PROCUREMENT AND RISK SHARING

Case Study

SUSTAINABILITY AT WILLIAM MCCORMACK PLACE

D.G. Jones
Queensland Department of Public Works (QQPDW),
Building Division, Built Environment Research
delwyn.jones@publicworks.qld.gov.au

G Messenger
QQPDW, Building Division, Portfolio & Housing

K Lyon Reid
QQPDW, Building Division, Government Office Accommodation.

ABSTRACT

The paper describes project management processes and tools used to deliver sustainable building initiatives at William McCormack Place in Cairns in Northern Queensland. From project initiation, the property's facilities management team was given responsibility for planning, design and construction.

A fundamental project requirement for this $17.5 million four-storey commercial office building of 4568 m2 net lettable area was that the building design, fabric and services elements were to be selected with regard to energy efficiency and life cycle costs. The aim was to prove that such a project could deliver strict building environmental and social sustainability targets at no additional capital while remaining economically and commercially viable in operations.

After one year fully occupied and operational external audits showed the office building used 40% less energy than comparable buildings to achieve the highest five-star Australian Building Greenhouse Rating. It also achieved a 4.5 star rated ecologically sustainable office fitout conforming to new Queensland Government's Guidelines.

The project demonstrated that typical Australian commercial office buildings present a range of opportunities for efficiencies that prudent building owners should recognise as they very significantly reduce building outgoings thereby increasing the asset value. William McCormack Place is a practical working model of how to incorporate best practice sustainability without, in any way, compromising quality, cost, time and scope parameters.

Keywords: Sustainable Building, Fitout, Facility Management, William McCormick

1. BACKGROUND

The Queensland Department of Public Works (QQPDW) manages a 821,000m^2 portfolio of government owned and private sector leased commercial office space in Queensland. Each year, the QPDW office accommodation program provides for construction or refurbishment of over 50,000m^2 of office fitout. The program's aim is to contribute to the Queensland Government's environmental objectives by providing ecologically sustainable office accommodation according to the Queensland Government (2000) award winning ESD Guidelines.

At Sheridan Street Cairns, the building is a four-storey commercial office building of 4568m^2 net lettable area owned and managed by the QPDW. Construction was by a private sector manager under a two stage, design and construct contract with a budget of $17.5M including fitout and public art. Innovative planning and tactical responses were exploited from project initiation.

Rather than the very significant technical innovations, the innovative management leadership had the greatest overall impact on project success. Manley (2003 and 2004) individually characterised innovations as advanced proven effective and simple building, services and fitout technologies. In this project it was the integration of proven advanced technologies to work efficiently as whole building systems that was most technically innovative.

2. INTRODUCTION

The context for the energy savings targeted in this project as reported by Jones et al (2003) found, building sector share of Queensland greenhouse emissions generation (GGE) was 22% in 1999 and residential and commercial operations dominated as shown in Figure 1.

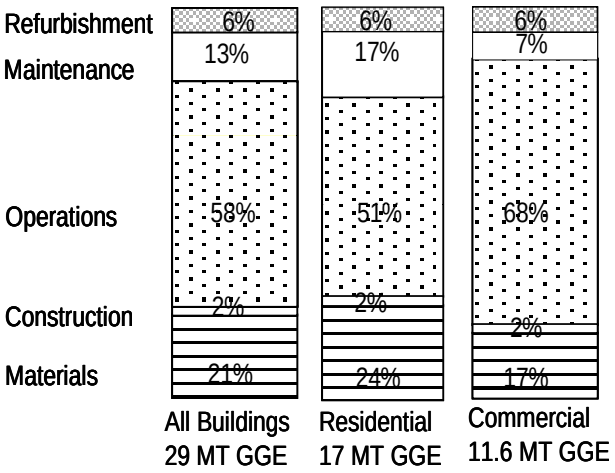

Figure 1 1999 Buildings GGE by Source (MT) & Phase (%)

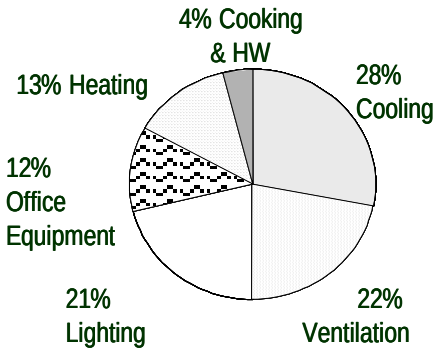

Figure 2 1999 Commercial GGE share (%)

As shown in Figure 2, the same studies estimated Queensland commercial building operational energy end-use shares as 28% cooling, 22% ventilation 21% lighting and 12% equipment.

