1200 Buildings

CASE STUDIES

385
Bourke Street

385 Bourke Street is an example of how to manage the retrofit of a very large commercial office building over a long project period to achieve significant energy efficiency imporvements.

Built

1983

NLA

Office 55000 m^2
Retail 6000 m^2

Tenancy

Major Tenants include Commonwealth Bank, TRUenergy, UniSuper. The building also has approximately 50 retail stores and 2 levels of car park.

Building owner

Commonwealth Property Office Fund

Property manager

Jones Lang LaSalle Management Services

Refurbishment project timelines

2004 – 2011

Project team

Project manager: Donald Cant Watt Corke
Project Director and Facilities Manager:
Jones Lang LaSalle
ESD consultant: Umow Lai
Contractors: AG Coombs, PARMAC and Johnson Controls

NABERS Energy

Previous: 0.0
Current: 3.5
Target: 5.0

NABERS Water

Current: 3.5
Target: 4.0

Key refurbishment features

- Upgraded BMCS
- Variable speed fan drives
- Economy mode
- Lux meter sensors
- T5 lamps
- Quantum heat pump units
- Flow restrictors in washrooms
- Commingled recycling program
- Metering

Energy saving

372 MJ/ m^2 per annum saving which is a 41% reduction in CO_2.

Water saving

Not applicable.

Greenhouse saving

4680 tonnes CO_2/annum

Project costs

$2.5 million

Annual saving

To be confirmed

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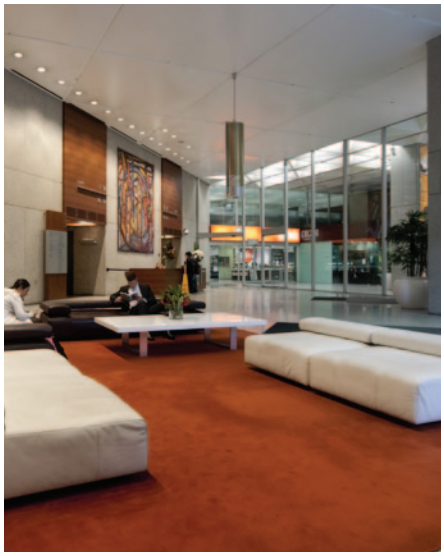


Background

The building, located on the busy corner of Elizabeth and Bourke streets, was completed in 1983 being a concrete and steel structure, with rectangular windows adorning a concrete façade.

The office podium is 45 storeys high, sitting at a 45 degree angle to the city grid. The building houses the Melbourne headquarters of the Commonwealth Bank and a number of other commerical tenants, with a variety of retail stores and a large open food court on the lower levels.

The retail area is 6,000 m^2 and the office, 55,000 m^2.

Jones Lang LaSalle manages the building for the building owners, Commonwealth Property Office Fund.

In 2004, an Australian Building Greenhouse Rating (ABGR) rating (the predecessor to the National Australian Built Environment Rating System NABERS) was conducted on the building, which revealed a zero star rating.

The consultancy Umow Lai then conducted a comprehensive environmental performance audit, which provided a list of options for the building to improve its energy efficiency. As a number of the mechanical systems of the building had reached the end of their life cycle, the recommendations were mainly directed at improvements to the efficiency of the heating, ventilation and cooling (HVAC) system.

The owners conducted a feasibility study to understand the risks and costs that would be encountered by the proposed system upgrades.

In 2005, the building owners agreed to go ahead with the works, and together with Sustainability Victoria and project managers Donald Cant Watt Corke produced a detailed project scope.

The project also involved a Umow Lai Environmentally Sustainable Design (ESD) consultant and contractors A.G. Coombs, PARMAC and Johnson Controls.

Objectives

The main objectives of the first stage project was to lift the building from a zero NABERS Energy rating to a 2.5 rating – a target, which it was understood, was achievable. This objective was essential for the building to maintain relevance in the marketplace.

Planning

The plan included the upgrade and reinvigoration of the HVAC system in the building. This was conducted in two stages.

Stage 1 – This entailed refitting systems and rationalising previous upgrades, such as upgrading the building management system, rationalising building controls, introducing energy metering of the chilled water system, replacing fan motors, conducting active air quality measurements and reviewing after hours operation and zone control.

A rational approach was adopted with planning, whereby the items recommended for upgrades or rationalisation were assessed within a set budget and understanding of ratings gains.

This stage of the project has now been completed.

