CH2 Setting a new world standard in green building design

Council House 2 (CH2) is a visionary new building with the potential to change forever the way Australia – indeed the world – approaches ecologically sustainable design.

CH2 has sustainable technologies incorporated into every conceivable part of its 10 storeys. A water-mining plant in the basement, phase-change materials for cooling, automatic night-purge windows, wavy concrete ceilings, a façade of louvres (powered by photovoltaic cells) that track the sun – even the pot plant holders involved a whole new way of thinking.

Although most of the principles adopted in the building are not new – using thermal mass for cooling, using plants to filter the light – never before in Australia have they been used in such a comprehensive, interrelated fashion in an office building.

CH2's environmental features are estimated to pay for themselves within 10 years when compared with a conventional building.

However CH2's wider value is as an example for others to copy. Compared with the existing Council House (located next door on Little Collins Street), CH2 will reduce its electricity consumption by 85 per cent and its gas consumption by 93 per cent. This means CH2 will use only 13 per cent of the energy consumed by the existing Council House.

CH2 emissions will be 60 per cent less than that scored by a top-rating five-star building. It will produce 20 per cent of the emissions of the current Council House.

A comprehensive eco-audit of the materials used in CH2 will assess all aspects of the manufacture and transportation of materials in relation to their effect on the environment and the occupants of the building.

Although the reduction in energy costs will be substantial, the greatest economic benefit is expected to be in increased productivity, reduced absenteeism and lower staff turnover rates, which cost employers millions of dollars each year. Studies have shown the improved air quality of systems like CH2's air conditioning system could achieve a 4.9 per cent increase in productivity, in part through reduced sick leave.

It is predicted this will save the City of Melbourne up to $1.12 million a year.

Why go green and healthy?

Council House 2 aims to set a new benchmark in building design.The City of Melbourne decided to embark on the revolutionary project when faced with a pressing need for office space and the desire to breathe life into an under-used section of the city directly opposite Melbourne Town Hall. >

Rather than build a regular office building, the Council seized the opportunity to put its environmental credentials into action with a building that was at once innovative, creative, technologically advanced, environmentally sustainable and financially responsible, while setting an example for others to copy.

Healthy benchmark

CH2 also aims to set a new benchmark in the design of healthy buildings, believing the savings generated by averting sick building syndrome have the power to revolutionise the building industry.

Millions of dollars are lost to employers each year through sick leave and the reduced effectiveness of staff with colds, flu and other diseases caught and spread at work.

CH2 will be a healthy building, with clean, fresh air and non-toxic finishes helping staff stay healthy, alert and effective at work.

Design process and team

To make this building a success, the Council assembled experts from around Australia and beyond.

The design process began with the project team attending a two-week workshop, followed by weekly design meetings over a period of eight months to ensure a truly collaborative effort.

The principal consultants are:

- City of Melbourne (design and project management)
- DesignInc (architectural design and documentation)
- Lincolne Scott (services engineering)
- AEC (Advanced Environmental Concepts)
- the Bonacci Group (structural and civil engineering)
- Marshall Day (Acoustics)
- Donald Cant Watts Corke (quantity surveying)
- Hansen Yuncken (Builders)

How it works

CH2 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, CH2 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 CH2'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 facade. 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 Street. The extracted water will be treated through a micro-filtration system to create A-grade clean water suitable for all non-drinking uses.

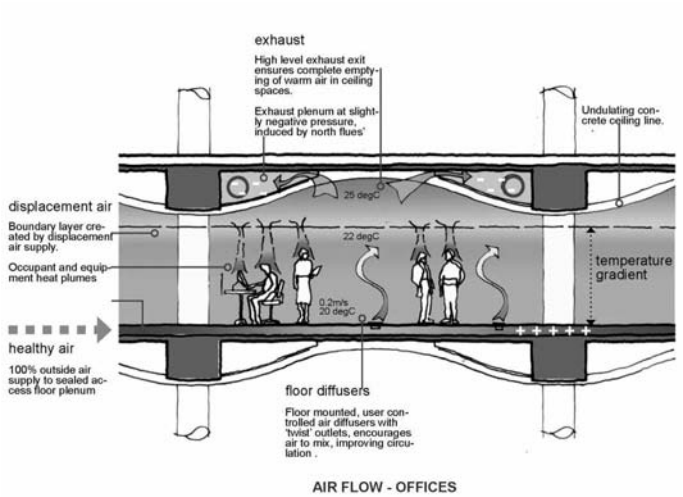
Some of the recovered water will supply CH2's water cooling, plant watering and toilet flushing needs. The rest will be used in other council buildings, city fountains and plants. More water will be saved through recycling water from the fire-safety sprinkler system and from rainwater.