2.1. PROJECT FOCUS AND GOALS

One aim of the building owner was to prove that an office building could be planned, designed and built to meet strict energy and sustainable fitout targets while remaining economically and commercially viable in a normal commercial market. Project goals included that the project was to be a:

- Four star National Building Greenhouse Rating (NBGR) (SEDA, 2001);
- Four star rated fitout ESD Office Fitout (Queensland Government, 2000)
- Commercial viable building without any Government financial incentives.

Design goals were that the property was to:

- Suit the owner, manager and tenant over the long term building life;
- Be flexible and manageable considering a historically high churn rate;
- Minimise lifecycle environmental, social and economic costs; and
- Employ local businesses to capture and improve their knowledge base.

3. METHODOLOGY

To ensure integrated planning from investment to operational management, the building owner gave overarching project control at project initiation to:

- A team with the property's future management responsibility;
- Ensure decisions retained long-term perspectives for the property's operational and functional performance; and
- Maximise functionality and manageability and deliver on time and budget.

The Building Owner's Brief sought:

- Economic consideration for local firms, material and apprentices;
- A project brief specifying key environmental performance and use targets;
- More sustainable economic, environmental and social outcomes;
- Integrated teamwork under FM project leaders with industry experience;

The Project Planning Brief called for building:

- Design, fabric and services with reduced energy and lifecycle costs;
- Compliance with a four-star ABGR rating in operations; and
- Compliance to a four-star ESD Office Fitout rating in operations.

The Project Design Brief called for delivery of:

- Passive design elements to conserve energy in-use over the building life;
- A safe, accessible and pleasant work-place with landscaped curtilages;
- An open streetscape, low roof-line, and shade trees in a tranquil setting;
- A bright coloured 'tropical' look incorporated into the building exterior.
- Culturally sensitive large-scale artwork and reflective space outdoors.
- Artwork developing built, natural, social and cultural linkages
- Indoor aspects making a pleasant place for occupants' work;

The Interior Design Brief called for compliance with Queensland Government Ecologically Sustainable Office Fitout Guidelines. These provide designers, contractors, tenants and occupants with strategic advice required to ensure:

- A healthier ecologically sustainable fitout;
- Reduced risks associated with hazards; and

- Liaison with industry to improve sustainable trade and employment.

The Building Services Brief required selection of active systems considering:

- Year-round air-conditioning in a hot, humid climate; and
- Simplicity, reliability and redundancy levels to compensate for occasional difficulty in obtaining spare parts in the semi-remote location.

Major project participants were

- Barclay Mowlem Construction Ltd as Managing Contractor;
- Design team lead by Cox Rayner and Cairns-based CA Architects;
- ARUP Structural/Civil/Fire Engineers;
- MGF Consultants (NQ) P/L Mechanical/ Electrical Engineers; and
- QPDW Project Services Office Interiors Design and Fitout.

4. RESULTS AND DISCUSSION

Results of project milestones, major achievements and key innovations are described initially followed by environmental outcomes in planning, design, construction, fitout, operations and disposal phases before economic and social outcomes.

4.1. MILESTONES

All project milestones were achieved on time and on budget including:

- Project approval and appointment of managing contractor in 2001;
- Completion of the design development stage in May 2001;
- Commencement of site works in May 2001;
- A fitout design freeze implemented in September 2001
- Practical completion in June 2002 and fully occupied July 2002; and
- ABGR Energy Audit August 2003 found it exceeded a four-star rating.

