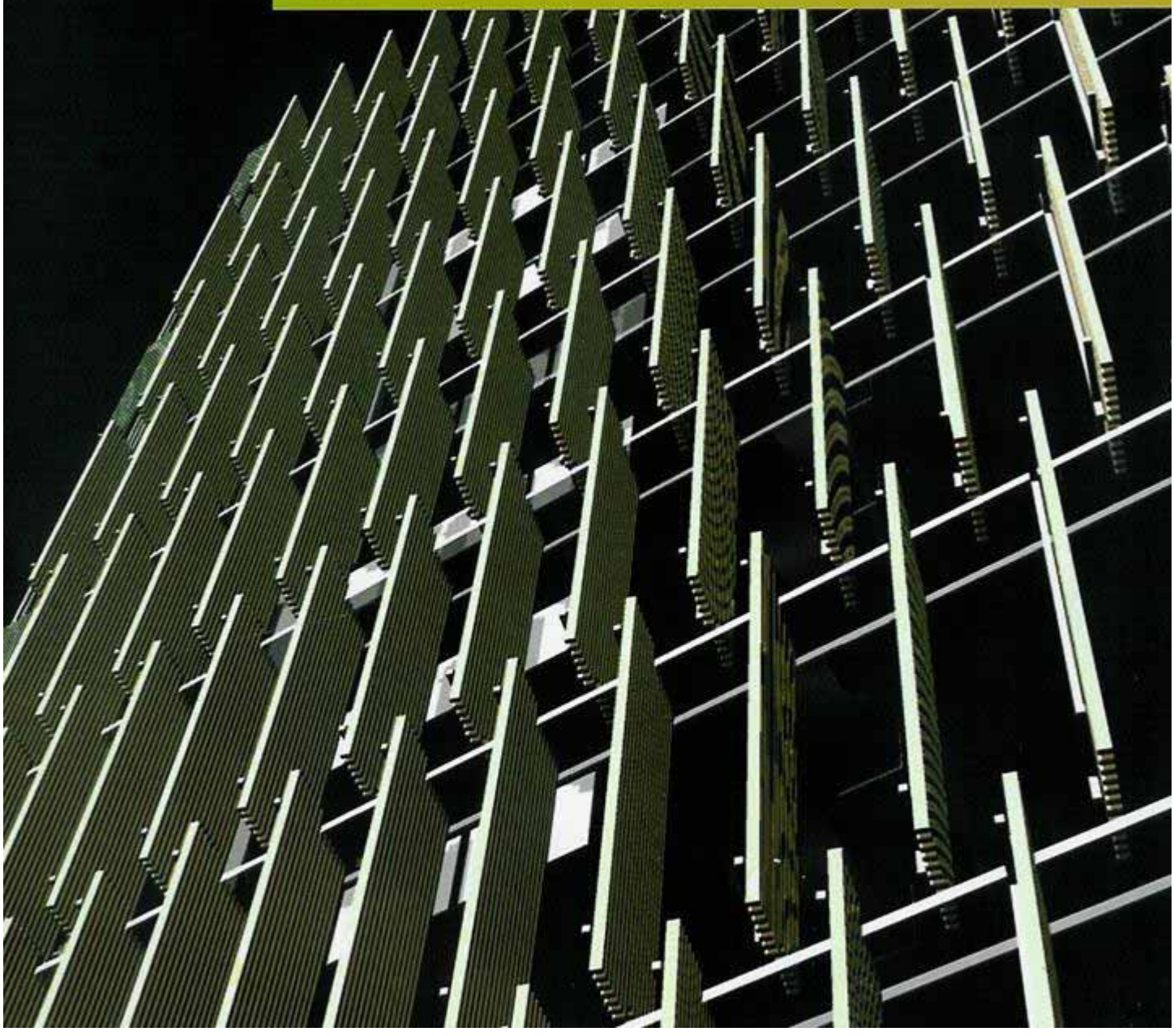
city of Melbourne

CH_2 Setting a new world standard in green building design



CH_2 in facts and figures

What: A 10-storey office building for about 540 City of Melbourne staff, with ground-floor retail spaces and underground parking

Where: 218-242 Little Collins Street

When: Completion by the end of 2005

Gross floor area (GFA): 12,536m² comprising:

- 1,995m² GFA basement areas
- 500m² net letable area (NLA) – ground floor retail
- 9,373m² total NLA
- 1,064m² GFA – typical floor

Bike spaces: 80

Showers for cyclists: 9

Car spaces: 20 plus one disabled space. The car park can be converted to office space or other uses

Project cost

$77.14 million:

Little Collins Street precinct development (including CH_2 building costs), roadwork, upgrades to other buildings, professional fees, relocation costs, fit-out, art costs, footpaths, landscaping and other costs.

