

CH₂ Setting a new world standard in green building design

Design snap shot 06: Shower Towers

Summary

Introduction

This fact sheet discusses the development of the shower tower feature for the development of Council House 2 (CH2) as shown in Figure 1.

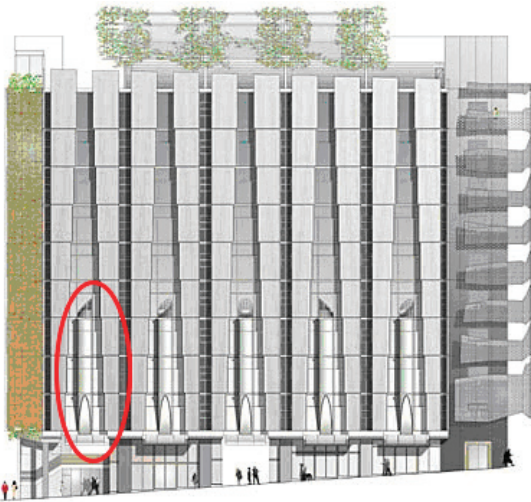


Figure 1. Shower towers on CH2 southern façade (DesignInc Melb)

In operation, outside air is drawn into the top of the shower towers at least 17 metres above street level. As the water falls in the towers under gravity, the air and water is cooled by evaporation. The cooled air is then used in the retail outlets on the ground floor of the building, and the cooled water used to pre-cool water from the chilled ceiling panels.

Drivers and objectives

The shower towers were developed to demonstrate natural cooling using water and to communicate the green aspects of the building in a direct form of interaction with the street. They are a physical demonstration of what the building represents; sustainable, smart and efficient in design and operation.

Costs and benefits

Aside from precooling water and reducing cooling loads in the retail spaces the other aim of the shower towers is to communicate with passers by, to intrigue them about the design and sustainability initiatives in the building. It is expected that by pre-cooling the water going through the chilled ceiling panels using heat exchangers the Phase Change Materials will stay charged longer and reduce the need for use of energy delivering savings. While in the retail spaces cooling loads will be reduced by the use of the air again reducing costs.

Outcomes

Initial testing of a simple scale model shows cooling may be greater than expected. This will add to the value of the towers. Performance evaluation will be carried out during operation to test this.

Otherwise, the main outcome will be educational and aesthetic. The towers on the southern façade will provide the effect of water raining down above those walking down little Collins Street, engaging and intriguing them.

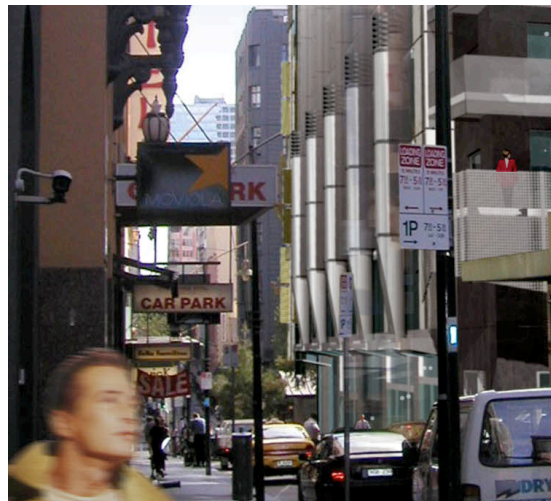


Figure 2. Shower towers (DesignInc Melb)

Lessons

The primary lesson from the shower towers is the potential benefit of using the natural properties of air and water to pre-cool both, and the contribution this will have to reducing cooling loads and energy consumption.

A secondary lesson is that the benefit for CH₂ energy efficiency will be dependent on the weather conditions, and may be greater than expected.

Aside from performance the other lesson from the incorporation of the shower towers into the design is the most overt demonstration of what CH₂ represents—the potential to have an energy/environmental benefit while stimulating curiosity, hopefully leading to creating change towards sustainability.

More detail

One of the great visual features of the CH₂ building is the shower tower array. The towers along the southern façade of the building cool air for intake and use in the ground floor.

The shower towers are made from tubes of lightweight fabric 1.4 metres in diameter. As the water falls within the tower, it sucks in air from above. This air falls down the tower, and is cooled by evaporation from the shower of water. The cool air is supplied to the retail spaces and the cool water pre-cools the water coming from the chilled ceiling panels before it reaches the PCM balls (Figure 3).

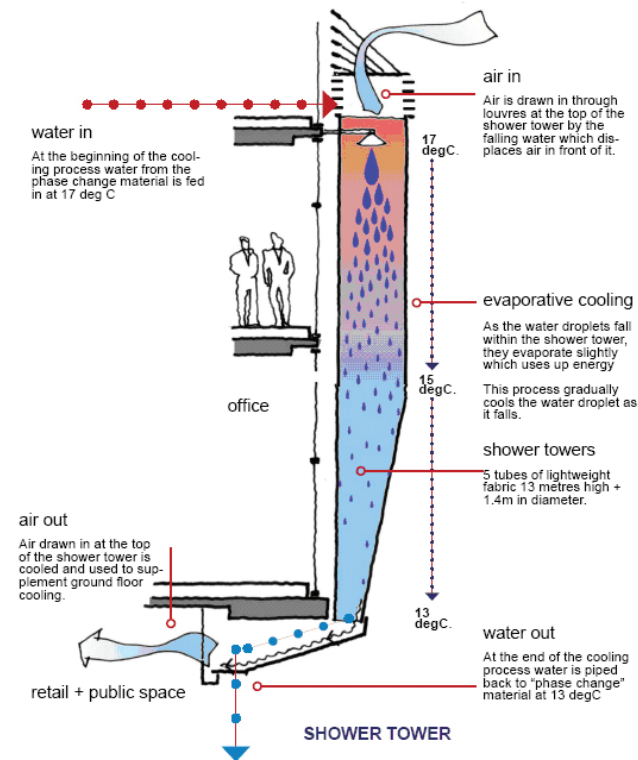


Figure 3. Explanation of the shower towers (DesignInc Melb)

