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Rethinking the central plant for greater efficiency

Almost 40% of the power required to run a building is consumed in one place: the central chilled water plant. A 20-60% saving in this energy use can be achieved by operating a facility's centra plant - the chiller, the air handling units, and the terminal units - as a single, integrated system rather than a collection of independent components and controls. At the intersection of mechanical systems and networks, new solutions are emerging to make continuous dynamic optimisation of central plant systems a reality.

By Neil Cameron 27 May 2016

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The larger the building and cooling load, the more critical it is to design, operate and maintain the central chilled water plant holistically to achieve improved efficiencies and sustainable performance gains. In Sou Africa this is rarely the case. Chillers, air handling and terminal units are typically managed separately, usin built-in systems that do not respond to changing conditions, or the performance of related systems. This results in suboptimal performance and inefficiencies.

Some examples of stand-alone strategies not fully optimised set the scene. Such a chiller strategy may se a controller used to define how many chillers run at one time and the temperature of the water in the chiller Seldom does it look at what the building needs and adjust chillers to deal with over- or under-capacity. Air handling units may have a set temperature to control return air. Terminal units that bring air into working are are often adjusted by building occupants to suite their own comfort levels.

In an optimised strategy, the temperature and humidity of the room can be communicated via the terminal unit sensors to the air handling units and central plant. The temperature of the water used by the chiller will adjust to more accurately meet facility needs, while air handling units will make use of return air at different temperatures to better support facility needs. With a prize of an up to 60% increase in central plant energy efficiency through use of an end-to-end solution, the question is: what's holding companies back?

Removing central plant optimisation (CPO) barriers

Chiller plants are costly and sophisticated pieces of machinery and the majority have very specific control

systems. Factors such as safety, operating thresholds and interlocks need to be taken into consideration. With a knowledge gap too wide to leap, organisations choose to avoid the risk of tampering with systems and rather stick to standard manufacturer control systems. There is also a product gap to be overcome. Many building management or other systems do not have the capability to integrate with, or control central plant equipment effectively.

The good news: thanks to technology developments, solutions are now available that can be used with any chiller, pump or tower brand in both new construction and existing buildings, as long as there is an effective building automation systems (BAS). These solutions deliver the potential to achieve and sustain ongoing savings throughout the entire lifecycle of a heating, ventilation and air conditioning (HVAC) system.

Optimisation of plant performance requires a combination of design considerations and operating decisions. While optimal design, updates and upgrades will improve plant performance, an integrated operating strategy, enabled by intelligent CPO software, usually part of a BAS, can improve efficiencies, deliver sustainable performance gains, and assist to reduce environmental impact.

The CPO enables building owners and operators to see essential plant components' operating parameters, uses smart algorithms to vary temperature and flow, and provide intelligent coordination between chiller power and plant auxiliary energy usage – in other words, it helps manage the entire system.

Optimal power relationships among components

Optimisation decisions are based on optimal power relationships among components, while control is based on relational control algorithms and calculations. This enables continuous automatic adjustment to meet real-time building loads. For the facility manager working remotely or 24/7 the CPO's cloud-based analytics and management capabilities deliver constant commissioning and real-time reporting, trend analyses and optimisation verification.

To put the system in place, what is needed is a service provider that has the ability to control central plant equipment effectively, that can help you to put in place a central plant operations and integration strategy, and can operationalise it. Look for a solution provider with expertise in network and mechanical engineering systems that also has the deployment experience (and references) to deliver on promises of energy efficiency.

The return on investment on a CPO project, depending on utility tariffs and chiller usage, is six months to one year. The investment may include an assessment of HVAC systems, development of a strategy, upgrades or refurbishment of equipment, deployment of the CPO solution to integrate all HVAC components, and operationalisation.

Central plant represents a big opportunity for increasing savings. With new solutions that address traditional CPO barriers, it's something forward-looking facility managers should consider.

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