CARBON BITES

From the CIBSE ENERGY PERFORMANCE GROUP

How COOL is your data centre?

Data centre growth

The growing reliance of the global economy on digital ICT has increased significantly and as a consequence, the amount of data required to be processed or stored is constantly increasing. With almost all markets worldwide experiencing exponential growth of their digital data management, the demand for data centres facilities has increased dramatically. However, high data processes requirements are directly related to high energy consumption. Data centres are responsible for 3% of the total power generated worldwide, and they show increasing trends.

Data centre cooling roadmap

Key to the operation of data centres is the provision of uninterrupted cooling to the IT equipment, and this forms the biggest proportion of the annual data centre ancillary energy consumption. Power Usage Effectiveness (PUE) is an established sustainability metric that quantifies the amount of energy consumed by the cooling/ancillary equipment. PUE is defined as the ratio of the total annual energy consumption of the data centre facility, over the energy consumption of the IT equipment only. PUE close to unity indicates that all power supplied on-site is used by the IT equipment, with the cooling and support facilities having very low energy consumption.

Traditionally, data centres use chilled water systems with water/air cooled chillers and associated computer room air handling units (CRAH). These systems had increased power requirements, with PUE values reaching 1.8-2 (for old systems). To mitigate the high power needs, efficient all-air optimisation cooling technologies have been gaining growing interest, namely the Direct Air Optimisation (DAO), and Indirect Air Optimisation (IAO) systems. Key players in the digital sector such as Facebook, Google, and Microsoft have already adopted those technologies, and achieve PUE values of as low as 1.1 (depending on the location). All-air systems are highly efficient because they take advantage of the latent heat absorbed by the water during evaporation to drop the air temperature, without the use of mechanical cooling, providing almost “free” cooling. This “free” cooling is achieved at the cost of high water consumption, which had led to the establishment of the Water Usage Effectiveness (WUE) metric, defined as the water usage per kwh (lt/kWh). Therefore, when all-air systems are deployed in localities where water resources are sensitive, the trade-off between low energy consumption vs high water consumption should be considered from early design stages.

Maria-Anna Chatzopoulou, Cundall, May 2017

Key Considerations

- High growth rates of data centres worldwide resulting in increased power requirements.
- All-air cooling systems use the heat absorbed by the water during evaporation, to reduce the air temperature, without the use of mechanical cooling.
- All-air cooling systems have reduced energy consumption, but increased water usage on-site.
- In localities where water sources are sensitive, careful selection and design of all-air systems is required to minimise water usage

LINKS

- http://www.apc.com/salestools/VAVR-5UDTU5/VAVR-5UDTU5_R2_EN.pdf
- https://journal.uptimeinstitute.com/a-look-at-data-center-cooling-technologies/
- http://www.cundall.com/Knowledgehub/Analysis-of-the-Benefits-of-Indirect-Air-Optimisation-in-AsiaPac.aspx?categoryid=70