Air quality

Instead of supplying the office spaces with about 85 per cent recirculated air, as is normal in typical variable air volume air conditioning systems for office buildings, CH2 will not recycle any air. All the air supplied to the office spaces will be 100 per cent filtered fresh air drawn from roof level, supplied via the south ducts and exhausted via the north ducts.

Minimum fresh air requirements

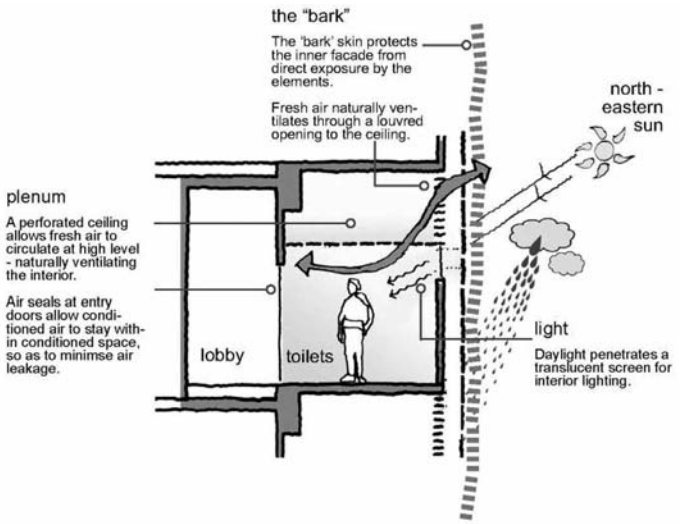
The diagram below shows how air will flow within Council House 2. Occupants and equipment will heat air to a temperature of 22 degrees Celsius. As the air rises it



AIR FLOW - OFFICES

will heat to 25 degrees Celsius. As the heated air rises it will be directed to exhausts due to the undulating concrete ceiling line. Healthy air will enter the building via floor mounted diffusers. A major part of designing a ventilation system is the minimum fresh air requirement. CH2 has set its minimum fresh air requirement to 22.5 litres/second/person. The Australian Standard requires 7.5 litres/second/person, the USA standard is 10 litres/second/person (ASHRAE Standard 62 2001) and European standards range from 10–20litres/second/person. An increasing amount of research shows that low fresh air requirements can be directly linked to low productivity and sickness, including colds and flu.

Fresh air is fed into the offices at low speed through individually controllable vents in the floor. Through natural convection, warm air from heat sources such as people will rise and move out of the space via vents in the ceiling. This means that fresh and stale air do not keep mixing, like in a typical variable air volume system, but instead follow a one-way path.