CH_2 building costs include:

- $29.9 million for the base building (2,334$/m² or 58.5 per cent of cost).
- $11.3 million for sustainability features including a portion of the building cost of purge windows, light harvesting devices, precast ceilings, timber shutters, precast exhaust ducts, solar hot water collectors, photovoltaic cells, chilled water cooling system, shading screens, co-generation plant, air conditioning and beams and slabs. (884$/m² or 22.1 per cent of cost).
- $2.8 million on education and demonstration including a portion of the cost of shower towers, multi-use water treatment plant, PCM modules, roof landscaping, and chilled ceiling panels/beams. (218$/m² or 5.5 per cent of cost).
- $7.1 million on requirements specific to Council use including a portion of the cost of vertical landscape, balconies, access floors, lift finishes, communication cabling, stand-by generator, security system and building automation system. (553$/m² or 13.9 per cent of cost).

Total building costs: $51.045 million

Payback period

It is estimated that in ten years time the sustainability features will have paid for themselves. Further benefits that could reduce this figure include:

- healthier staff – less time lost to colds, flu and other illnesses;
- increased workplace effectiveness;
- less costs for public domain and infrastructure; and
- the value of building as a guiding light in sustainable building.

Environmental savings

CH_2 emissions will be 64 per cent less than a five-star building with:

- electricity consumption reduced by 85 per cent;
- reduce gas consumption by 87 per cent;
- produce only 13 per cent of the emissions; and
- reduce water mains supply by 72 per cent.

New LCD computer monitors should consume 77 per cent less energy and new T5 light fittings should consume 65 per cent less energy.

48m² of solar panels will provide about 60 per cent of the hot water supply.

26m² of photovoltaic cells will generate about 3.5kW of solar power.

A gas-fired co-generation plant will provide 60kW of electricity, meeting about 40 per cent of the building's electricity with much lower carbon dioxide emissions. Recycled waste heat from the co-generation plant will provide 40 per cent of the building's supplementary air heating/cooling system.

Health and well-being

CH_2's improved air conditioning is expected to give the City of Melbourne:

- a 4.9 per cent increase in staff effectiveness, partly through reduced sick leave; and
- healthier, happier staff, saving $1.12 million a year.

Some special features

Climate control

CH_2 features five shower towers, 1.4 metres in diameter and 13 metres long, that draw air from over 17 metres above street level. Shower towers lower air temperatures to around 21°C (from around 35°C) and lower water temperatures to 12°C. Air falls down the shower towers and is cooled by evaporation from showers of water. Cool air is then directed to retail spaces while cool water goes to the phase change material 'battery' where the 'coolth' (as opposed to warmth) is stored.

CH_2's wavy ceilings are pre-cast concrete panels 180mm thick. These create thermal mass to cool the building and reduce cooling system demands by 14 per cent in summer.

Traditional variable air volume air conditioners mix recycled air with contaminated air. In CH_2, 100 per cent fresh air will be drawn in through vents on the roof and directed into offices through individually controlled floor vents. As the fresh air enters, warm stale air will be extracted through ceiling vents, preventing mixing of contaminated and fresh air.

Water Use

CH_2 will reduce mains water use by 72 per cent. A water mining plant will draw about 100,000 litres of black (toilet) water from the public sewer for recycling. Sewers usually contain 95 per cent water. The plant, along with rain water tanks, will supply 100 per cent of the non-drinking water for plant watering, toilet flushing and cooling for the building, with the surplus directed to other buildings, fountains, street cleaning and plant irrigation.

The fire-sprinkler system is filled with potable (drinking quality) water, normally discarded in the process of regular pressure testing. CH_2 will recycle this water, providing 25 per cent of the building's potable water requirements.

A comprehensive water monitoring system in CH_2 will record all water supply and use, producing valuable data on how water is used and how it can be saved.

