CASE STUDY

COOLING TOWER WATER AUDIT

Monash University Clayton

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Cooling tower setup at Monash University

COOLING TOWER WATER AUDIT

Education key to cooling tower water savings

Monash University's Clayton Campus is home to about forty cooling towers across dozens of buildings. By making some simple changes to just a handful of poor performing towers, related water savings have contributed to the site reducing its water consumption by over 25% since 2002.

Established in 1958, Monash University's Clayton Campus is located 20 kilometres south-east of Melbourne. It is the university's largest campus, covering an area of over 100 hectares, and is the only university in Australia to have its own postcode.

The campus is home to over 23,000 students and 4,000 staff, and features over 75 buildings, many of which are mixed use accommodating classrooms, lecture theatres, study rooms, administration offices, research facilities and science laboratories.

These buildings are serviced by about 40 cooling towers, ranging in age and condition; making the site a microcosm of sorts for greater Melbourne.

Reported as one of Victoria's Top 200 water users in 2002, Monash University had a total campus water use of 442 megalitres that year, and has worked on a range of infrastructure improvements to reduce consumption and increase water efficiency.

As part of its overall environmental strategy, the university set a 2012 target of reducing water use by 15% on 2007 levels.

While water use by the site's cooling towers was known to account for about 17 percent of total water consumption, initial water savings opportunities focused on 'big ticket' items such as improved water management inside buildings through more efficient plumbing fittings and staff awareness; water harvesting; improved grounds management and irrigation; as well as improved metering and monitoring.

These changes saw water use dramatically reduce to 333 megalitres in 2009, a reduction of about 25%, and targets adjusted to make even greater savings in the future, despite growing student numbers and increasing scientific, medical and engineering research activities which can be water intensive.

It was around this time that Michelle Giovas, Environmental Advisor for Monash University's Office of Environmental Sustainability received an invitation via the university's water retailer, Yarra Valley Water, to participate in a cooling tower water audit program being delivered by AIRAH for the Victorian Government.

The audit measured the performance of the site's cooling towers relative to best practice standard and provided a score as well as recommendations on where water savings could be made in the systems.

"It was a great opportunity for us to see how our cooling towers were operating against other business and other industry," Giovas said.

COOLING TOWER WATER AUDIT

"We had done water audits of the campus earlier and at that time the cooling towers accounted for 17% of total campus water use, so we knew the towers were a major water user. We also believed that monitoring them and reducing their water usage would help us meet our waterMAP and EPA EREP (environmental resource efficiency plan) reporting requirements."

Following Monash University's commitment to be involved in the audit program, Sven Denton of AquaKlar Analytical Services conducted audits on all 30 cooling towers, producing separate reports on each system which revealed performance ranging from excellent to poor.

"There were all sorts of recommendations relating to maintenance and improved controls; while the whole audit and recommendation process raised awareness with our maintenance staff and our water treatment service providers," said Giovas.

"Sven had identified there were opportunities for water savings in some of our largest cooling towers, and these savings could be as high as 30% by basically improving controls and management, as well as increasing cycles of concentration. In practice, we have found the savings have ranged from 5% to a staggering 85%."

While minor changes in maintenance and water management regimes were implemented following the first audit, recommendations to replace control systems had not yet been acted on when a secondary audit was conducted.

This audit revealed only two systems had improved, while three had not, and recognizing the opportunities that existed to make significant water savings, Giovas brought together all parties to dissect the results and map a way forward.

"Sven met with us all, explained his findings and just spelt out what was required. At that meeting we had the maintenance team, plant operators, project officers, and our service maintenance provider there as well."

"They all came along really willingly and the whole process raised the team's awareness and confirmed that cooling towers were something we were not only interested in, but wanted to improve on."

Apart from identifying the need to replace a number of ball valves on the cooling towers, two important decisions resulted from those meetings – one, that there were a number of control units in desperate need of replacement, and two, that cycles of concentration remained an opportunity for continuous improvement.

According to Giovas, the cooling tower audit process and follow up of recommendations has helped highlight the benefits to management of hands-on monitoring, as well as helped highlight the importance of timely and proactive maintenance, which continues today.

"Clearly this program raised the profile (of cooling tower water consumption) at the site," said Denton.

"There's some evidence to suggest that these audits are critical in making change happen, and while events and faults might be recorded, they may not be reported to the right people and therefore remain unchecked."

Where PLC replacement was conducted on cooling towers serving a major medical faculty building, water consumption was dramatically reduced.

The initial audit revealed the two tower system serving the building to be using 518 kilolitres more than it should, or 36% excess over best practice; largely due to bleed valves remaining open.

This problem was immediately fixed through PLC replacement; with a third audit showing excess water had been reduced to 158 kilolitres, a reduction of almost 70% to bring excess water within 19% of best practice.

Another of the site's worst performing cooling towers, serving the site's iconic Menzies Building, was found during the initial audit to be using 564 kilolitres more water than it should, or 24% excess over best practice. This disparity was attributed largely to the system operating at very low cycles of concentration.

Following the before mentioned meetings with Giovas, Denton and other key stakeholders, cycles of concentration were lifted in line with best practice, such that excess water dropped to just 36 kilolitres, a reduction of almost 94%. This brought the cooling tower to within 8% of best practice.

"We knew the cooling towers used a lot of water, but I think this program has helped us recognise ways we can reduce it, and it has engaged our plant operators to save water used by the towers," said Giovas.

"We didn't look at water savings from a cycles of concentration perspective, which is about reducing bleed off, and there was probably a reluctance to do that because the control of Legionella is very high on people's agenda. We've been very strong on that for years because of the risks involved in the number of towers we have on this site."

Both Giovas and Denton believe that aside from a few equipment issues, the savings achieved at Monash University to date have been delivered through education and raising awareness among the key stakeholders involved in cooling tower maintenance and management.

Such is her and the university's commitment to making further savings that Giovas attended a one-day course run by AIRAH on cooling towers and water conservation, which she says gave her the knowledge to be able to talk through the issues with maintenance and service providers.

While there remained a number of recommendations to be actioned across the campus' cooling towers at the time of publication, Denton estimates the remedial action implemented delivered a saving of 1.21% on total campus water consumption.

However Giovas reported in late February 2011 that these figures were in fact larger.

"Pleasingly, actual meter readings from the towers have proved a 1.8% saving in total potable water usage and cooling tower water usage has reduced to 12% of the total (down from 17%)."

While small in percentage terms, such savings can be difficult to find when 'big ticket' savings have already been achieved.

Once all recommendations for the site's other moderately performing cooling towers are implemented, it is expected that water savings could represent about 2.5% of total campus water use.

1 Cycles of concentration (referred here as chemical concentrations) refers to the ratio of mineral concentration in the cooling system to that in the water supply.

AIRAH

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