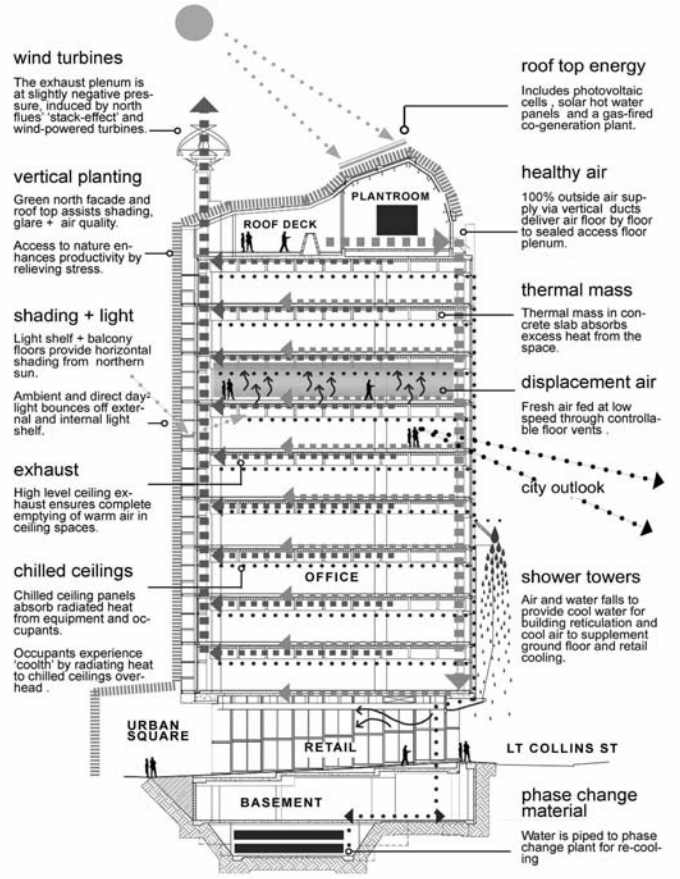
AIRFLOW - NATURAL VENTILATION

Natural ventilation

The diagram above shows how natural ventilation occurs within Council House 2. Fresh air naturally ventilates through a louvered opening to the ceiling. A perforated ceiling allows fresh air to circulate at high level which naturally ventilates the interior. Air seals at entry doors allow conditioned air to stay within conditioned space. Bathrooms have open windows and will rely on outside air for ventilation all year round.

Indoor air pollutants

Many products emit toxic gasses for months or years after construction and significantly reduce indoor air quality. All materials used in CH2 are being subjected to



BIO CLIMATIC SECTION

a full environmental audit to ensure, among other things, that low volatile organic compound materials are used in products such as carpets, paints, adhesives and sealants.

Cooling and heating

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 CH2, fresh outside air will be drawn in from 17 metres or more above the street and channelled into shower towers on the southern side.

As air falls within the towers it will be cooled by evaporation from the water shower. The cool air will be channelled to the shops below and the cool water supplied to a Phase Change Material (PCM) tank in the basement.

This PCM tank will be much like a battery that stores coolness, or 'coolth'. Water cooled by the towers will travel through the tank, freezing the battery. A separate

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The Ali-clad system was selected for the new K2 5star housing project in Windsor for the Victorian Government and the Miglas' doubled glazed timber windows for the 6 Green Star rated Council House 2 office project in Little Collins Street in Melbourne, proving you can have style and exceptional environmental performance from a timber window system.

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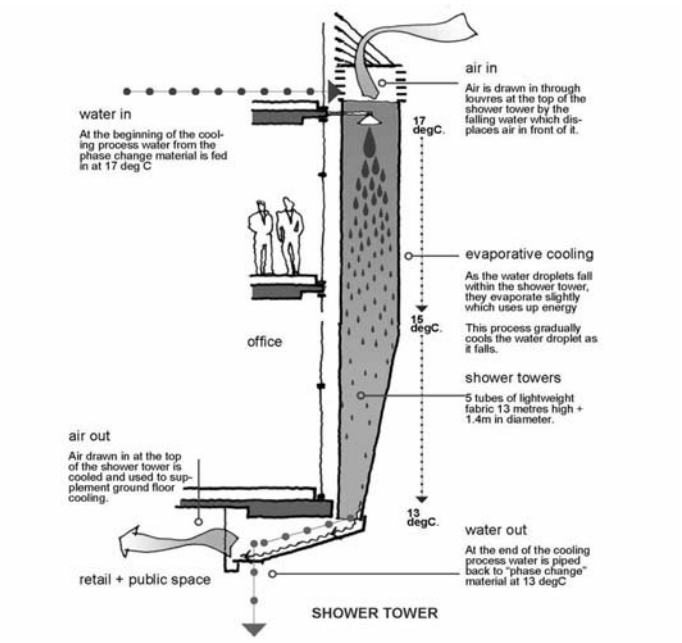

water stream will pass through the battery to be chilled, through chilled ceiling panels and beams to cool the building, and then back into the battery to begin again.

Cool water running through chilled panels fixed to the ceiling – and chilled beams in front of the windows – will create gentle radiant coolness that will descend into the workspace at about 18°C. This will replace traditional systems that use fans to blow colder 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.