4.2. MAJOR ACHIEVEMENTS

William McCormack Place became the first full-scale Australian commercial office building officially awarded a five-star energy rating. Indeed its performance exceeded that rating by 15% to set a new benchmark. Success in this project confirmed that:

- Clear objectives and thorough design reduced risks to accepted levels;
- Savings in system design and construction balanced any added costs;
- Regional firms were key technology leaders and knowledge providers.

Manley (2003) found that the innovative air-conditioning saved 37% energy costs and 61% in capital and maintenance costs compared to conventional systems. Passive building design for daylighting, fitout design for reliance on natural daylight in layout and high-efficiency luminaires acted together to significantly reduce lighting energy fuel consumption.

Tenants also selected efficient office equipment to reduce energy consumption. Improved performance, largely achieved without increased costs, was mostly due to combining proven advanced compared to typically technology.

Quantity survey reports show the cost of building environmental enhancements was no greater than a comparable ordinary commercial building. Along with attaining a new benchmark for reduced greenhouse gas pollution it set another

benchmark for a commercially, community and environmentally friendly fitout for future commercial office buildings. Many systems improvements incorporated throughout acted together to achieve these benchmarks.

4.3. KEY INNOVATIONS

Some improvements relied on state-of-art technology while others exploited simple lessons learned in owning and operating QPDW's office portfolio. The innovative project delivery focus on integrating whole building systems successfully demonstrated achievement of new sustainability benchmarks without compromising quality, cost, time or scope. The innovative plant room depicted in Figure 3 houses the highly energy efficient, simple, reliable and highly redundant air-conditioning system with:

- A pre-conditioning unit with thermal wheel recovering 61% exhaust heat;
- Plant with rotary screw chillers on duty/standby each carrying 105% load;
- Pumps/Fans variable speed drives and zoned variable air volume boxes
- 15,000l chilled water storage tank to eliminate long period of low load and
- Building management system to control/monitor after hours operation

To improve performance in-use and maintenance proven technologies were innovatively integrated as whole building systems including:

- Extended eaves for shade and maintenance staff access without lifts;
- High performance glass and wall insulation to reduce solar heat gains;
- Recyclable cut-pile carpet tiles to reduce life cost 21% over loop-pile tiles;
- Flexible office space: through strategic columns placement; and
- Zone lighting control, occupancy sensing to limit conditioned air delivery.

An innovative response ensures ease of safe access to all parts of the building exterior with walkways incorporated into the sun shading, depicted in Figure 4, give access to all parts of the façade for cleaning and maintenance without the use of lifting machinery.

Figure 3. The Plant Room

Figure 4 Shades For Maintenance

4.4. ENVIRONMENTAL OUTCOMES IN PLANNING

Thorough planning, open and honest business relationships between project stakeholders and good communication fostered the climate of change needed to incorporate environmental sustainability into all aspects of the project's development. Sustainability was not just an add on but the essential foundation for the project.

The planning and consultation phase had the greatest long-term influence to reduce the property's environmental impact as decisions made during this

critical period affect the way buildings perform over its lifetime. Strategies applied in this phase ensured that vital life cycle environmental issues were addressed early enough to be successful and cost effective. Particular attention was paid to the passive building design, active air conditioning, electrical systems, interior daylighting and layout for facility flexibility, adaptability and simplicity.

Project planning incorporated features to minimise lifecycle costs, environmental impact and enhance manageability throughout construction, use, maintenance and eventual demolition. This was achieved through use of long lasting, low maintenance and recyclable materials so that with correct timely maintenance will last as long as possible. Examples of this approach include use of:

- Colorbond♥ steel cladding and
- Pre-finished aluminium sheeting façade;
- Colour-render rather than painted concrete and minimal applied finishes;
- Low maintenance materials such as stainless steel and aluminium;
- Low maintenance floor/wall finishes to minimise use of chemical cleaning;

4.5. ENVIRONMENTAL OUTCOMES FROM DESIGN

Design for clean lines and visual amenity ensured it did not impose on nearby government and commercial premises as shown in Figures 5 and 6.

