The Refurbishment of 55 St Andrews Place, Melbourne: Turning a sparrow into a peacock

By David Clark, Partner, Cundall

1. INTRODUCTION

This article describes the upgrade of an existing government building, 55 St Andrews Place in Melbourne's Treasury Reserve, utilising an unconventional design process and with a strong emphasis on integrated design from the outset.

The aim of the project was to transform a poorly performing building, from both an energy efficiency and indoor environment quality perspective, into a building that meets current best practice for greener office spaces.

The building is owned and occupied by the Victorian Government.

2. BACKGROUND

55 St Andrews Place has an interesting history. The following is taken from the Heritage Victoria publication *The Treasury Reserve* (2000) by Frances O'Neill.

During the 1960s the State Government planned to build a skyscraper office tower behind the Old Treasury Building. An architectural competition was held in 1962, in which twelve firms were invited to submit designs. The guidelines for the competition mentioned the State Government's wish for a building which would express "soaring wonderment".

Eleven submitted designs conformed. The twelfth, Yuncken Freeman, put forward an entry by architect Barry Patten, who believed that a tower block "would destroy Melbourne's best vista – that is – looking eastward from the top of Collins Street to the Old Treasury Building". Patten's design was for two infill buildings of similar scale to the Old Treasury Building (constructed between 1854 and 1862) and 2 Treasury Place (constructed in 1859) which would "stand out like brown sparrows between two peacocks of Victorian architecture". A taller building was then to be placed facing Macarthur Street. At first this entry was disqualified by the judging panel, but then the decision was reconsidered.

The design was finally accepted and the three pre-cast concrete panelled boxes were built with height, scale and proportioned window openings which complemented the classical forms.

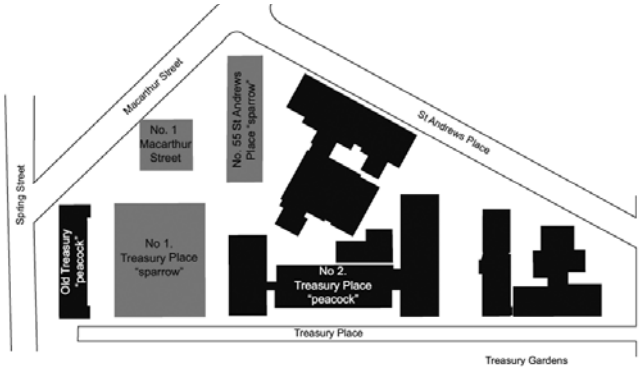

Figure 1: Plan of Treasury Precinct

Two of the buildings, 1 Treasury Place and 1 Macarthur Street, commenced construction from 1963, while 3–5 Macarthur Street (later renamed 55 St Andrews Place) was constructed as a four storey building in 1967.

Figure 2: 55 St Andrews Place under construction in 1967
(Source: National Gallery of Australia)

Figure 3: 55 St Andrews Place prior to upgrade in 2005 (the top floor was added in 1997)

Brief history prior to refurbishment

1967	Commenced life as the State Chemical Laboratories for the Department of Agriculture.
1994	State Chemical Laboratory tenant vacated the building.
1996–97	During the building refurbishment an additional level was added (level 4).
2006	The Department of Justice (DoJ) moved out of the building.

In 2004–05 the Government commenced evaluation of options for the building. The goal was to ensure its ongoing use as an effective part of the government's property portfolio. Concurrently two events occurred – the search for a new tenant and the development of a plan to improve the building.

3. VICTORIAN GOVERNMENT ACCOMMODATION STANDARDS

In 2005 the Victorian Government Office Accommodation Guidelines were launched, and 55 St Andrews Place was the first major government owned office building construction/refurbishment to commence under the guidelines.

The key targets prescribed for government office buildings were:

- Green Star – Office Design: 4 stars
- Green Star – Office Interiors: 4 stars
- ABGR (now NABERS Energy) Base Building: 4 Stars (existing), 4.5 stars (new)
- ABGR (now NABERS Energy) Tenancy: 5 stars

Key requirements included:

- Engage a dedicated ESD consultant
- Involve the Government Services Group environment manager (EMS)
- Increase productivity by improving working conditions
- Provide access for people with a range of disabilities
- Water efficiency
- Select materials to minimise waste and off-gassing
- Minimise waste – kitchen design, recycling area and construction waste
- Data centre energy efficiency to be considered

4. THE PROBLEMS WITH OL' 55

From a sustainability point of view the building was in poor condition. The opportunity was taken when the DoJ vacated the premises to give the building a much needed makeover.