Principal consultants

- City of Melbourne (Design and Culture Division) – Design and Project Management
- DesignInc – Architectural Design and Documentation
- Lincolne Scott – Services Engineering
- AEC – Advanced Environmental Concepts
- Bonacci Group – Structural and Civil Engineering
- Donald Cant Watts Corke – Quantity Surveying
- Hansen Yuncken – Building Contractor

Supporting consultants

- Marshall Day Acoustics – Acoustic Consultant
- Melbourne Certification Group, MCC – Building Certification and Inspection
- CSIRO Evergen – Process and Materials Consultant
- SEAV – Scientific Simulation
- Carl Mahoney & Associates – Climate Consultant
- TDC – Vertical Transport
- Flagstaff – Program Consultant
- DEGW – Accommodation Consultant
- Vawtex Ltd UK – Turbine Design Consultant
- Golder Associates – Geotechnical Consultant
- Ancon Beton P/L – Concrete Technology
- Andrew O'Brien – Traffic Engineering
- Reeds Consulting – Land Surveying
- Andrew Long & Associates – Archaeological Investigation
- Blythe Sanderson – Disability Management
- Direct Access – Cleaning Access
- Oid Design – Graphic Design
- Formtech – West Wall Timber Louvre Mechanical and Hydraulic Design

Study and Outreach Program consultants

- RMIT Centre for Design
- University of Melbourne
- Deakin University

With support from

- AusIndustry
- Australian Greenhouse Office
- The Building Commission
- The Sustainable Energy Authority of Victoria
- The Green Building Council of Australia

city of Melbourne

Setting a new world standard in green building design

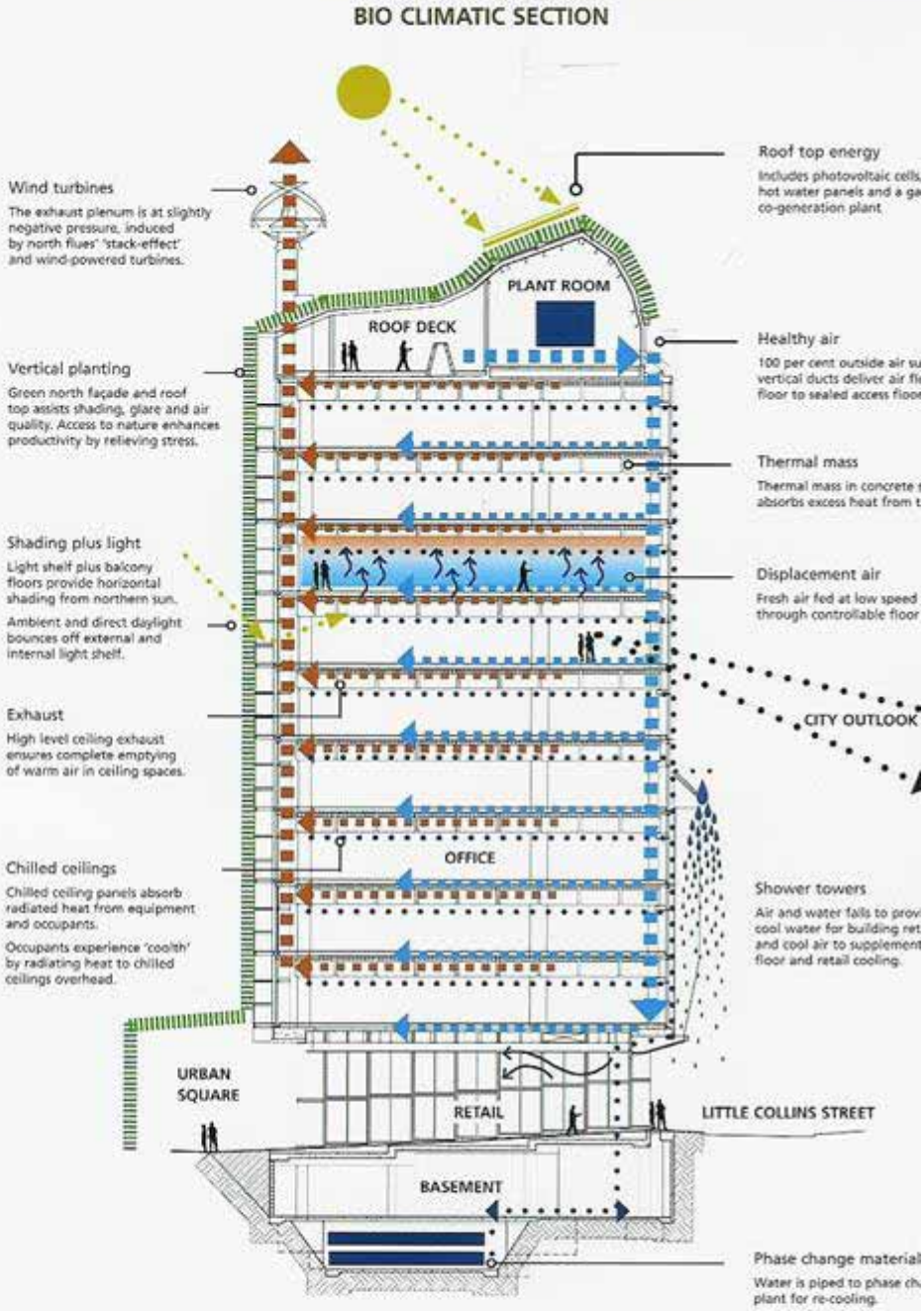
CH_2 has been designed to reflect the planet's ecology, which is an immensely complex system of interrelated components. Just as it is impossible to assess the role of any part of this ecology without reference to the whole, CH_2 comprises many parts that work together to heat, cool, power and water the building, creating a harmonious environment.

