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William McCormack Place Stage 2

Premier's ClimateSmart Awards 2011

Category: ClimateSmart Built Environment Award

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Project description

Building green to save the future and reduce costs

William McCormack Place Stage 2 (WMP2) is a 10,000m² office building for the Queensland Government located in Cairns, Far North Queensland. It is the first building in the tropics to be recognised with a 'World Leader' 6-Star *Green Star – Office Design* rating from the Green Building Council of Australia. The design of WMP2 combines existing best practices with a number of innovations to reduce its environmental impacts and improve indoor environment quality for the building's users. The building was completed in July 2010 and fully tenanted by Queensland Government departments and agencies from October 2010.

WMP2's design is predicted to reduce energy/emissions by approximately 60% and reduce potable water use by 75% compared to a median office building. Throughout the buildings' construction, fewer (and more sustainable) materials are used than a median building, and as a result places less demand on urban energy and local water infrastructure. And at the same time it provides a healthier work environment, with tenants benefitting from improved air quality, daylight, and high-comfort electric lighting.

Environmental benefits and functions

WMP2 demonstrates that high quality (Grade A) office space can be provided at significantly reduced environmental impact compared to conventional practice – even in a demanding tropical environment and in a regional market. The building is predicted to reduce environmental impacts in a number of areas:

Emissions and energy (climate change and energy infrastructure)

- 60% (1,000 tonnes/year) reduction in CO₂ emissions, compared to a median (2.5 Star) building;
- 40% reduction in demand on the electricity grid due to off-peak operation of air conditioning chillers;
- with 63kW onsite Solar PV production;

Water use and wastewater (catchments and the Great Barrier Reef)

- 75% (17 Megalitres/year) reduction in potable water use, compared to a median (2.5 Star) building;
- 80% (18 Megalitres/year) reduction in waste to sewer (including 1 Megalitre/year greywater re-use);
- 25% (2 Megalitres/year) reduction in flow to stormwater system due to rainwater collection and re-use;
- Treatment of stormwater (Gross Pollutant Trap).

Materials use (resource depletion)

- 70% reduction in reinforcing steel used;
- 30% reduction in air conditioning ductwork used;
- A fit-out design which reduces waste in tenancy re-fits.



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Leadership and innovation

The key design and engineering solutions implemented on this project along with other engineering initiatives have assisted in delivering the WMP2 project on budget and ahead of schedule.

The environmental benefits outlined in Criterion 1 have been achieved by combining existing ‘best practice’ with a number of engineering innovations which were made possible by a unique collaborative approach undertaken throughout all stages of the project

The design process for William McCormack Place Stage 2 is characterised by an unusually high degree of integration and collaboration. The client, architects, and engineers cut across traditional boundaries of responsibility in a series of design charrettes to ensure a structure within which all disciplines could excel – and continued this interaction throughout design and construction.

The most significant innovations of the building are explained below:

- A 1.5 million litre chilled water Thermal Energy Storage system provides for the whole site’s cooling needs with the air conditioning ‘chiller’ operating only at night. The cooler night-time conditions allow the air-cooled chiller to operate more efficiently than a traditional water cooling tower system would in the day. This saves approximately 7 million litres of water per year and eliminates legionella risk. Also as a result, around 24% of the whole building’s energy use will occur in the network off-peak period, reducing demand on electricity infrastructure, and also reducing ‘indirect’ emissions from transmission line losses.

- A large Rotary Heat Exchanger captures ‘coolth’ from waste air and uses it to pre-cool incoming fresh air. This passive system provides around 25% of the building’s cooling, with negligible energy use. As an added benefit, the approximately 160,000 litres of moisture condensed from incoming air will be captured and re-used as grey water. WMP2 is one of only a handful of Australian buildings to be pressure-tested for air leaks, maximising the effectiveness of this system.

- Ceiling fans are provided throughout the open plan office spaces to assist air conditioning via a ‘physiological cooling effect’ (cooling by breeze over skin) – reducing cooling energy use by 20% and reducing the need for (wasteful) air conditioning during partial occupancy after-hours. The fans are controlled by a ‘DALI’ lighting control system – a world first – via a novel device designed and built by a Queensland company.

