1200 Buildings

CASE STUDIES

115
Batman Street

115 Batman Street is an example of a newly constructed building (built within a pre-existing shell) that utlises a range of energy efficient techniques and technologies to achieve an excellent NABERS Energy rating.

Built
2009 (original structure built in early 1900s)
NLA
2750m^2
Tenancy
Offices of Norman Disney Young (NDY)
Building owner
Batman & Robyn Pty Ltd
Property manager
Norman Disney Young
Refurbishment project timelines
2007 - 2008
Project team
Building services engineers: Norman Disney Young (NDY) Architect: e+ architecture Structural engineers: Winward Structures Building contractors: Construction Engineering Mechanical contractos: A.E.Smith
NABERS Energy
Current: 5.0 Target: 5.0
NABERS Water
Not yet assessed
Key refurbishment features
• Complete re-construction within existing façade • Highly insulated building shell • Chilled beams in the ground, 1st and 2nd levels • VAV Economy cycle on 3rd level • High efficiency gas boiler for heating • High efficiency luminaries • 15,000 litre rain water tank • Soar panels for water heating
Energy saving
NA
Water saving
NA
Greenhouse saving
Operating at 89 kg CO_2 / m^2 (compared to 5 Star target of 101 kg CO_2 / m^2.
Project costs
$10 Million for entire refurbishment plus ESD features
Annual saving
NA

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History

The building at 115 Batman Street was originally a machinery factory built in the 1920s. The building had been derelict since the late 1980s.

Background

The building is owned by interests associated with Norman Disney Young (NDY), a building engineering consultancy, focused on sustainable building design.

The modern office building, which houses the corporate headquarters and Melbourne office of NDY, is the result of substantial conversion. The interior of the factory was completely gutted, leaving only the brick wall façade. The new building was constructed in this space, combining the new and the old in an architecturally balanced and beautiful edifice.

The basement car park and two of the floors sit within the original walls of the factory, and two new floors sit above. The new area above the original brick walls consists of vitrapanel clad with heavily insulated walls and a new pitched, corrugated and heavily insulated roof.

The two lower floors utilise the original space in the brick façade for the windows. The free standing building faces north, with very little shade provided by surrounding buildings.

The building was purchased in 2007, and has been fully operational since December 2008.

The redevelopment was an excellent opportunity for NDY to showcase their understanding and commitment to sustainable building design.

Objectives

There were several key objectives for this redevelopment project:

- introduce state of the art engineering services with very low levels of energy consumption
- provide a comfortable working environment to enhance productivity
- achieve 5 Star Green Star and 5.0 star NABERS Energy ratings.

Planning

Achieving a high rating, according to Ian Hopkins, CEO of NDY requires a team approach. In their case, NDY drove the project.

As ESD/service engineering consultants, NDY has had experience in the development of energy efficient buildings since the 1970s. NDY worked closely with e+ architecture throughout the project. At that time, the architect had little experience in working with high efficiency and low carbon buildings, but the architect and NDY shared the project vision which meant this was an easily overcome problem.

NDY drafted and documented all the mechanical, electrical, fire protection and hydraulic services, and these designs were integrated into the architectural design of the building.

Given that the building was effectively a new structure, the project team had control over all elements of the design, and this was put to full effect in terms of the external structure, the interior design spaces and the mechanical systems.

Implementation

The builder, Construction Engineering, was not familiar with some of the building issues associated with sustainability which meant the building construction had to carefully managed.

The mechanical contractors, AE.Smith, installed the systems to the NDY design.

As chilled beams had been selected as the cooling system, this meant striking out into somewhat unfamiliar territory. The project team noted that the key issues for passive chilled beams are ensuring the façade is very energy efficient and the beams are appropriately located.

Features

Building

The original factory brick walls were maintained, which are 470 mm thick, providing a high level of thermal insulation.

The walls on the top two floors were newly constructed using vitrapanel with rock wool insulation.

The pitched roof uses corrugated iron, with high performance, 50 mm aluminium fibreglass insulation placed underneath. An additional thickening of the ceiling at this level was provided to further enhance insulating properties and accentuate performance.

Under the first floor slab, insulation was required to isolate the floor above from the cold basement area.

