Rapid change opening up new world of opportunity

Mike West, Aqua Group Data Centre Projects Manager, looks at how developing technology is impacting data centre design.

The world of data centre design is incredibly fast moving and very fluid, and we’ve come a long way from the days when 19°C air temperature and 6°C chilled water was a key design principle. Over recent years, equipment manufacturers have been united in their efforts to minimise energy consumption, unsurprising really when faced with a potential global energy crisis around CO2 emissions and the accepted premise that energy costs account for 31% of data centre total operating costs.

As green technology has developed, cooling system design has evolved in hand in hand. When 10°C chilled water temperatures became a workable possibility, it opened the door to free cooling options. Then Turbocor compressor technology stepped into the arena, a highly effective solution for chilled water applications but savings needed to be carefully balanced with ongoing service, maintenance and replacement part costs.

Next, fresh air systems became feasible as allowable air temperatures further increased. The downside to these was the tendency to need a larger footprint, they often needed back-up systems to provide redundancy and ducting air in and out of a data centre to keep working temperatures bearable.

In today’s market, air temperatures have been driven up to 27°C under normal running conditions, with even 32°C acceptable for short periods. This has really opened up the opportunity for refrigeration free or “chiller-less” designs.

Proper maintenance

Cooling towers provide this perfectly, as do hybrid adiabatic coolers with a basic chiller for ±1 and the energy savings can be quite remarkable. Aqua won a CEEDA gold award accreditation in 2014 for an installation using water cooled rear doors alongside a cooling tower, and this was really the springboard to the design theory we use today. Historically, cooling towers have had bad press because of legionella and H&S requirements, but proper maintenance

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is the key here. Equally, there have been concerns around water cooled systems because of water being near servers and data. However, our chilled water systems run through our patented Leak Prevention System (LPS), which gives a leak free guarantee and continuous operation.

This year we’ve won industry accreditation for a project we worked on in partnership with 4D Data Centres Ltd at their Catwick facility, deploying a highly energy efficient, intelligent “chiller-less” cooling solution. The facility’s legacy system was chiller based and the upgrade achieved energy savings of 80% almost immediately, with an annualised part load Power Usage Effectiveness (PUE) of 1.125. The system has redundancy built in, is scalable and future proofs the facility for the years ahead.

The project consisted of a cooling tower alongside a packaged plant room and full water treatment facility which was installed whilst the data centre was live.

The tower uses evaporative cooling to lower the temperature of the computers within the data centre facility. The use of specially designed CRAC units, operating on a 2°C difference between air and water temperatures, eliminated the need for mechanical cooling, allowing the chillers to be replaced with natural source cooling.

Client needs

In addition, a Carel CPCs platform provided the system’s control strategy and was engineered to minimise energy usage.

The monitoring technology is aware of the minimal energy requirements for each piece of equipment within the system, ensuring it runs at the optimal needs of the data centre with zero energy wastage.

So, taking the success of the 4D project into consideration, would I say that “chiller-less” design is the way forward? Yes – and no! Energy efficiency is a fundamental key determinant and newer technologies mean this sort of approach is becoming a really workable option. However, there are always a number of variables at play aside from air temperatures when you’re looking at the best solution – for example the end user’s approach to capital expenditure versus operational expenditure, whether it’s a new build or legacy facility, corporate responsibility towards environmental issues and overall business goals and objectives.

For me, system design starts with the end client’s base needs and requirements and the final cooling system design comes from those. For one client that might be a high efficiency free cooler or a “chiller-less” hybrid cooler, for another we could offer an on-chip/immersed cooling product.

It’s key to always consider the total cost of ownership. Overall savings need to reflect not just the electrical cost but other costs such as water usage, ongoing maintenance, so that the true cost of ownership is established, and the client can see a real energy saving. Our customers get given full, and part load, seasonally adjusted figures based on real situations. If we offer an annual energy and cost saving that’s what client will achieve each and every year. But it’s also important to stay true to the needs and wants of the client, a higher cap ex outlay may achieve the best ROI longer term, but for some clients, cap ex needs to be kept to a minimum.

Essentially, there’s no one-size-fits-all solution. We’re working more and more with natural cooling sources, whether that’s cooling towers, hybrid coolers, bore holes, river/sea water and the energy savings achievable are off the scale. For sure the focus must remain on energy saving, not just for the bottom line but for the future of the planet. There are exciting projects in the pipeline now on recycled carbon, taking carbon emissions from a waste stream and repurposing them for another application. When you think how far data centre cooling design has come in the last decade then the future will offer up even more opportunities than ever before.