4.1 Energy Issues

The energy use in the building was high – the total electricity and gas use exceeded best practice for this type of building and it was one of the government office portfolio's worst performers. The building rated about 1 star in an unofficial Green Star rating (one third of the building's points were due to its proximity to Parliament railway station) and would have achieved around a 1 star rating using the ABGR (now NABERS Energy) Whole of Building rating tool.

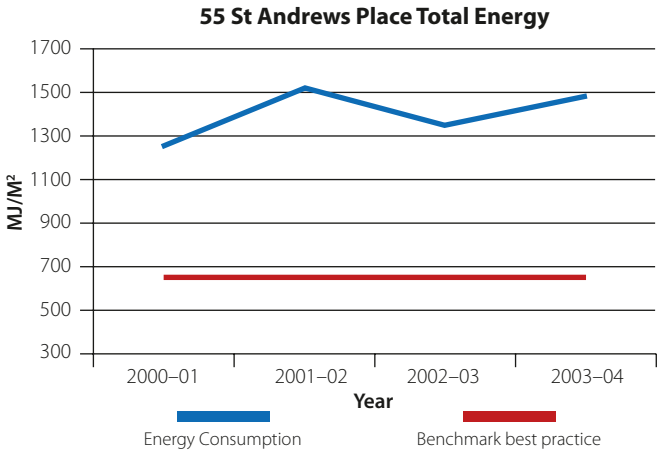

Figure 4: Historical electricity and gas consumption compared to a benchmark of 'best practice' from the Property Council of Australia Energy Guidelines 2003.

4.2 Indoor Environment Quality Issues

While the required temperature set points were usually maintained within the building, from an occupant's point of view the comfort levels were poor. This was due to a combination of the poor thermal performance of the building fabric and building services issues, including:

- The heavily tinted glazing became very hot in summer causing localised discomfort due to radiant heat, and cracking of the glazing in a number of windows.
- The outside air intake location resulted in it collecting exhaust fumes from vehicles in the adjacent service road (causing more than one evacuation of the building in the past!)
- The top floor roof added in 1997 was not well insulated and thus air returning to the plant via the ceiling plenum from the level 4 office space reached 40 to 50°C on extreme days, when ideally this would be around 27°C!
- The addition of VAV boxes to air-condition the additional level 4 drew air from the main Air Handling Unit, reducing the supply air to the other levels. The VAV boxes also ran backwards if started before the main system.

- Cold air draughts and perceived lack of fresh air.
- Problems with the air-conditioning control system with temperature sensors being incorrectly positioned or not relocated during tenancy fitouts.

Figure 5: Original outside air grille to main AHU behind and original window to lower ground floor stair well.

4.3 Other Issues

Other issues which needed to be addressed included:

- Light – the building was very dark due to the heavily tinted windows, and the artificial lighting system didn't meet modern lighting practices
- Water – there were no water conservation features in the building.
- Fire Services – required upgrade.
- Floor Coverings – the carpets were nearing the end of their life.

4.4 But it wasn't all bad

On the plus side the workstations left behind by the previous tenant (DoJ) were in good condition, with a number of spare parts. The walls and floors were in good condition and the existing solar hot water system on the roof was working well.

5. DEVELOPING A BUILDING IMPROVEMENT PLAN

In mid 2005 the Victorian Government sought consultants to develop and implement a building improvement plan to achieve the following for a base building upgrade and interior fitout:

- 4 star Green Star – Office Design
- 4.5 star ABGR (NABERS Energy) Base Building
- 4 star Green Star – Office Interiors
- 4.5 star ABGR (NABERS energy) Tenancy rating.

Consultants were engaged to develop the improvement plan for the building, and they, in turn, engaged architects and electrical, hydraulics and fire services to assist in developing the concepts and budgets. Three strategies were developed with budget costs for each:

Option 1: Measures to achieve at least 4 Star Green Star and ABGR (NABERS Energy) ratings

Option 2: Other measures that achieve 4 Star rating and improve the health, well-being, spatial efficiency and productivity of the building.