Energy

Low energy computing

CH2 will use LCD monitors and thin client workstations, which consume 77 per cent less energy than older, bulky CRT monitors and individual personal computers. Thin client workstations allow office workers access to more centrally located powerful computing resources while reducing the number of computer processors. LCD monitors are energy efficient, anti-glare, do not flicker, do not emit radiation, produce less heat, generate less greenhouse gas in their operation and produce less pollution in their manufacture.

Low energy lighting

The use of T5 light fittings for ambient lighting and individual task lighting for workstations will consume 65% less energy than the lighting system in the Council's current building.

Electricity from co-generation

A gas-fired co-generation plant on the roof will be used to generate electricity and heat, reducing reliance on the public electricity grid. The co-generation plant will have much lower CO2 emissions than coal-fired electrical generation and will provide 60 kVA of electricity, meeting about 30 per cent of CH2's needs.

Heat from co-generation

Heat from the co-generation plant (about 100Kw) will be used to help CH2's air conditioning plant. This heat can be used directly for heating or, via an absorption chiller, for cooling. It is estimated the co-generation plant will satisfy 80% of the building's fresh air heating/cooling requirements just by using waste heat.

Heat Recovery

Heat is recovered from the air that gets exhausted out of the offices. CH2's fresh air system uses no recirculated air so fresh air from outside needs to be constantly heated or cooled to be supplied at 18°C. Through a simple heat exchange process, the temperature of the air exhausted from the space is used to help heat or cool the fresh supply air.

Solar hot water Heat Recovery

About 60 per cent of the hot water supply will be provided by 48 square metres of solar hot water panels on the roof. On days with little solar heat gain, a gas boiler will heat water instead.

Solar photovoltaic cells

CH2 will use about 26 square metres of photovoltaic cells on the roof to generate about 3.5kW of electricity from the sun's energy. This energy will power the movement of the louvres to shade the west façade.

Wind turbines

Six wind turbines will extract air from the offices spaces through ducts on the north façade. The turbines, especially designed for CH2, are 3.5m high and replace electric fans that would normally carry out the same function.

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Light

Natural lighting

Lower floors generally receive less daylight than upper floors so windows on the north and south facades will be larger on the lower floors than the upper ones. This allows the total amount of glass to be minimised, thus reducing energy loss, while maintaining desirable natural light levels. Sensors will monitor the amount of daylight coming in and adjust the artificial light required.

Artificial lighting

The level of artificial light will be low and will be supplied by low-energy T5 fittings linked to sensors that will reduce the light when sufficient daylight is available. However it will be supplemented with individually controlled lamps at workstations to give occupants more control over their environment. Thus the level of lighting on a floor or in an area will reflect the level of activity.

Light shelves

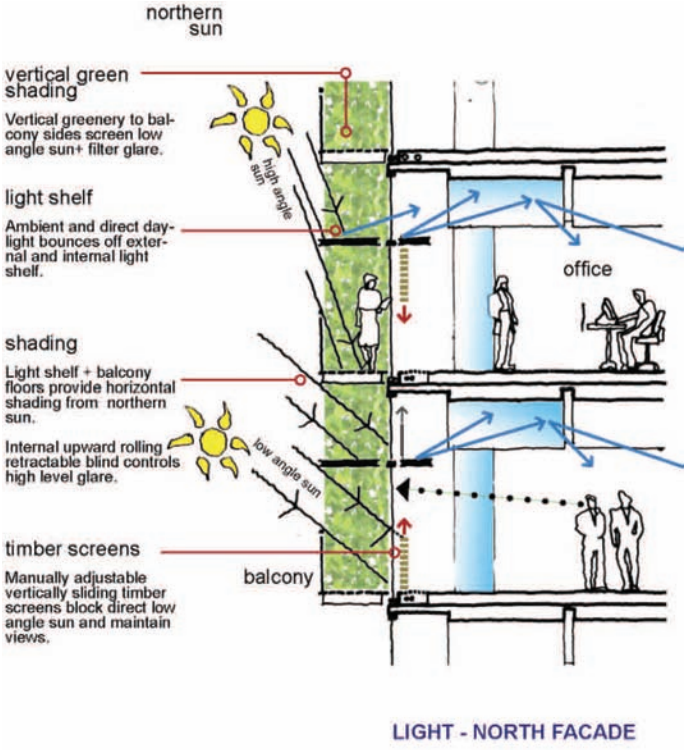
Light shelves on the north façade will reflect sunlight onto ceilings and produce a soft indirect light, reducing artificial lighting requirements. The light shelves are internal and external and made of perforated steel. Sensors will increase and decrease the artificial lighting according to the amount of sunlight being reflected into the building; thus a balance of natural and artificial light will be achieved.