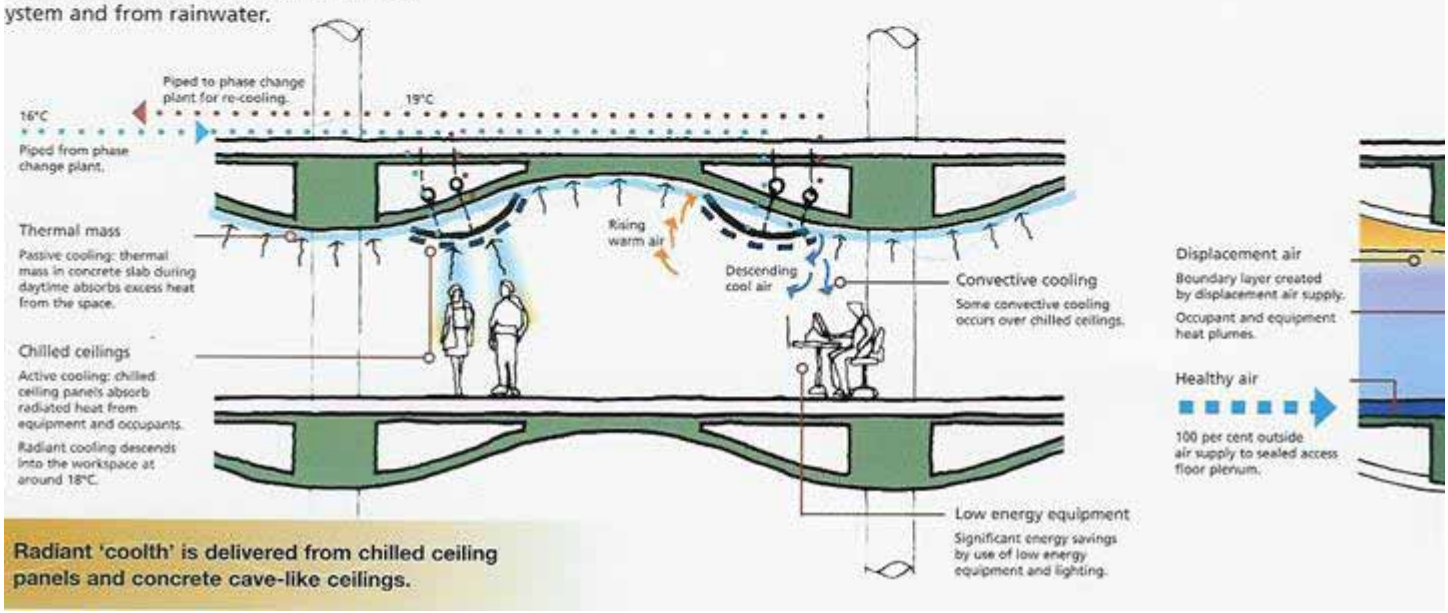
For example, in nature, dark colours absorb heat and hot air rises. Accordingly CH_2's north façade will comprise 10 dark-coloured air extraction ducts that absorb heat from the sun, helping stale air inside rise up and out of the building.

The south façade will comprise light-coloured ducts that draw in fresh air from the roof and distribute it down through the building. Staff will be able to control the flow of this 100 per cent fresh air to their work spaces by floor vents. Louvres made from recycled timber will shade the west façade. Energy from photovoltaic roof panels will power the louvres, which will move according to the position of the sun. Together these features combine to create a controlled and healthy climate.

About 100,000 litres of black (toilet) water a day will be extracted from the sewer in Little Collins St. A city sewer usually holds 95 per cent water, a burden on the system and a waste of water. The sewage, along with any generated on site, will be put through a Multi-Water Treatment Plant that will filter out the water and send solids back to the sewer. The extracted water will be treated through a micro-filtration system to create A-grade clean water suitable for all non-drinking uses.

Some of the recovered water will supply CH_2's water cooling, plant watering and toilet flushing needs. The rest will be used in other council buildings, city fountains and plants. More water will be saved through recycling water from the fire-safety sprinkler system and from rainwater.