Figure 5. Clean lines

Figure 6. View of the Environs

A low structure houses the top of the cooling towers as the only protrusion above the roofline and the lift motor rooms were located on ground floor and other plant rooms on level one. Passive elements incorporated in the design include that for the:

- Building shape and orientation to minimise façade exposure to direct sun;
- Façade material and glazing to minimise heat transmission to the interior;
- Extended roofline incorporating wide eaves to shade the façade;
- Window shade for 100% all seasons without impeding interior sight-lines;
- Efficient roof insulation and air-tightness to
  Minimise untreated outside air influx and
  Control of waste air egress to maximise heat recovery potential.

As depicted in Figure 7, a perspective across the garden, the importance given in design to bring the natural and built environment together is evident. Public area artwork was designed on natural environmental and community themes. Major pieces commissioned after expressions of interest from artists include:

- Hew Chee Fong and Lorretta Noonan's Water and Earth, sculptures in the forecourt as in figure 8, an apparently wet dry waterfall in granite; and
- Claudine Marzik's series of sculptural "Weather Report" panels in the forecourt and garden paths representing Cairns' tropical rainstorms.
- Wik Elder, Arthur Pambegan Jnr's foyer centrepiece as pictured in Figure 9.

These exterior artworks link natural and built environments while the entry foyer artwork brilliantly articulates the local indigenous people's ongoing spiritual connection to nature and the land.

Figure 7. View over a Forecourt

Figure 8. Carved Granite Waterfall

4.6. ENVIRONMENTAL OUTCOMES OF CONSTRUCTION

As a direct result of the concise contractual requirements set out in the project brief, site environmental issues that arose were minimal and were dealt with swiftly. Thorough construction planning and design also minimised rework and wastage.

The imposition of the fitout design freeze nine months before practical completion was effective as it allowed the seamless integration of the 'hard fitout' into the construction program without the need to demolish and waste any already completed work. Fitout construction incorporated seamlessly into the shell construction and was completed shortly after the building itself. The partition, air conditioning duct work, and electrical and communication cabling hard-fitout was carried out by the managing contractor as a main contract variation to ensure it was incorporated in original construction and to avoid wastage due to removal or changes to work already completed.

4.7. ENVIRONMENTAL OUTCOMES IN FITOUT

The fitout is by QPDW's Office Interiors designers who engaged in consultation with EPA and staff to facilitate successful outcomes with features including:

- Open plan workstations near windows for daylight as Figure 10 shows;
- Offices and meeting rooms to the centre of the floor as Figure 11 shows;
- A highly flexible and open workspace with minimal built zones; and
- Demountable partitions and furniture of modular design.

The design features reducing environmental impacts include:

- Doors of uniform size to allow for future re-use;
- Assembly with mechanical connections to promote reuse;
- Very low off-gassing materials used throughout;
- Wide use of recycled materials in the furniture;

- Mobile units, partition screens and shelves of recycled waste polymers;
- Screen fabric upholstery from recycled plastic bottles;
- Timber products from sustainably managed sources.
- Carpet selected for environmental/ economic life cost benefits including:
  Installation using water based solvents and
  Low off-gassing of VOCs from the carpet or solvents;

Figure 9. Wik Elder's artwork.

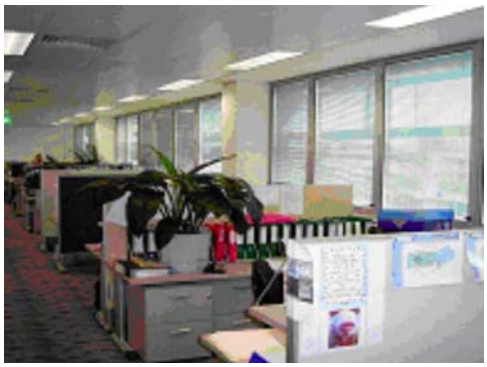

Figure 10. Window Workstations

4.8. ENVIRONMENTAL OUTCOMES IN OPERATION

The building is a low and unobtrusive structure set back from the street with complimentary landscaping, seating, public art works and local native planting providing a visually attractive and inviting presence appealing to staff and visitors. Indeed tenant surveys show that staff generally feel good about working there and EPA staff feel they 'practise what they preach' at work.

