CASE STUDY

GREEN BUILDING FUND

406 Collins St, Melbourne

AIRAH

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406 Collins Street is in the heart of Melbourne's CBD.

Taking ownership

For the most part, refurbishment projects for pre-loved buildings are largely financially driven. But for the owner of a 1950s commercial office building in Melbourne, the investment said as much about a commitment to sustainability as it did about economics.

The commercial office building at 406 Collins Street, Melbourne would likely be described as "average" by most observers. Its owner, Dr Dorian Ribush, however, is not typical of most building proprietors.

For many owners – often faceless conglomerates – the decision to refurbish is strictly a financial one. A relifed building is usually not only more energy efficient, saving money straight away in the form of lower utility bills, it also is more attractive to prospective tenants.

Ribush, though, made his involvement personal, getting involved in the nitty-gritty of day-to-day decision making.

A relic from the 50s

Built in 1958, the building's steel and concrete form is a standard of modernist architecture from the period. Before renovation, a nondescript glazed façade lacked any real ornamental detail, except for a statue of Atlas at street level. This quirky feature continues to be the only remnant of the 19th century Mutual

406 Collins Street in the 1950s

Assurance Society of Victoria headquarters that preceded the existing building on the site.

Just three years after the original six-storey building was completed, a further four were added. The building's mechanical services could best be described as "serviceable" for the time.

The boardroom

Back then, the term "sustainability" was not commonly in use, and electricity was cheap.

When Ribush bought the building in 2006, it soon became apparent that a substantial refurbishment was needed to achieve any form of energy efficiency.

The HVAC system was antiquated, and the addition of the top four floors in 1961 had effectively split the building in two. A large boiler located in a basement plantroom and a chiller on the roof were the only common elements.

Air handling was divided between the bottom six floors (from the basement up) and the top four floors (from the roof down).

The building also operated using a rudimentary control system, supplying air that is cooled to satisfy the zone with the greatest demand, and reheated air for all other zones to meet their requirements.

No easy solution

There was no easy way to implement any form of energy-management system. Even on days where ambient temperatures were in the extreme at both ends of the scale, both the boiler and chiller operated.

Inefficiencies were everywhere; an audit by a large consultancy soon revealed the extent of the building's problems.

Not only was the HVAC system past its use-by date, but reheat coils were found to be blocked by years of grime; control valves were persistently sticking. Insulation on solid ducting had deteriorated badly and stairwells were "lit 24/7 like Kmart" by hundreds of inefficient fluorescent tubes, according to Ribush.

Among a list of recommendations was that the entire HVAC system should be replaced with a gas-fired, variable-refrigerant-volume (VRV) system to bring the building up to current Code performance.

"I realised quickly that this was the deluxe way of going about it," says Ribush. "You hand someone a building, and a couple of years later the job is done – then you pay them this huge amount of money."

New to commercial building ownership, but not so green as to accept there being only one way of doing things, Ribush sought out the advice of independent consulting engineer and AIRAH Fellow Dick Lister.

Rather than go down the "deluxe" path, Ribush saw an opportunity to be hands-on through the process – not only to reduce the cost, but to invest personally into the project.

"I'm of the inclination that if I can find a way to save some money and spend it on something else – or turn a certain amount of money into a better result on the project – then I'd rather do that than basically pay someone to just round up a whole lot of subcontractors and do the job, which is what I expected to do."

With the assistance of HVAC contractors Blue Planet, Ribush and Lister put together a refurbishment concept to improve the building's energy efficiency, achieve a minimum 4 star NABERS energy rating and reduce the total carbon footprint.

"It was very much based on a progression – just getting acquainted with what had to be done," says Ribush of his inexperience in the area.

"It was a big job, but there was nothing to say that it would be so complex that you couldn't find someone to do it."

Difficult decisions

In 2009, amid the worst of the global financial crisis and with a project budget of $1.5 million, Ribush applied for an AusIndustry Green Building Fund grant.

Established by the Australian Government, this program provides finance to retrofit and retro-commissioning projects that lower greenhouse gas emissions through a reduction in base-building energy consumption.

The application success – a grant of $500,000 was awarded – was the catalyst for the project going ahead. By then, Ribush had already spent $100,000 upgrading the building automation system (BAS), and had achieved some energy-efficiency improvements from "low-hanging fruit".

At that point the building was fully tenanted, and one-third of the project cost were covered. The risk for the building owner had been considerably reduced.

"The risks were two-fold," Ribush says. "I could invest the money in the upgrade and not see it in improved rents or capital value. But by not doing it the opportunity of the Green Building Fund grant would be gone.

"At that point, it seemed like a good idea to proceed, and personally I felt like I had an interest in doing something."

After the grant was secured, refurbishment works began quickly.