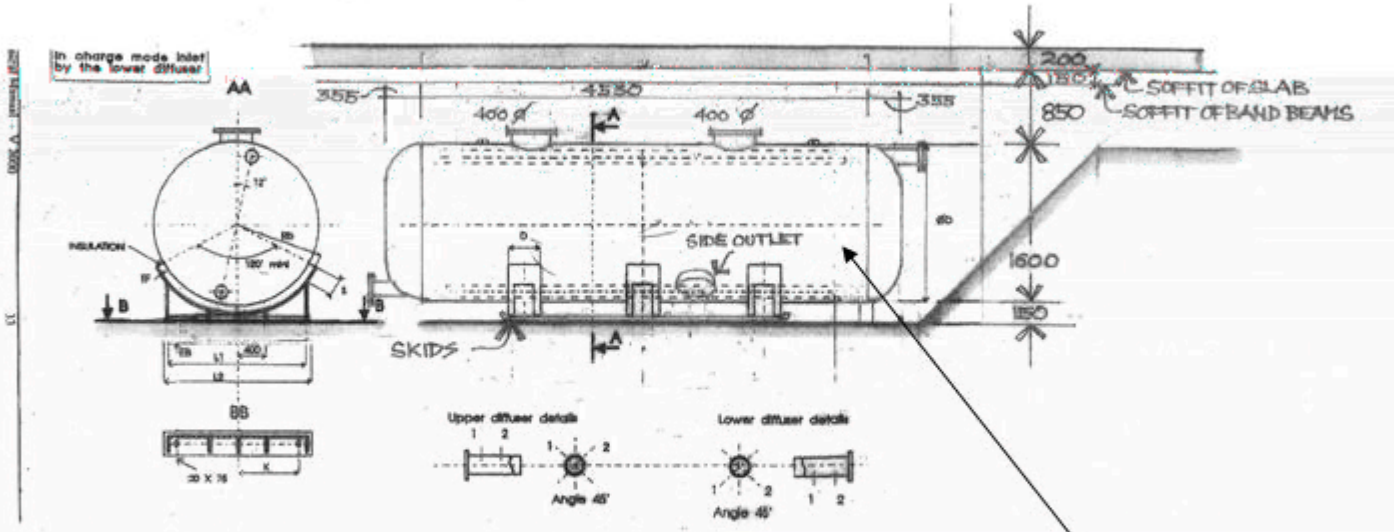




Radiant 'coolth' is delivered from chilled ceiling panels and concrete cave-like ceilings.

