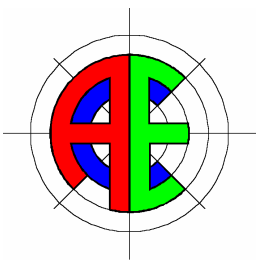
Melbourne City Council House (CH_2)

Technical Design Overview +

Building Services Philosophy

Prepared for:
Melbourne City Council

Prepared by:
Advanced Environmental Concepts Pty Ltd
ACN 075 117 243
Level 1, 41 McLaren Street
North Sydney NSW 2060



design advice

passive systems

design analysis

low energy services

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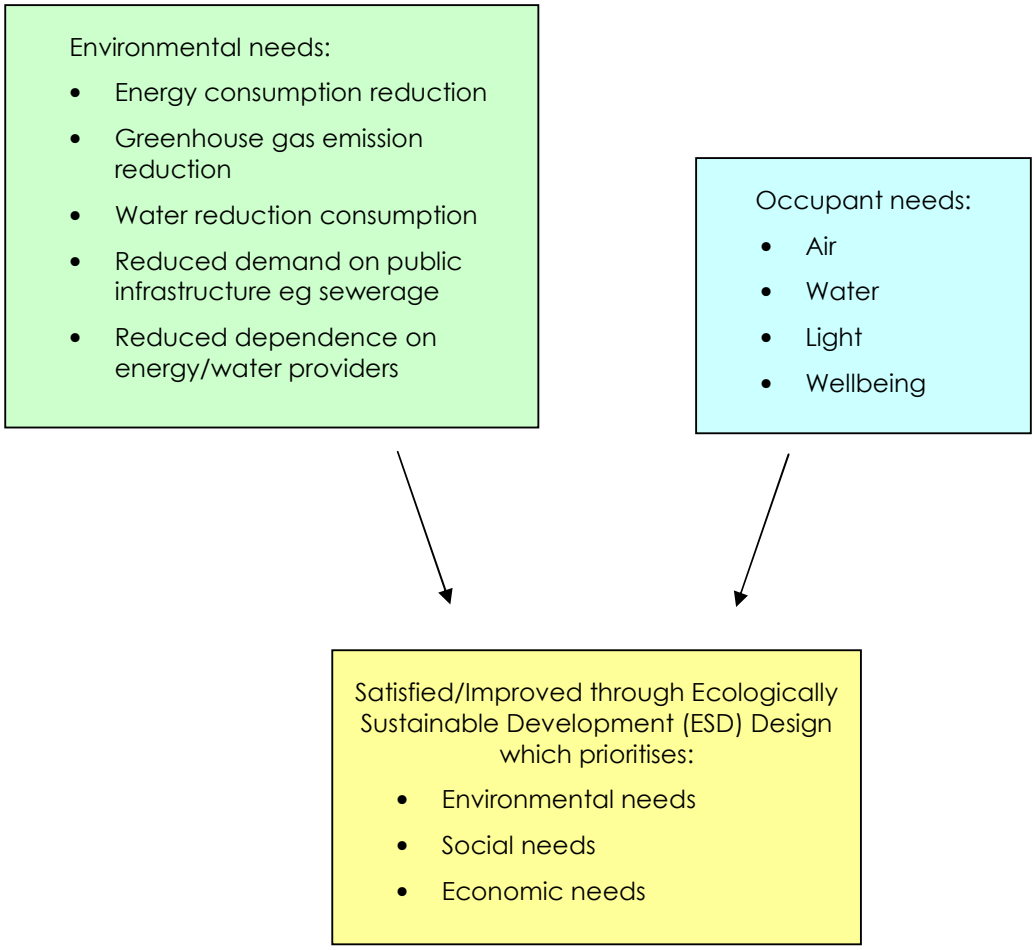

1 TECHNICAL DESIGN OVERVIEW

1.1 Air

Environmental benefits:
- Energy consumption reduction
- Greenhouse gas emission reduction
- Reduced dependence on energy providers

Occupant benefits:
- Provision of non re-circulated 100% fresh air to workspaces
- Provision of 100% fresh air at 22.5L/s/person, a rate more than double the standard 10L/s/person providing fresh air replaced in the workspace every half hour
- Chilled ceiling/beam air cooling system provides gentle cooling effects

Ecologically Sustainable Development (ESD) Design Issues:
- Thermal mass of concrete ceilings utilised
- Night purge used to cool building
- Displacement ventilation gently provides fresh air into workspaces and flushes out warm contaminated air
- Shower towers are used to cool air and water
- Phase Change Materials store coolth needed for chilled ceilings
- Co-generation plant used to provide 100kW waste heat whilst providing 60kVA of electricity for building
- Heat recovery system utilises waste heat
- Wind turbines naturallly exhaust air on the north façade
- Toilets are naturally ventilated

1.2 Water

Environmental benefits:
- Energy consumption reduction
- Water consumption reduction
- Greenhouse gas emission reduction
- Reduced dependence on energy/water providers

Occupant benefits:
- Needs are satisfied

Ecologically Sustainable Development (ESD) Design Issues:
- Solar gas boosted domestic water heating
- All fittings are AAAA rated (highest)
- All toilets are dual flush
- All urinals are waterless and odourless
- 72% of non-potable water needs ie for landscape, cooling towers, shower towers and toilet flushing are satisfied through the use of a Multi-Water Re-use plant which will treat grey and blackwater
- 22% of potable water needs for are satisfied through the reuse of collected, clean, potable water used for sprinkler testing
- Dependence on the public sewer system is reduced by 80% through the use of the Multi-Water Reuse plant.