Stage 2 – This involves further upgrades mainly to HVAC reticulation such as heating and cooling water systems, chilled water controls and some additional sub-metering.

The objective of Stage 2 is to further lift the NABERS ratings to at least a 3.5 Star NABERS energy rating.

Implementation

The project was implemented over two and a half years and broken down into discrete packages, undertaken at the same time where practicable.

For instance, changes to the boilers on level 43 and the chilled water system in the basement, which are essentially different systems, could be tackled at the same time. This improved the efficiency of implementation and reduced expenditure.

The building maintained near full occupancy during the upgrade.

Features

Building

There were no changes made to the structure or façade of the building. The building structure and skin were deemed to be in very good condition.

HVAC

Over time, as tenants moved and vacated floors, the building's HVAC had been retrofitted from a pneumatic to a Direct Digital Control. The legacy of this randomised refurbishment was that it left the building in an unbalanced state, and necessitated a complete recommissioning of the plant in line with the changes made to the new floors. This re-tuning or re-balancing was undertaken early in the project.

Variable speed drives to fans were installed to each air-handling unit that serves a zone across a group of floors. This was a substantial investment involving eleven large air-handling units (AHU) with both supply and return air fan motors being retrofitted.

The system was re-programmed to improve the use of economy mode (free cooling from cooler outside air when available) instead of using the chiller plant. This is considered one of the more significant energy-saving initiatives implemented in the refurbishment project.

The air handling ducts to each floor were investigated systematically and any leaks sealed.

The plant equipment was not changed, although the chiller's operation was revised in terms of stage up and stage down strategies, and a revision of cooling call logic.

The installation of variable speed drives and the AHU logic change enabled the building to operate more efficiently in after-hours mode. Previously, half the building's HVAC plant would run to condition one floor and the fans would run at full speed across all floors. The distribution is now zoned at individual floors, which means that for after hours use, there is greater control over each floor as well as the building as a whole. This has had a very positive impact on energy savings.

Eight floors of the building had a different Building Automation System (BAS) to the rest of the building and this caused some control issues. Consequently, this was upgraded in line with the rest of the building, which enabled greater control over the central plant controls and consumption.

Lighting load

Lux meter sensors are installed in the foyer and programmed to detect the level of ambient sunlight, which then determines the number of circuits that need to be switched on at any time.

As floors are refurbished, the lighting is also significantly upgraded with energy efficient lamps, currently at T5s. Tenants then install smart controls including proximity sensors as the floors are partitioned.

Water

Originally, domestic hot water was provided by the main boiler plant, which was oversized for this role resulting in significant energy losses. This system was replaced by six energy efficient quantum heat pump units; three located on level 42, and three on level 2. This has enabled the main boiler plant to be taken offline, except in seasons when building heating is required.

Flow restrictors were placed on all taps in the washrooms, and showers received new water efficient heads.

As floors are upgraded, the toilets are installed with the latest dual flush systems.

Waste

In 2005, VISY was engaged to introduce one cardboard box for each workstation for recyclable waste (a co-mingled recycling program), and general waste confined to the kitchen area.

All construction waste from floor refurbishments, plant and equipment, and other materials is recycled, achieving a 60 per cent recycling ratio.

There is a cardboard baler to compress disused cardboard boxes.

A centralised oil collection bin is available for the food court.

A bin is provided for used lamps and tubes so that they can be disposed of correctly rather than sent to landfill.

Environment

Air handling systems actively measure, respond to and prevent CO_2 levels from rising too high. If required, more outside air is delivered to the office areas.

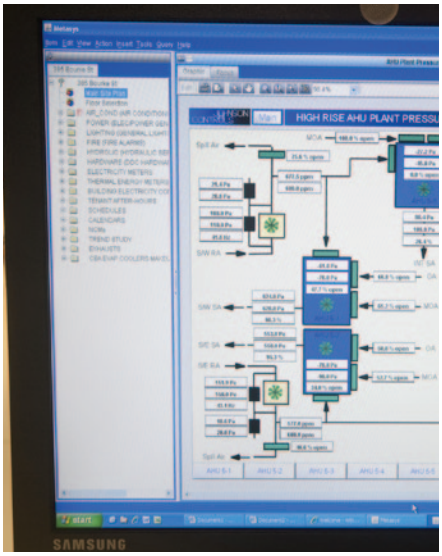
Replacement of air curtains on entrances with automatic doors resulted in significant savings in heating and cooling energy in the food court and retail areas.

Low volatile organic compound carpet, paints and other materials were used in the tenancy refurbishment.