TANK DESIGN

HORIZONTAL WATER RECEIVER 1600 OD X 4530mm SHELL LENGTH 5240 OVERALL LENGTH



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filled with E15 (+15C)
PCM solutions providing
1,000 kWh TES for a free
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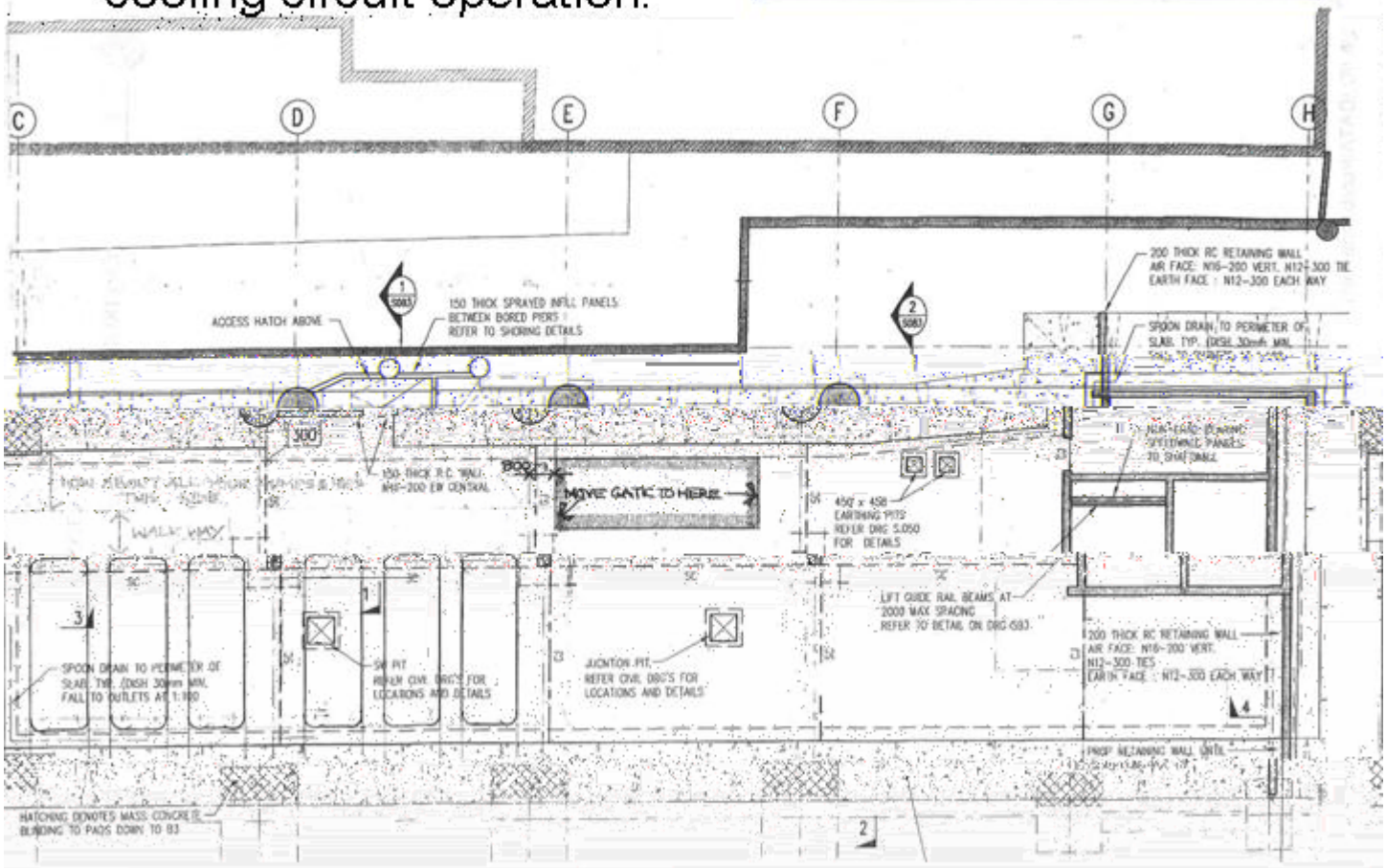


reen Star rating

onstruction began early in 2004 but ready the design stage of the building as received a preliminary rating of six ars – world leader status – from the Green uilding Council of Australia. The rating as assessed via the new Green Star ethod of comparing the environmental erformance of commercial properties ee www.gbcaus.org).

Exhaust air is pulled out by wind driven turbines on the north façade.

Vertical gardens

Some of the recycled water will be used in the vertical gardens that will run the full height of the northern façade. The vertical gardens will assist with shading, glare and air quality.

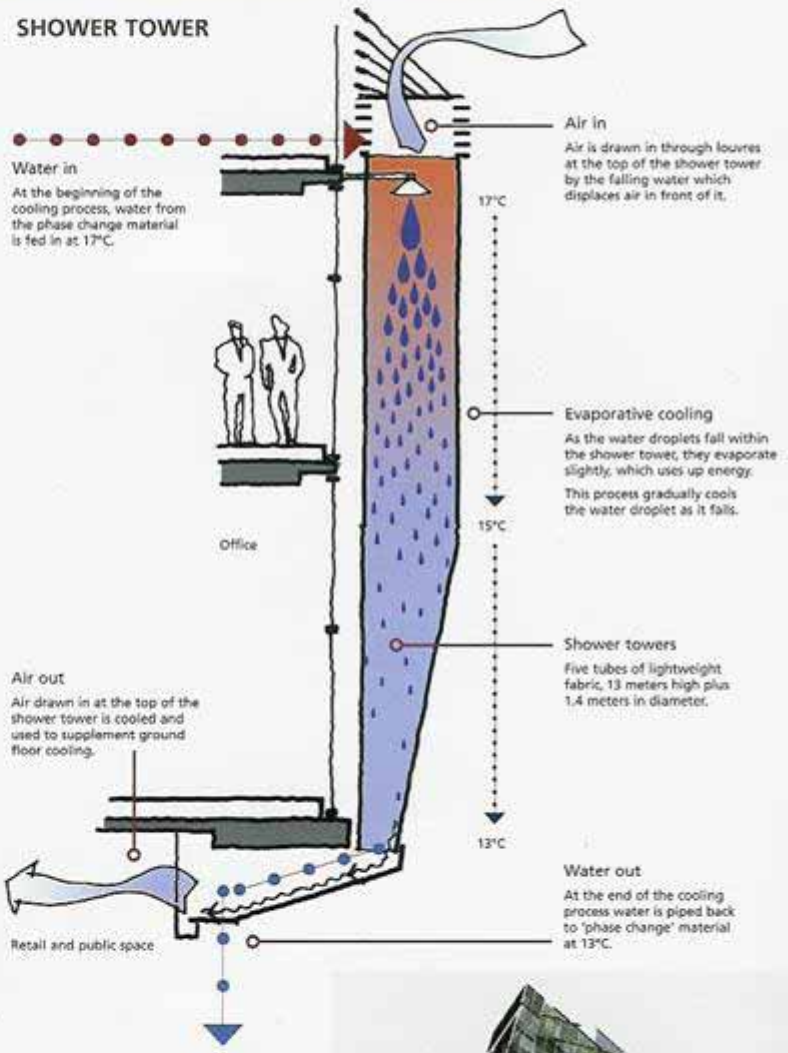
The plants will be grown from special planter boxes built into the balconies on every storey. Vines will grow up the façade via stainless steel mesh. As one vine trails out, the vine on the next level takes over.