Rather than a central HVAC system, a floor-by-floor design was adopted. This used two-pipe and three-pipe split variable-refrigerant-volume (VRV) systems in order to service floors. Each condenser unit was located on the roof, with copper pipe installed down the riser or stairwell to the floors, supplying the indoor fan coil units (FCUs) at the various levels.

Although not necessarily the most energy-efficient of concepts, this design was considered the simplest and most cost-effective to install given the limitations presented by a tenanted building. It also avoided the need to crane a new chiller and boiler onto the roof. Also conveniently avoided were permits, a road closure,

temporary removal of tram overhead wires and potential damage to street trees.

Other options such as variable-air-volume (VAV) systems were deemed incompatible with the building's existing duct infrastructure.

"With a peak load of 300kW(r), this building is at the bottom end of an appropriate load for chilled and heating water," says Lister of the decision to use a floor-by-floor design.

"Replacement of pipework throughout the building would have been difficult, and the use of substantial air handlers on a floor-by-floor basis would have reduced the net lettable area."

Lister says the original plan was to use a three-pipe system throughout, offering the advantage of heat recovery, whereas fan-coil units in a single system are in different modes simultaneously.

This could occur, for instance, when a cooling load in the east zone and a heating load in the west zone co-existed on a cool morning, due to the solar load resulting from east-facing glass.

Ultimately a two-pipe system was adopted for the majority of floors.

"Although it would not necessarily be my system of choice if designing a new building with the same configuration and location as 406 Collins Street," Lister says, "this solution compares favourably with most alternatives."

Typical of pre-loved buildings, a number of technical challenges presented. Many of these remained undiscovered until the refurbishment commenced. As works began on a vacant Level 6, it quickly became apparent that no two floors were identical. For instance, the location of the kitchen and plumbing on each floor differed, making a rigid installation plan impractical.

Changes to ductwork made during previous fit-outs, and limitations in ceiling voids due to structural beams and excessive amounts of cabling, also presented their own challenges.

Lister says determining the existing duct lay-out was difficult due to the lack of drawings. And "baffling" changes in configuration were found between the lower six and upper four levels.

"It would have been disruptive to fully identify these before commencing work," Lister says. "The team took a very flexible approach, and generally solved the problems as they arose. In some cases specialised transitions had to be manufactured, which disrupted the flow of work."

FCUs were installed in place of the aging reheat coils, requiring alteration works localised mainly to the corridor area of each floor.

Five were installed on Level 6, with numbers then reduced to four on Levels 1 to 4, as well as Levels 7 and 8. By reducing the total number of units, significant cost savings were made. Performance was only slightly compromised at the south (Collins Street) end of the building, where existing double glazing reduced heat gain.

Overshadowed by adjacent buildings on its other three sides, any impact from heat gain occurs mainly on the north side from level 6 upward. External and internal shading, as well as the installation of a sunshade over part of the exposed roof, has substantially reduced solar heat gain to affected tenancies.

Given there was no existing provision for AHU economy cycles, a rudimentary system was introduced to provide a night purge rather than true economy cycle. Additionally, the installation of isolating dampers on each floor and speed control of the outside air fan reduced fresh-air quantities to the required volume.

Only when the new system was installed across all floors was the existing roof-top chiller and boiler made redundant.

Further energy savings were achieved through the installation of motion sensors and low-voltage lamps in the stairwell lighting system and lifts.

A complete new sub-metering system was also installed to collect comprehensive data on a half-hourly basis. This is now able to be accessed both on-site and remotely through the BAS.

Taking ownership

Throughout the refurbishment, Ribush performed the role of project manager: overseeing project scheduling, rubbish removal, fire-services arrangements and making decisions around the placement of equipment. He also performed the critically important role of tenant liaison.

"I don't think I did a fantastic job, because it is just so difficult, and you're going to make mistakes," he says of his tenant-liaison skills.

"You think someone will be OK with something and they're not, or you go to a terrible lot of trouble to please someone and get everything right, and they are hardly there during the works. I've learned it is important to have a good property manager to deal with tenant issues."

Since completion, substantial energy savings have been realised, with consumption reduced by as much as 50 per cent. The building is on target to achieve a 4.5 star NABERS energy rating. Its carbon footprint is set to be reduced further when 406 Collins St switches to green electricity.

Ribush doubts he will see a full return on investment through energy savings alone. But for him the project was about more than just commercial imperatives. He recognised an opportunity to do something, however small, about the impact of buildings on climate change.

This philosophy permeated the entire project, and continues today as the building is fine-tuned.

Project at a glance

The professionals

Owner: Dr Dorian Ribush

Consulting engineer: R.C. Lister Engineering Pty Ltd

Contractor: Blue Planet Electrics

The equipment

Air-handling units: Existing

BAS: ECS/Winton Services

Dampers: High Fire Heating

Fan-coil units: Mitsubishi

Sub-metering: ECS/Winton Services

VRV split systems: Mitsubishi