Building management and controls

Part of the control strategy to reduce energy was to implement a system that would clearly identify where and how much energy was being consumed. Energy metering on the major plant was subsequently installed, allowing better levels of monitoring and making it easier to pinpoint any issues. An external service provider dials into the system, analyses the data and reports monthly on issues and anomalies within the data.

A number of points in the BMS were made into variable points to enable tuning and manipulation by operators to improve the building performance and energy efficiency.



Key sensors to the control systems (supply air temperature and system pressure) were recalibrated and relocated to improve reliability and accuracy.

Paul Vandervlis, Senior Engineering Manager of Jones Lang LaSalle who was with the building project team during the planning to commissioning phases confirms that significant energy savings have been made through a concerted effort to improve the control systems.

Challenges

The project team had a clear idea of the building's potential for optimism however communicating this effectively with and between consultants and contractors was sometimes challenging.

For the project team the challenge in this project was getting the installed equipment and control strategies working and tuned correctly post commissioning.

An external technical agent from A.G. Coombs was brought in to assist with the tuning of the building performance strategies.

They did not introduce performance-based contracts because of the amount of additional work going on at the same time. It would have been difficult to separate the contribution individual component projects were having on the whole energy performance unless all work was rolled under the same contract.

The commissioning process took over a year as there were challenges getting the BMS strategies running effectively. There were also a number of complex control strategies that needed seasonal tuning. Parts of the installation works had a number of technical issues relating to latent conditions, and there were differences in perception of scope.

The site documentation was not up-to-date. This was a problem in so far as it meant not knowing whether the new control strategy would in fact negatively impact the operation of a different component of the complex system.

The project team adopted the approach to write the documented programming specification in the format of a revised building technical manual. This made clear what changes were required to all elements of the program. This also assisted in having accurate as-built manuals on these complex strategies.

Keeping occupancy rates up was also a challenge. This relates to the NABERS Energy rating as it is calculated on the energy used, square meterage occupied and the hours of operation. In other words, to gain a significant rating, the building needs to be substantially occupied.

Outcomes

Energy

372 MJ/m^2 per annum saving which is a 41 per cent reduction in CO_2, which was also a NABERS energy improvement from 0 to 3.5 stars.

Water

NABERS Water star achieved 3.5 stars.

Social

Tenant surveys will be the ultimate guide to tenant comfort and attitudes toward the indoor environment. However, the project team believes that the building is providing a level of HVAC performance greater than prior to the project works. Some of the works involved meant considering the internal working conditions of the building as well as plant performance.

Maintenance

The works brought to the surface a number of underlying maintenance issues. These are being addressed and management needs time for the maintenance works to stabilise in order to determine the cost impacts and determine a decrease in HVAC comfort complaints.

Commercial

The increase in NABERS Energy rating will certainly open up the building to a larger market of tenants, in particular those that are seeking a NABERS rated building.

Overall

Not available at this stage.

Lessons

For Paul Vandervlis, the main lesson is having the right people within the contractor and consultant firms on board, and having them motivated, with the right attitude and sharing the same objectives. Therefore, the selection of the project team is critical.

When dealing with suppliers, project teams should exercise caution and watch out for sales pitches that may have little or no relationship with the products they are selling. This can range from individual equipment products to the capabilities of the firm sitting behind that salesperson.

Another important lesson is the need for effective commissioning, which is often performed incorrectly. Ensuring that the works are fully complete, and are operating correctly is part of the commissioning process. In this project, handover was not an issue as the project team included the people who were expected to operate the building system once it was commissioned.

The future

The calendar year 2009 revealed that the building was operating at a 2.5 star NABERS Energy rating.

The calendar year 2010 revealed that the building has improved and achieved a 3.5 Star NABERS Energy rating.

In the future, the project aims to to lift the NABERS Energy rating beyond 3.5 star. This will be achieved by:

- additional back of house-plant works, such as a full recommissioning of the air handling system to make sure each floor is receiving the correct amount of air
- more metering, and smarter meters, that will flag energy alarms on plant components if they exceed normal usage
- examining air handling, cooling tower water and chiller performances to gather more information on how they influence one another, and tune them to get the best operational performance.
- installing new cooling towers to improve water and maintenance efficiency, rather than energy efficiency as such.
- assessing the original boiler plant to establish the cost effectiveness of replacing it with a high efficiency boiler.
- further work to the economy mode control of the building including close scrutiny of the moisture content in the air, ensuring this resource is maximised.