Shower towers and phase change tanks

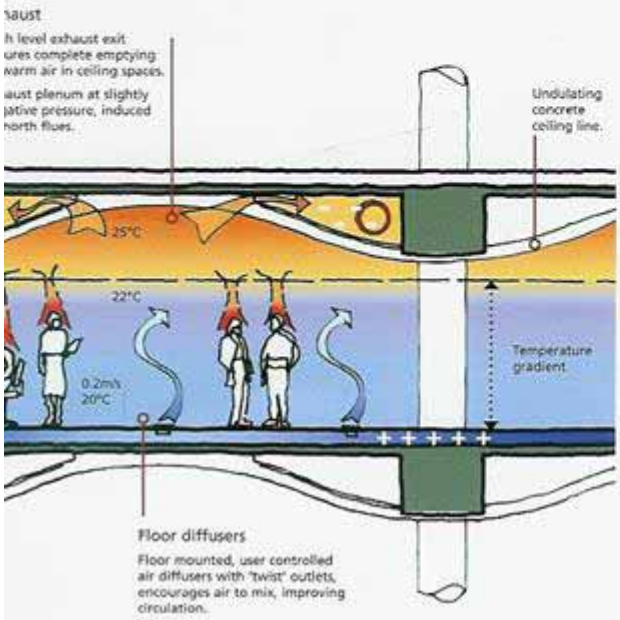
Much effort has been invested in ways to cool, rather than heat, the building. This is because human activity and electronic equipment give off vast amounts of heat. The building and its air-conditioning system are designed to capture and use that heat so the major need for energy is for cooling.

In CH_2, fresh outside air will be drawn in from 17 metres or more above the street and channelled into shower towers on the southern side.

Shower towers that use falling droplets of water to cool air will be seen from Little Collins Street.



Air delivery stratification and exhaust maintains a comfortable climate for working.



Night purge windows and thermal mass

air falls within the towers it will be oled by evaporation from the water ower. The cool air will be channelled the shops below and the cool water pplied to a Phase Change Material CM) tank in the basement.

iis PCM tank will be much like a battery at stores coolness, or 'coolth'. Water oled by the towers will travel through e tank, freezing the battery. A separate ater stream will pass through the battery be chilled, through chilled ceiling panels id beams to cool the building, and then ck into the battery to begin again.

ol water running through chilled panels ed to the ceiling – and chilled beams in ont of the windows – will create gentle diant coolness that will descend into the orkspace at about 18°C. This will replace ditional systems that use fans to blow lder recycled air directly at occupants.

Meanwhile, natural ventilation will cool the building at night. Windows on the north and south façades will open to allow fresh cool air to enter the offices, flush out warm air and cool the building. This is called night purging. Sensors will close the windows when they detect high winds and rain or higher temperatures.

Outside air from the night purge will cool the 180mm-thick pre-cast concrete ceilings that store this coolness due to their high thermal mass. In much the same way as a cement wall retains heat long after the sun has set, this 'coolth' radiates back into the office space during the day and will contribute to the cooling needs of the offices, thereby reducing air conditioning plant load by up to 14 per cent in summer.

Setting an example

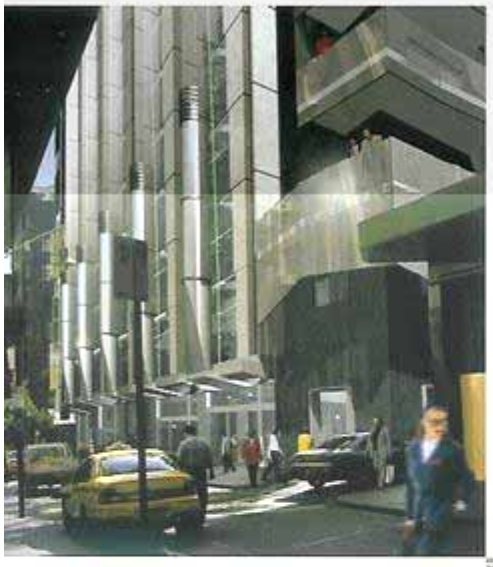
CH_2's environmental features are estimated to pay for themselves within 10 years when compared with a conventional building.