1.3 Light

Environmental benefits:
- Energy consumption reduction
- Greenhouse gas emission reduction

Occupant benefits:
- More control over individual lighting
- More lighting control over total floor area – each zone has dimmers

Ecologically Sustainable Development (ESD) Design Issues:
- Low energy fittings ie T5 lamps
- Combined individual task lighting + low level lighting - more individual control over lighting
- Automatic perimeter zone dimming with increased daylight levels through the use sensors
- The adoption of clear glass benefits daylight penetration and view clarity – increasing connection with outdoors
- Shading on North, East and West façades for solar control

1.4 Wellbeing

Not usually considered but has been given priority.

Environmental wellbeing:
- In embracing ESD design all environmental needs are satisfied

Occupant wellbeing:
- Prioritising the provision of vegetation on balconies, shading elements and on the rooftop for occupants
- Increased health and productivity due to the increased provision of non recirculated fresh air to workspaces
- The adoption of flat screen LCD monitors are more beneficial to workers, compared to traditional CRT monitors because of increased image refresh rates, decreased reflective glare, and increased desk space. LCD monitors also consume much less energy and reduces demand on the air conditioning system.

2 LOW ENERGY BUILDING SERVICES PHILOSOPHY

The design behind the Melbourne City Council Building is one of the most comprehensive in the world. From the choice of building materials, to energy systems, to computer monitors, all decisions endeavour to world's best practice. The focus on the design of this green building has not only given priority to the environment, but to its occupants as well.

An ecologically sustainable development (ESD) focus has been integrated in all aspects of building design to provide a healthy environment for all.

2.1 Cooling and Heating

The chilled ceiling air conditioning system evenly spread around the workspaces provide low energy cooling to the occupants. Gentle radiant and convective cooling effects fall freely from the chilled ceiling at comfortable cooling temperatures of around 18-19°C. A traditional VAV system would use fans to blow air at around 13°C directly at occupants.

Heating is managed through the use of convective heating fins sitting below floor level. The fins act to protect the office area from the cold by forming a warm air barrier around the perimeters, which rise into the space naturally using buoyancy not fans.

Natural ventilation will be utilised during night time and on weekends to cool down the building during unoccupied hours. Night purging utilises thermal mass benefits to store the coolness from the cool night air in the exposed concrete ceilings, this helps reduce loads on the air conditioning system by up to 14% in summer. Cool night air flows into the building through north and south windows and cools the concrete ceilings which radiate "coolth" to the occupants during the day.

2.2 Fresh Air

The building's fresh air displacement ventilation system far exceeds conventional practice. Firstly because fresh air rates, at 22.5 litres per second per person have more than doubled standard practice of 10L/s/person which means that occupants are breathing much higher quality air. Secondly, contaminated warm air exhausted out of the space is completely flushed out and not re-circulated back into the space, which means that occupants are constantly breathing a source of high quality non-recycled air. The result is that the air in each workspace is fully replaced with fresh air every half an hour.

The displacement ventilation system introduces this fresh air at a low velocity below floor level. Buoyancy enables the formation of thermal layers from floor to ceiling which separates clean cool air from contaminated warm air. Warm air from heat sources lift up through occupied zones and get relieved through vents in the ceiling. This air is relieved from the space by exhaust air shafts located at the building's north façade, a wind extract turbine at the top of each shaft ensures that air is continually exhausted through passive means.

2.3 Energy

The design of the energy systems behind the heating/cooling and fresh air system is extremely innovative and extensive.

The cool water running through the chilled ceilings is been cooled via passing through a phase change material store, which stores coolness. Water runs around in a closed loop. It leaves the phase change material as cool water, passes through the chilled ceilings, cools the space, runs back into the phase change material store to become cool again and is ready to run through the chilled ceilings again. During small periods in summer, when the phase change material storage cannot provide enough coolth, the chilled ceilings will be supplemented by an electric chiller.

Coolth for the phase change store is produced by water which has passed through shower towers and cooling towers. Water passing through the shower towers and cooling towers at night will be cooled and stored by the phase change material tank. This method of water cooling at night enables "free-cooling" to be achieved, whereby cool water is generated without running a chiller.

Shower towers will not only be beneficial for cooling water, but will be used to provide ventilation to the retail space below office levels. Outside air is drawn in from high levels (8m or more above street level) and induced into the space. As this air falls within the shower tower it is cooled through the evaporation of water.

Fresh air for occupants is provided at 19°C and needs to be heated or cooled before entering the workspace. This heating/cooling of fresh air will be not powered by a traditional system of gas boiler and electric chiller, but instead, a co-generation plant and a heat recovery system.

The gas fired co-generation plant is used to firstly generate electricity for use within the building, and secondly, utilise the waste heat produced for any air heating/cooling needs. It has been calculated that the optimal size for the co-generation plant will satisfy 80% of the building's fresh air heating/cooling requirements, just by utilising waste heat.

75% of domestic water heating needs will be met through solar panels on the roof. However, for days with little solar heat gain, a gas boiler will be used.

2.4 Water

22% of potable water needs, for drinking, kitchen/bathroom basins, will be satisfied through the re-use of clean potable water used for sprinkler testing, reducing demand on mains water.

72% of non-potable water needs, for landscape, cooling/shower towers, toilet flushing, will be satisfied through the use of a Multi-Water Reuse plant which will treat grey and black water, significantly reducing mains water demand.

80% of sewerage will be treated on site using the Multi-Water Reuse plant. This means that dependence on the public sewer system is reduced by 80%.