Option 3: Measures that achieve a benchmark building in fulfilling the triple bottom line (TBL) objectives of the Office Accommodation Guidelines.

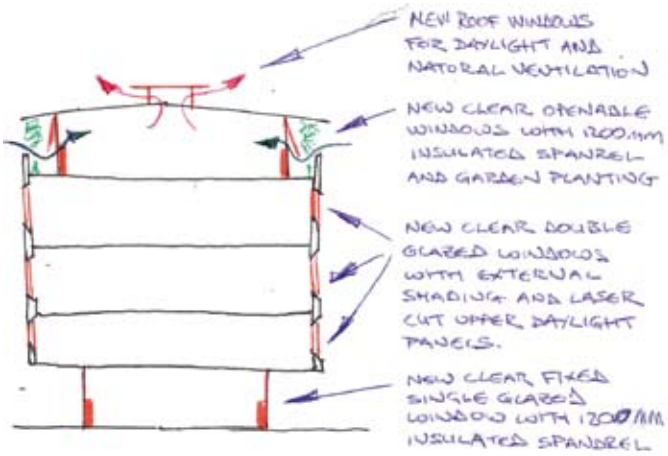

Figure 6: Fabric improvement concept used in original business case.

6. IMPLEMENTING THE IMPROVEMENTS

In 2006 the client gave approval to proceed with Option 3 with a budget of $4.3 million allocated. The ESD consultant was appointed as principal consultant to manage and prepare the design and documentation for the base building. At this time Cundall was a new consultancy in Melbourne offering ESD and Mechanical Services. While it might be considered unusual for the ESD consultant to engage architects, engineers, quantity surveyors and building surveyors as sub-consultants, this was consistent with the Government Services Group's desire to challenge conventional design processes as well as conventional design solutions on this project. The team was:

- Architect – H2o Architects
- Electrical, Fire & Hydraulics – Medland Mitropoulos
- Quantity Surveyor – WT Partnership
- Building Surveyor – Stokes Perna

Shortly after the ESD consultant was engaged for the base building upgrade works, the Department of Parliamentary Services were signed up as the tenant for the whole building. H2o Architects and Cundall were subsequently appointed to provide architectural and engineering services respectively for the fit-out works, while another firm, Montlaur Project Services, was engaged around the same time to project manage the tenant fit-out and provide construction administration services for the combined base building and fit-out works.

The design of the tenant fit-out and base building upgrade proceeded in parallel. The design documentation and drawings were truly integrated with only one set of documents produced and tendered for the whole project.

7. DESIGN PROCESS

Very early in the design process the team realised that an innovative and consultative approach was required. Throughout the design phase the whole project team met on a weekly basis for approximately two hours to review the progress made over the last week. An Action Plan spreadsheet (a double-sided A3 sheet) was developed and updated at each meeting. This worked as the design brief, meeting minutes, cost plan, program and a 'green plan' all rolled into one. The benefits of the design approach were many:

- all team members had a clear understanding of the ESD elements of the building
- the team was asked to contribute their own thoughts
- the team members added value to the design from their own professional perspective
- the client team knew, first hand, the issues, the cost and the resolution proposed

This process meant the whole team 'owned' the design. The team also asked the engineering services manager from Jones Lang LaSalle (facility manager of the building) to attend, which proved to be a huge advantage, as the design has a maintenance culture embedded throughout.

The base building design outlined in the ESD Improvement Plan was further tested and refined. New features were added and other initiatives were deleted or adapted to either keep the project on budget or to reflect the fit-out requirements of the tenant, The Department of Parliamentary Services.

Major changes to the original design included: converting the ground floor from an office layout into eight larger Parliamentary committee rooms and a multi-purpose room; relocating the building entry from the end of the building to the side (its original location prior to the 1997 upgrade); deleting the proposed mixed mode system on Level 4; and adding a new data centre.