- A ‘smart’ irrigation system balances the irrigation needs of each landscaped area with the available grey water (captured from showers, basins, and air conditioning condensate): Each landscaped area has its own soil moisture sensor so that only the required irrigation is provided. When there is little grey water available, the system seeks to defer irrigation until more is available. Conversely when there is excess grey water that would be dumped to sewer, the system actively seeks areas to irrigate. This system minimises the use of potable water for irrigation, at the same time using landscape as a place to ‘dispose’ of wastewater rather than sending it to sewer (and ultimately the Great Barrier Reef).

- High ceilings and windows and light finishes provide daylight for the vast majority of working requirements right through the 8 metre deep open-plan office zones. Extensive external shading and vacuum double-glazing minimise glare and heat gain from the windows. The avoidance of traditional dropped ceilings in these zones encourages their continued use as open plan spaces rather than individual offices.



Natural amenity and the built form

- A 'daylight harvesting' system regulates the amount of electric lighting provided to open plan office areas based on the amount of daylight available in each space. Such systems have commonly proven unacceptable to users (and are therefore often bypassed) due to poor sensing and noticeable and disruptive switching/dimming of the lighting. WMP2 applies a novel technical approach using carefully placed 'indirect' lighting sensors which monitor the amount of light bouncing off the ceiling of the office, as well as smooth/slow dimming fluorescent lighting to provide a system which is both efficient and comfortable. As a result, lighting energy in the open plan areas is reduced by up to 60%.

- The structural engineer worked with the client to bring a standard government brief for compactus zones (document storage areas) in line with world-best-practice guidelines. This and other structural engineering initiatives produced a streamlined and highly efficient post-tensioned structure – reducing concrete and steel use; and allowing maximum flexibility for installation of efficient building services.

The design team has already presented to industry one case study and one technical paper on these innovations; with a further four technical papers in preparation. These, along with educational tours provided to local and visiting industry, facilitate the application of WMP2's sustainable engineering initiatives on other projects locally and nationally.

In addition to the reduced environmental impacts detailed above, WMP2's design incorporates the best features of the natural environment to a healthier and more productive working environment than a conventional office building.

Internally, this is achieved through increased quantities of fresh air; improved air turn-over and comfortable breezes from ceiling fans; dedicated exhaust of potentially contaminated air from photocopiers and the like; high levels of diffuse daylight; high-comfort lighting; and finishes and furnishings which minimise air contamination.

The working environment in the open plan office areas can be compared to working in the shade of a fig tree on a comfortable Cairns winter day, as captured in this description:

"The air is clean and cool and dry (but not cold or desiccated), and there is a slight breeze (from ceiling fans). It is bright under the canopy but not glaring, with some light from above (electric lighting) but most coming in from the sides (diffuse daylight through shaded windows). The view out beyond the canopy is much brighter – looking up from time to time one's must eyes adjust to this light – but never painfully so. The environment is stable but not static – there is some movement in the canopy (turning of ceiling fans) and the light changes over the course of the day."

Carl Gray, MGF Consultants (NQ) Pty Ltd

The qualities described above are in contrast to many conventional office buildings: Air conditioning provides cold, dry, still – and sometimes stale – air. Windows may provide little useful light, and electric lighting is static and sometimes glaring. Though WMP2 is still in early occupancy – occupant satisfaction surveys have not yet been undertaken – the design team believes that WMP2 effectively incorporates the best qualities of the natural environment into the built form.

As well, in lieu of a traditional air-conditioned lobby and cafe, WMP2 provides a shaded and weather-protected outdoor lobby/cafe space for the amenity of workers. An overhanging 'living green wall', native plantings, and natural stone flooring are provided. The lobby's orientation catches natural breezes throughout the year, but for hot still days large (2.4m) ceiling fans are provided – these circulate air down and across the cool stone floor for effective but gentle cooling.

Summary

Raising the bar

William McCormack Place Stage 2 has set new standards for office accommodation in Cairns, significantly exceeding the client's brief for a sustainable and effective office building with low lifecycle costs. It has also helped place Cairns on the sustainability map, nationally and internationally.

The collaborative and integrated approach with an entirely local project team, from the earliest stages of schematic design, has resulted in a cohesive building. The siting, envelope, structure, and services work together rather than competing to achieve 'world leading' sustainability outcomes including a 6 Star Green Star Office Design v2 rating.