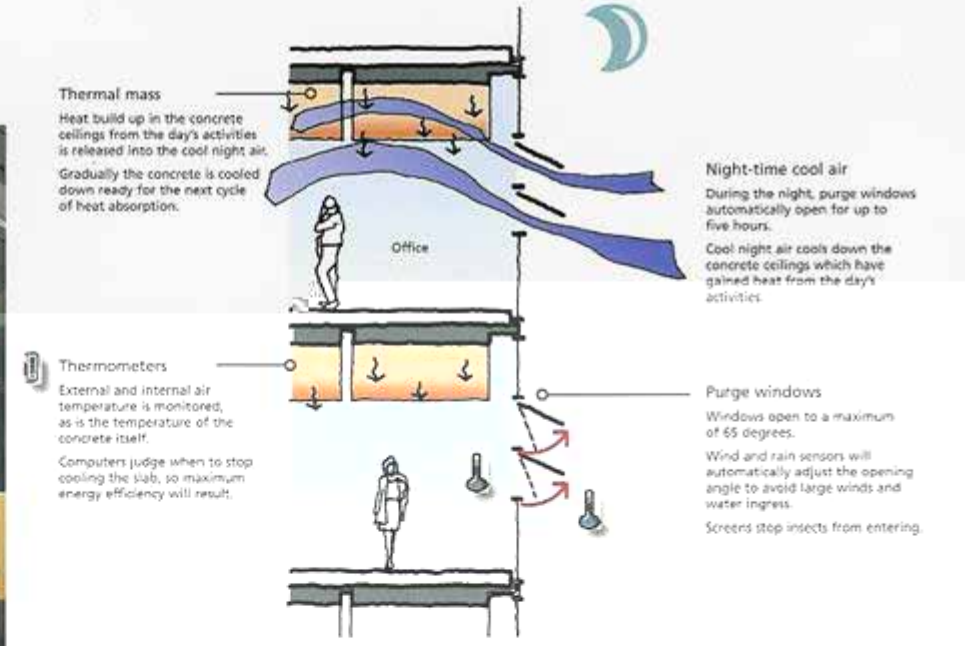
However CH_2's wider value is as an example for others to copy.

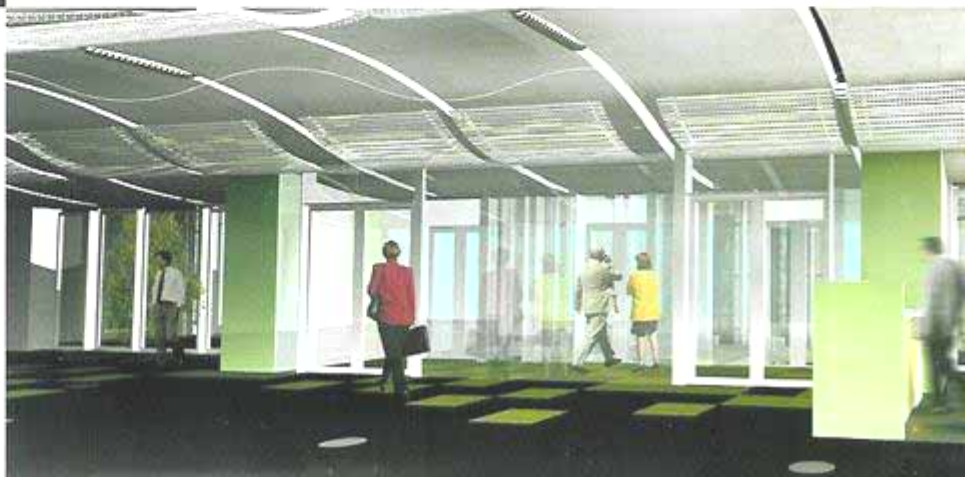
Compared with the existing Council House, CH_2 will reduce its electricity consumption by 85 per cent and its gas consumption by 93 per cent. This means CH_2 will use only 13 per cent of the energy consumed by the existing council house.

CH_2 emissions will be 60 per cent less than that scored by a top-rating 5-star building. It will produce one fifth of the emissions of the current council house.

The night purge windows open to flush out day heat.







www.CH2.com.au

Do you have a question for the Melbourne City Council? Call and speak to us.

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