The typical approach to refurbishing poorly performing existing buildings is often to simply replace existing services, internal materials and fittings. The approach to 55 St Andrews Place was to go back to first principles and consider the same key issues as when designing a new building. The core design philosophy was to:

- improve daylight
- improve comfort and air quality
- reduce solar heat load entering the building through the roof and windows
- retain existing materials, systems, appliances and other equipment where possible

8. IMPROVING THE FACADE PERFORMANCE

The majority of the building's windows face east and west and receive large solar heat loads. As they were not shaded, the resultant internal heat gain required a lot of energy to air-condition. To manage the solar heat loads through the windows, the existing glass had been heavily tinted and a reflective film had also been applied. Consequently, very little daylight entered the building. Because the windows were so dark they also got hot, which meant it was uncomfortable sitting next to the windows when the sun was on them.

To increase the daylight potential, improve comfort and reduce air conditioning loads, the punched window glazing to levels 1–3 was replaced with clear glass, and external automated blinds were installed to control the solar load before it enters the building. The blinds allow for adjustment in two panels – allowing for glare to be avoided at desk level, and light to be reflected up to the ceiling at the same time. Each window has a manual override switch to give users direct control.

Figure 7: Refitted windows on Level 3 – clear glass and external automated daylight guidance blinds.

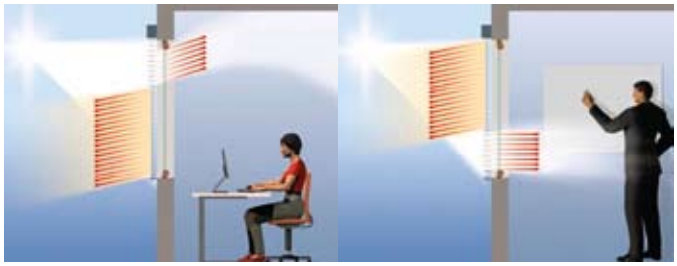

Figure 8: External automated daylight guidance blinds
(Source: Shade Factor)

On Level 4 the large expanse of full height tinted glazing in the office area was replaced with an insulated 1.2m high spandrel panel and new low-e glass (except in the new naturally ventilated resource room where the existing glazing was retained and glass louvre doors added). This reduced heat losses/gains through the façade, improved comfort and increased daylight levels. The existing full height glazing to the ground level was retained as this had good shading (and the budget did not allow total replacement of this glazing).

Figure 9: Naturally ventilated resource room (the high concrete upstand outside the perimeter of the top floor raises the question – why was full height glass originally installed?)

9. MODIFICATIONS TO THE AIR CONDITIONING SYSTEM

The original VAV air conditioning system and Air Handling Unit was retained and modified. To cope with the high occupancy levels in the ground floor committee rooms a new HVAC system was installed to serve these rooms. This comprises a new Air Handling Unit with heat recovery and indirect evaporative cooling supplying 100% outside air to a Fan Coil Unit in each committee room. A separate existing package A/C unit serves the small lower ground floor space.

A number of modifications were made to the existing HVAC system to reduce energy and/or improve indoor air quality and comfort. These include:

- Relocating the air intake for the building.
- Increasing outside air to 40 per cent above the minimum code requirement
- Cleaning all the ductwork to remove dust accumulation from years of building use
- Installing high performance swirl air outlets to reduce draughts and improve air distribution to give more even temperature.
- Ducting the return air to the level 4 fan assisted VAV boxes to reduce ceiling void heat losses and gains.
- Creating a naturally ventilated winter garden at the northern end of level 4. This space is not air-conditioned (the existing ductwork is capped off) and is used as a meeting resource room, accessible to all building occupants.
- Improving the air-conditioning control strategies including a setpoint which is adjusted based on the outside air temperatures
- Installing CO_2 sensors to monitor air quality in the building.
- Installing a new separate exhaust system for printer / photocopier rooms to directly remove air pollutants such as ozone from the building.

1: New supply air grilles cut into existing plenum on side and back wall (away from loading dock, car park entrance and service road)

2: Former supply air grille for car park blocked off. Plenum behind now supplies outside air to 55 St Andrews and to car park

3: Former air intake for main AHU converted into exhaust grille for new committee room AHU

4: Former window to lower ground stairwell blanked off, stair removed and space converted into plant room for new committee room AHU

5: Former air intake grill for lower ground A/C unit converted into window forming part of new supply air plenum.