Environmental and economic benefits derived from a building's energy efficiency are both immediate and ongoing throughout its life. Passive design elements maximise daylight as shown in Figure 10, as well as minimising thermal penetration into the air-conditioned space. In turn active systems maximise heat recovery to reduce the air conditioning heat load.

These are extremely cost effective ways to reduce energy use over the building life. In typical building active systems the energy contained in the already conditioned waste air is simply lost as the air is allowed to leak from the building. However, in this building the waste air exhaust is controlled to facilitate recovery of a large percentage of the otherwise lost energy it contains.

As previously noted a common pre-conditioning unit provides all the outside air into the building. Used air is also exhausted through this unit where a thermal wheel recovers energy from the conditioned exhaust air to cool/dehumidify incoming outside air before it flows to ventilate/condition the main chiller plant room. This flow path effectively 'wrings' the last useful energy from the air before it finally leaves the building. The advantages of this system are:

- Humidity removed from supply air without inefficient reheat systems.
- 61% energy recovered from otherwise lost heat in waste air and then this

Normalised energy consumption is 109kWh/m2/annum and emissions 108kg CO2/m2/annum. The project brief called for a minimum of four stars having a normalised energy consumption of 179kWh/m2/annum, normalised emissions of 180kg CO2/m2/annum and total actual emissions of 1,074,175kg CO2/annum. The results show a reduction over the original consumption target of 40% and annual saving of 317t greenhouse gas emissions.

- Exhaust air to ventilate and cool chiller plant room without added fans.

Figure 11 A Plan of the Interior Layout

4.9. ENVIRONMENTAL OUTCOMES IN DISPOSAL

Upon eventual demolition of the building the bulk of the materials used in its construction will be recyclable. Construction as well as office recycling was facilitated via provision of space for bins and recycling service contractors. The generic design of the building facilitates future adaptive reuse as office space or for some other use. Even stripping back to its structural shell will involve minimal waste as most façade and internal components are recyclable.

The fitout with modular workstation components of recycled materials and mechanical fixings rather than glues, facilitates disassembly and adaptive reuse. The carpet tiles selected for environmental and economic lifecycle cost benefits can be 'remanufactured' to give an extended life and benefits include:

- 15 year 'first life' prior to lifting, minimal remanufacturing and re-laying;
- Backing recycling of the carpet is finally replaced;
- 30 year useful life, 4 times broadloom that is discarded to land fill;
- Sections more easily replaceable than with broadloom; and
- Replacement runs can be supplied so spares are minimised.

These concepts are being used in the 33 Charlotte Street fitout, a 15,000m2 new development for the QPDW in the Brisbane CBD.

5. ECONOMIC OUTCOMES OVER PROJECT LIFE CYCLE

The business case described the project economic objectives as a commercial venture. Inclusion of environmental and sustainability initiatives in property development did not increase project economic cost, reduced operating costs and contributed to improvement in the market rental position.

The project also aimed to provide short and long term economic benefits for the Cairns community. The Queensland Government's requirement to employ local people under its Local Industry Policy meant that maximum use was made of local consultants, contractors and suppliers for the project. This policy had a major effect on the Cairns economic environment.

During design and construction, the project generated 12,550 person weeks of work. Two new full time positions were created for direct building operation. In addition many local contractors and suppliers are employed in the day-to-day

operation and maintenance of the property adding to the 'economic mass' of the Cairns region.

The success of the project ESD initiatives and its resultant high profile increased exposure and business opportunities for many of those involved. In particular, Cairns firm MGF Consulting gained industry-wide exposure as the designer of the mechanical services and electrical systems that contribute greatly to the building's active systems energy efficiency.

QPDW has developed strategies to communicate the success of this project to interest groups in the construction and facilities management industries including promotion of the project with various industry groups; making it available for case studies; and facilitating the flow of project information and data to students and others through Internet publications. It is a practical working model of how environmental sustainability can be addressed without compromising quality, cost, time and scope parameters.

6. SOCIAL OUTCOMES

It was important that William McCormack Place contributed to the social environment of the community of Cairns as much as it achieved environmental and economic outcomes. Tenants actively participated in the design development process that valued the contribution and worth of individuals and connections between tenant organisations and the local community.