Testing

AEC carried out tests using an 8M cooling tower with a 25l/min flow rate. These tests showed that large temperature differentials can be experienced in cooling air (shown in Figure 4 below). This makes the shower towers ideal for supplying cooler air to the retail areas to satisfy their fresh air requirements during normal working hours. Initially when the concept was developed and tested the intention was that the water, which was also cooled, would be used to ‘charge’ the phase change materials. Pre-cooling of 0.5 to 1°C was expected and this would aid the charging process through the cooling tower.

In practice the system was designed so that the water from the shower towers pre-cool the water leaving the chilled ceiling panels before it reaches the PCMs therefore increasing the effectiveness of the PCMs by about 10-20%.

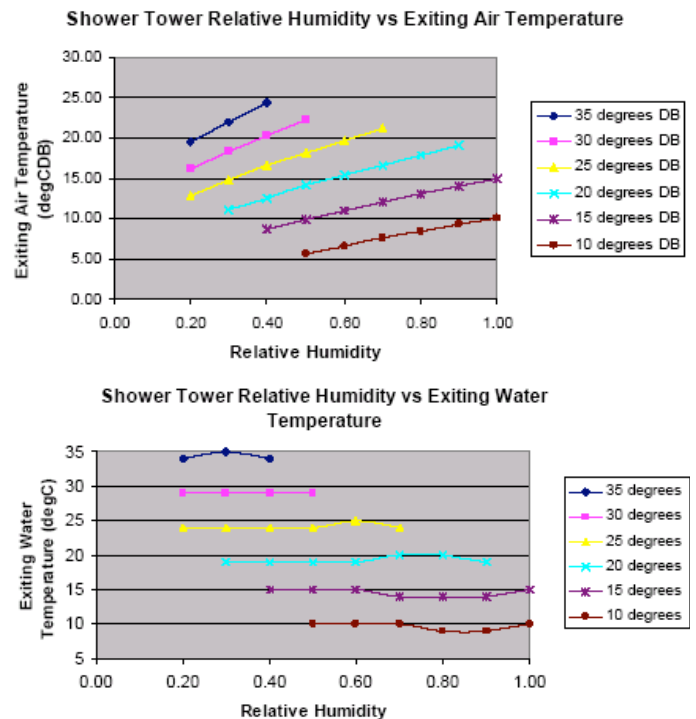


Figure 4. Cooling provided for air and water in shower tower using different relative humidity levels (AEC)

Displaying the shower towers at the 2004 Sustainable Living Festival

The opportunity was taken to display the CH₂ technologies at the Sustainable Living Festival early in 2004 as a communication initiative. A mock up of the shower tower was on display. It was made of a metal frame 2.5 metre tall and 400mm in diameter, with a clear plastic bag, especially sourced for the application, slid over it.

The tower sat in a 'pond' of water nominally 150mm deep. Water was pumped from the 'pond' to the top of the tower where it fell from a 100mm shower rose.



Figure 5. Mock-up of the shower tower and thermometer for Sustainable Living Festival Melbourne 2004

The temperature of air coming out of the bottom of the shower tower was measured and compared to the outside air temperature (and the relative humidity). The chart below is a summary of some of the recordings of the temperatures for the weekend. Results of the shower tower mock-up at the SLF 2004 are shown below. They show a reduction of temperature between 4 and 13 degrees Celsius.

Time	Relative Humidity- air entering tower	Temp – In at top	Temp- out at bottom	Temp – Improvement
Friday 13/2/04				
11:40am	66%	22.1	17.6	4.5
3	56%	25.8	17.6	8.2
7	61%	23.4	17.4	6.0
Saturday 14/2/04				
11	44%	31.4	23.6	7.8
3	35%	40.9	26.8	14.1
6	30%	38.9	25.1	13.8
Sunday 15/2/04				
1	45%	31.5	23.1	8.4
3	48%	31.4	23.1	8.3
4	50%	30.1	22.1	8.0

Table 1. Selected results CH2 Shower Tower Mock-up Performance 13/2/04 – 15/2/04

An interesting lesson from this exercise is how easily some elements can be mocked-up and demonstrated to the general public, and the positive response this can provoke in people. Outreach and Communications Officer for CH2, Bruce Filley, wrote the following in his report on the demonstration at the SLF:

Public interest in CH2 was very high. There was a lot of general interest, but there were also a lot of people who really wanted to understand how various parts of the building worked ...My personal observation from my time on the stand (around 8 hours over the three days) was that interest was high, feedback was positive and that the project generated considerable kudos for the City of Melbourne. Bruce Filley, Outreach and Communication officer for CH2, City of Melbourne.