6: Delivery dock and car park entrance

Figure 11: Relocated air intake

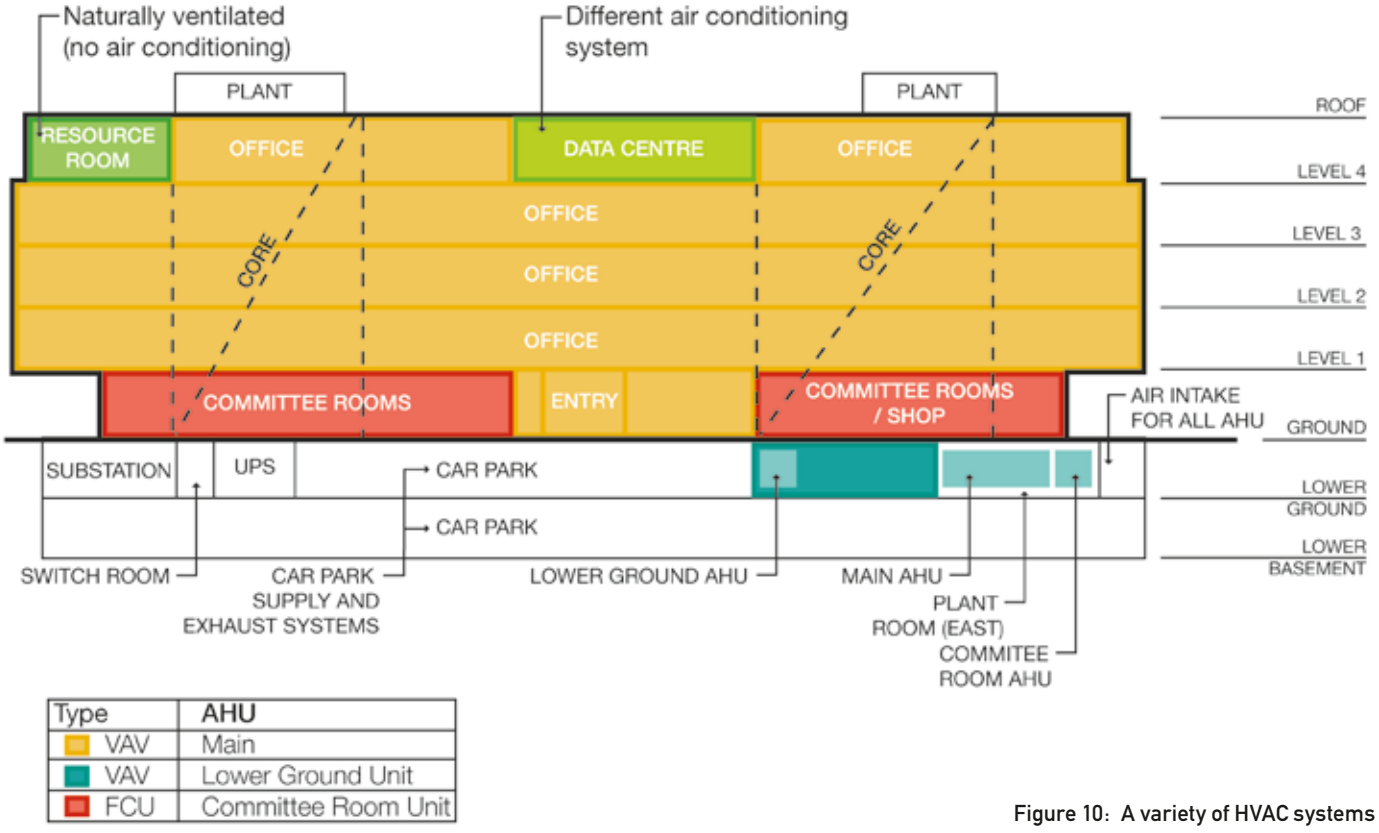

Figure 10: A variety of HVAC systems

Figure 12: New supply air plenum behind new window to lower ground floor

10. DATA CENTRE COOLING

The building's data centre on Level 4 serves not only 55 St Andrews Place, but the whole of Parliamentary Services' IT system throughout Victoria. Even though it utilises energy efficient blade servers, when all these servers were placed into level 4, they accounted for over 60% of the tenant's total energy consumption in the building. Chilled water to the proprietary IT cooling system in the room is supplied by the central chilled water system.