The project has delivered a safe, accessible, inviting place connecting with those living and working nearby, that reflects local area cultural and heritage values. Low-targeted external lighting, prominent entry and limited 'blind' corners contribute to a safe secure place for staff and visitors, day and night.

Pedestrian and cycling access from all directions is incorporated into the building that is designed to be fully accessible by people with disabilities. Occupants and visitors can recognise visible environmental aspects of a building made to ensure it is a pleasant place to work as well as to visit as it has features incorporated including:

- Seating near shade trees in a tranquil space for occupants and visitors
- Open streetscape and artworks for a pleasant soft visual impact and
- Cycle parking with change room facilities for staff cycling/walking to work;

Public art works feature prominently and to reflect the intrinsic diversity of the local community works of local indigenous cultures are integral in the building to celebrate reconciliation and difference. The artworks also promote concepts of community engagement and shared ownership. Some aspects of the project have been far-reaching and found to be contributing to the social capital of the area in unforeseen ways. Wik Elder Arthur Pambegan Jnr produced a large-scale version of his traditional work that encapsulates his people's story of the flying fox legend. While many of his pieces are displayed in galleries in larger southern cities now locals can see his work close-by in Cairns.

7. EXTERNAL VALIDATION OF PROJECT OUTCOMES

Compared to a 3½ star 'average', the building consumes 45% less energy, saves 419t GGE and costs $68K less in a year to run. It sets benchmarks for new buildings and demonstrates how to go about improving energy efficiency. This project provided QPDW with an ideal opportunity to develop a building that realised the State Government's objectives for sustainable office accommodation. While William McCormack Place is a practical example of

ecologically sustainable design with best practice environmental outcomes it is also achieved best practice economic and social outcomes planned and achieved at every lifecycle phase and for the building's lifetime.

An official energy audit in August 2003 resulted in it being the first new commercial office building in Australia awarded the highest rating, a five star energy rating in the Australian Building Greenhouse Rating Scheme. It was also the joint winner of the 2004 Facility Managers Association of Australia Sustainable Energy Authority Environmental Excellence Award.

8. CONCLUSIONS

The key project goal achieved was to prove that an office building could be constructed to meet strict environmental targets while remaining economically and commercially viable. The paper confirms that the project demonstrates that inclusion of environmental and sustainability initiatives in property development need not increase project economic cost, can reduce operating costs and contribute to improvement in the market rental position. William McCormack Place surpassed initial targets for energy consumption.

The success of this project was largely due to the owner engaging a strategic approach to the project's development and providing the means to implement sustainable solutions and strategies. From project initiation, the team responsible for the day-to-day property management, showed how facility management resolves lifecycle environmental, social and economic issues.

Those involved in the project are taking the knowledge and experience back to their respective organisations in a practical way that will provide the basis for ongoing improvements to practices and processes. Ongoing monitoring, analysis and reporting of the outcomes will contribute significantly to the knowledge base on sustainable development and improvements in similar developments in the future. Sustainability lessons from this project are that

- System savings balanced out cost of improved design and construction;
- Sound objectives and design process reduced risk for builder and client;
- Early facility manager involvement lead to optimal building performance;
- Regional firms can be leaders in technology as well as local knowledge;
- Clients managing risk can lead industry in showing benefits of innovation.

9. BIBLIOGRAPHY

Barton R.T., Jones D.G. and Gilbert D. (2002) Strategic Asset Management Incorporating ESD, J of FM Henry Stewart Publications, London, UK.

Jones D., Lyon Reid K., and Gilbert D. (2003) Sustainability Assessment Considering Asset And Building Life Cycles, Proc CIB Conference: Smart and Sustainable Buildings, Brisbane Nov 2003.

QLD Govt (2000) Ecologically Sustainable Office Fitout Guideline, http://www.build.qld.gov.au/aps/ApsDocs/ESDMasterDocument.pdf June 2004,

Sustainable Energy Development Authority, (2001), Australian Building Greenhouse Rating scheme, www.abgr.com.au as of Feb 2003, Australia.