Shading

The following diagram shows how northern sun is filtered into Council House 2. Vertical green shading is used to screen low angle sun and to filter glare. Ambient and direct daylight bounces off external and internal light shelf. The light shelf and balcony floors provide horizontal shading while internal blinds control glare. Finally, manually adjustable vertically sliding timber screen block direct low angle sun. Shading to control sun and glare will be used on the north, east and west facades. The north facade uses vertical gardens for shading, the east uses perforated metal and the west uses recycled timber louvres that move with the sun.

The north-facing facade will comprise steel trellises and balconies supporting a series of vertical gardens nine storeys high. The foliage will help protect the building from the sun and filter sunlight to reduce glare indoors.

The entire west facade of CH2 is protected by a system of timber louvres that pivot with the sun to be fully open in the morning and closed for the full sun in the afternoon. The louvres will be made from recycled timber and will be controlled by a hydraulic system that moves the panels through a six-hour open and close cycle.



LIGHT - NORTH FACADE

Water

Water consumption reduction

To reduce water consumption, all water fittings will have AAAA (highest) ratings, all toilets will be dual flush and all urinals will have sensor-triggered flushing.

Potable (drinking) water

About 25 per cent of potable (drinking) water will come from the sprinkler system used for fire safety. Safety regulations require that sprinker systems are tested regularly and this involves discarding large quantities of clean drinking water. In CH2 this water will be collected and used.

On-site treatment (water mining)

About 100,000 litres of black (toilet) water a day will be extracted from the main sewer in Little Collins Street. A city's sewer usually contains 95 per cent water, which is 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 the solids back to the sewer. The water recovered will supply all CH2's water cooling, plant watering and toilet flushing needs while reducing the burden on Melbourne's treatment plant.

Non-potable (non-drinking) water

The Multi-Water Treatment Plant and rain water collection will supply 100 per cent of non-drinking water for water cooling, plant watering and toilet flushing needs.

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. ■

Information supplied by City of Melbourne: ***www.melbourne.vic.gov.au***

CH2 + The Container Connection

As you have just read, Council House 2 (CH2) is the City of Melbourne's new office accommodation project, situated in Little Collins Street. Council decided to set new benchmarks in office design and construction with this project and sought to incorporate environmental sustainability and financial responsibility with innovative, creative and technological solutions.

The Green Building Council of Australia, through it's "Green Star" Rating Tools, has awarded the project a rating of 6, the highest level attainable. The award is significant as the design and performance of the building is evaluated across a number of criteria including energy and water conservation, the quality of the indoor environments and resource conservation.

The Container Connection was sought to participate in this ground breaking project to both assist in the design development and deliver the final manufactured product. The Landscape Architecture component of the Design Team required specific outcomes & innovative solutions to a variety of issues including the bio-filtration of indoor air and external filtering of sunlight with greenlife forms. With a Design Development period extending to 2 years, various greenlife species were studied and monitored for growth and water consumption behaviour and characteristics, leading to unique specifications in the capillary irrigation action performance of the Planter Systems.

A total of 120 balcony planters were planned for the exterior with sub-irrigation to be integrated into the building construction. Specialised rotor moulded co-polymer planters complete with "mona" sub-irrigation and custom aqua valves to monitor the water level at low pressure were manufactured.

The CH2 project benefited from the unique skills and experience that has placed The Container Connection as market leaders in planter and sub-irrigation technologies. Through designing, tooling and final moulding, the CH2 project demanded innovative and creative outcomes that were matched and exceeded by The Container Connection, thus contributing to the enhancement of the environment for the building occupants and setting new benchmarks for the future of commercial buildings.

If your project has specific design, manufacture and installation requirements for planter solutions, contact The Container Connection Australia wide at our website: **www.containerconnection.com.au** ■