All the chilled water to 55 St Andrews Place, 1 Treasury Place and 1 Macarthur Street is provided by a central plant located in the adjacent 1 Macarthur Street building.

A previously unused chiller in the nearby Old Treasury Building was recommissioned and connected to a new Muller 3C heat rejection unit located next to 1 Macarthur Street. This chiller was then connected to the central chilled water system to enable the data centre to be cooled out of hours (evening and weekends) without turning on the main chillers and cooling towers in 1 Macarthur Street.

11. LIGHTING SYSTEM

The previous lighting was designed to provide light levels of 400 Lux and sometimes provided higher levels. A new lighting system was installed comprising:

- Ceiling lighting providing a background lighting level of around 180 Lux, which is generally better for computer screen based activities.
- Local task lighting at each workstation providing user controlled lighting levels for paper based activities. The task lighting is connected to the lighting control system to turn off out of hours.
- A lighting control system with motion sensors and time clock control.

12. WATER SYSTEMS

Water efficient taps and showers, and bioactive waterless urinal system were installed.

The rainwater from the roof is collected into a single stormwater pipe at lower ground level. New pipes were connected to this in the lower basement car park below and stormwater diverted into new storage tanks located in the basement car park (in an old, disused storage room). The rainwater is pumped to the floors above for toilet flushing and future level 4 planter boxes. The new gate valve controls the water flowing into the storage tanks and has also been programmed to act as a first flush system.

Figure 13: Task lighting to workstations

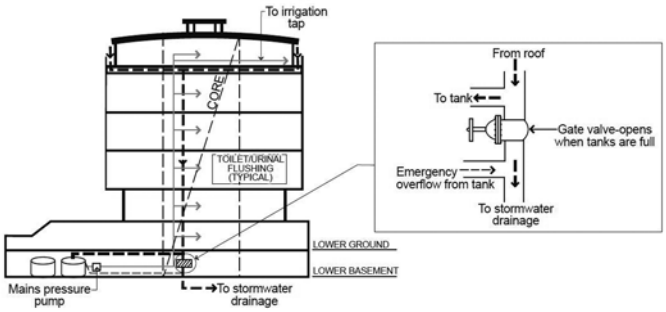

Figure 14: Rainwater harvesting system

13. OTHER ENVIRONMENTAL INITIATIVES

This paper has focussed on the building services aspects of the refurbishment. A number of other environmental initiatives were also incorporated into the building including:

Construction waste was reduced firstly, by reusing as many materials as possible, including:

- All workstations
- 80% of existing suspended ceilings (exception being ground floor)
- 50% of existing office partitions
- 50% of tables
- 67% of storage units
- 80% of air-conditioning ductwork, plant and systems.

Where new materials were used, effort was made to avoid PVC and materials that are known to have significant off-gassing:

- new pipe work and communications cabling has no PVC content
- carpet tiles have low VOC emissions and no PVC backing
- sheet flooring used linoleum with no PVC content
- joinery uses particleboard and MDF with low formaldehyde content (EI and EO standard)

As part of the renovation of the building, waste management features were incorporated to allow for separation and storage of recyclable waste.

- A dedicated storage area is located in the lower ground car park area and provides for the separation, collection and recycling of office consumables.
- A designated storage space is allocated on each floor for waste bins (recycled/compost/landfill).
- 85% of demolition and construction waste was diverted from landfill and either recycled, or reused during the refurbishment works.

The building's location gives it excellent access to public transport – trams, trains, buses. In addition, 20 secure bicycle storage facilities, with change facilities, lockers and showers were provided to further reduce reliance on cars.

14. CONSTRUCTION

The building works were completed in May 2007 by Schiavello. The combined project cost for the integrated base building upgrade and tenancy fitout was approximately $8 million including construction costs and consultant fees. This equates to approximately $1,315/m2. The split between base building and fitout was approximately 60:40 giving a base building upgrade cost of $790/m2 and a fit-out cost of $525/m^2.

