather scenario and its effect on maximum power demands and cooling supply. Next to this summer peak simulation, the influence of the heating up effect on the annual energy consumption (the EUE of the facility) can be determined. The improvement of cooling and power performance in peak situation also affects the annual energy consumption of roof mounted cooling equipment, influencing the facility's OPEX in quite high degree. This influence can be shown additionally as result of CFD simulations.

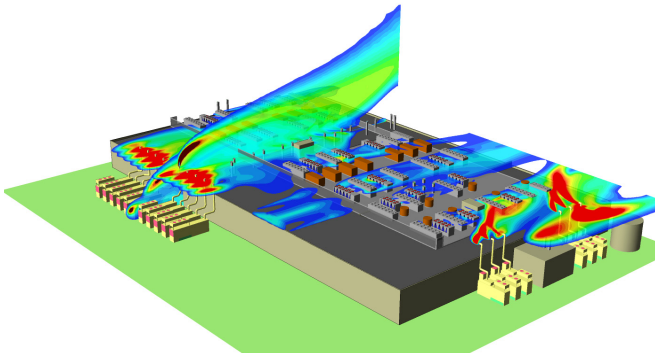


Optimize roof layout

The increased inlet air temperature for the cooling equipment can be influenced by optimizing the roof design and layout. This effect can be minimized, resulting in a better cooling efficiency. The mutual influencing of roof mounted equipment and heating up effects of solar irradiation on the cooling performance can be clearly shown by performing CFD simulations, being computer calculations showing air flows, temperatures in a dynamic simulation.

By means of CFD the magnitude of the heating up effect can be assessed for different weather conditions, e.g. changing wind directions, velocities and solar irradiation. The CFD simulations calculate the resulting air inlet temperatures for all roof mounted cooling equipment, allowing the determination of resulting cooling performance on power demand as well as cooling output.

In addition of simulations on the basic situation, the effect of improvement measures can be assessed, thus optimizing the roof design as well as cooling and power performance. The CFD calculations can be used for optimizing costs and benefits of different improvement measures. By adding TCO calculations, the optimal set of measures can be determined, being measures on civil, mechanical and electrical level.



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