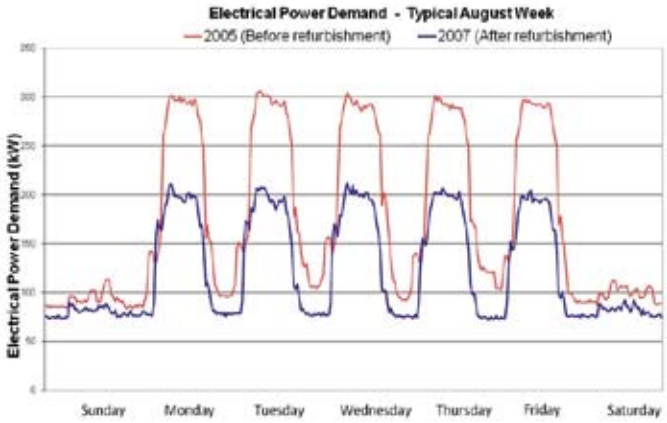

Figure 15: Building after upgrade works

15. PERFORMANCE

According to the facility manager for the building, the indoor air quality and ambience in the building has significantly improved compared to before the upgrade. The improvement in air quality is primarily due to relocating the air intake, cleaning the ducts and filters and increasing the amount of outside air. The improvement in ambience is primarily due to replacing the heavily tinted windows with clear glass and installing daylight guidance blinds.

The automated blinds and task lights have been well received by the tenant. Typically only about 10% of task lights are turned on during the day, occupants instead relying on daylight and the reduced ceiling lighting levels.

Unfortunately, the author has been unable to obtain energy data for the first 18 months of the building's operation. The graph below summarises the energy performance of the building before and after the upgrade for a typical week in August. This shows a 30% reduction in total electrical use in the building for base building and tenancy (excluding the chilled water which is supplied by the central plant). The chilled water consumption will be unchanged, as the original cooling capacity was retained to enable outside air quantities to be increased. The electricity data for 2007 includes the new data centre installed during the upgrade works.

Figure 16: Electricity profile for a typical week in August 2005 v 2007

16. GREEN STAR RATINGS

The base building and fitout have recently gone through the Round 1 submissions for Office As-Built and Office Interiors ratings. It is expected that both will achieve 4 star ratings. A number of the key initiatives implemented did not achieve green star points (e.g. relocating the air intake, split daylight guidance blinds, task lighting). Good design does not always fit neatly into prescriptive rating tool criteria and designing only to score points does not necessarily lead to the best outcomes when greening an existing (or new) building.

The amount of work required to obtain the necessary as-built documentation and supplier documentation for these ratings should also not be underestimated!

17. CONCLUSION

The upgrade of 55 St Andrews Place was achieved by breaking with conventional design processes and solutions. The ESD consultant was the principal consultant and together with the client defined the project brief and budget. The ESD consultant then took on the role of principal consultant and managed the design process for the base building. This placed sustainable design at the heart of all the decisions made on the project.

The design solutions are simple and cost effective. By improving the façade performance, the team was able to improve daylight and comfort, and reduce energy consumption, while retaining most of the original mechanical systems and ceilings.

The fit-out and upgrade works were truly integrated and this was most apparent in the design of the lighting system which combines ceiling lighting with task lighting.

The project demonstrates that to make significant environmental improvements in existing buildings it is not always necessary to 'gut' the interior, and start again.

The project won the Sustainable Refurbishment of the Year at the UK's Sustainable Building Services Awards in 2007.

REFERENCES

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BEDP Environment Design Guide, CAS52: Office Building Retro fit At 55 St Andrews Place, Melbourne – Turning A Sparrow Into A Peacock by Roger Kluske and David Clark

ABOUT THE AUTHOR

David Clark is a Partner with Cundall and has relocated to the practice's Manchester office in January 2009 for 3 to 4 years after 15 years working in Australia. He helped establish Cundall's Melbourne office in 2004 and has played a key role on many of Australia's leading green buildings including The Gauge (the first 6 star Green Star – Office As-Built rated building in Australia), VS1 in Adelaide (the highest scoring green star project to date) and St Leonards College Sustainable Living Centre (UNAoA Green Building Award 2008). In 2008 he was named the Sustainability Champion of the Year in the UK's Sustainable Building Services Awards.

ACKNOWLEDGEMENT

All figures (photos, diagrams, etc) by Cundall unless stated otherwise.

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