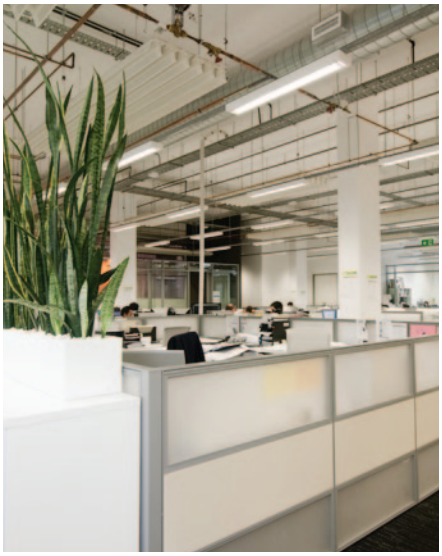
The first two floors have high ceilings that expose the building services. There is an open space office plan for the first three floors, whereas the top floor consists of enclosed office space.

All windows are high performance double glazed, 0.23 shade coefficient on north and west facades, and 0.27 shade coefficient on south and east.

The north and west windows are externally shaded to a depth of 900 mm.

The strategy was to construct all the building elements with high levels of energy inertia to substantially reduce air conditioning and heating loads.

The combination of existing walls, glazing and external shading reduced the load to less than 85 W/m^2 in the perimeter zones.



HVAC

The decision was taken to install passive chilled beam air conditioning on the ground, first and second floors.

Because of the roof and consequent heat load, the project team was unable to utilise the chilled beams on the top floor – so a conventional variable air volume (VAV) air handling system with economy cycle was installed.

Other HVAC features include:

- increased fresh air supply (twice the volume required by the standard) to ground, first and second floor levels
- high speed compressor chiller and adiabatic condenser using wetted pad heat rejection system for the chiller to optimise energy consumption, minimise water consumption and eliminate legionella risk
- high efficiency gas-fired boiler, feeding hot water radiators and convectors around the perimeter of the space on the ground, first and second levels to provide heating.

Energy load

To reduce the energy load:

- high efficiency luminaries (fluoroescent tubes) are used throughout the building
- a comprehensive lighting control system ensures lights are off when areas are unoccupied
- windows are double glazed and sized to provide excellent natural daylight which reduces reliance on electrical luminaries
- colour schemes throughout the interior of the building are kept to the light palette to maximise internal reflection.

Water

Below the basement concrete slab, there is a 15,000 litre water tank that stores rainwater from the roof. This water is used for toilet flushing and the air conditioning wetted pad condenser.

The building uses high efficiency, low water consumption fittings throughout.

Solar panels on the roof are used to heat the domestic hot water system.

Waste

During the building's construction, the builder and all sub-contractors were required to separate their waste into recyclable and landfill waste.

The management is very conscious of recycling material such as glass, paper, cardboard and printer ink cartridges, and all office waste is separated into recyclable material or landfill waste.

Environment

There are plants throughout the building with an average of two succulents per staff member, absorbing CO_2 in the building.

There are bike racks, showers and lockers in the basement to encourage staff to ride to work, and estimates indicate 10-15 per cent of staff are now engaged in this activity.

NDY is certified under the ISO14001 standard for environmental management. This is a standard audited by an external agency to organisations that minimise their environmental impact, comply with applicable laws and regulations and continually improve their environmental performance. The certificate is valid for three years.

Although NDY has not conducted a formal study, the feedback from staff is very positive about the work environment and this has contributed to what has been a very good absenteeism record.

Building management and controls

A comprehensive building management control system (BMCS) is installed to facilitate fine-tuning and optimise energy use.

The system enables viewing of the operation of the energy system, particularly the HVAC system. The component energy consumption data is collected on a monthly basis, so that management can see how energy use is tracking. Any issue or problem revealed by the system can then be fixed.

This BMCS was an off-the-shelf unit, but NDY and AE Smith, the mechanical contractor and controls contractor, AEC, developed all the control algorithms and modifications.

When it was installed, AE Smith took the NDY staff through an extensive formal training period on the functionality of the BMCS and how to operate it once NDY took over the operations of the building.

NDY now does all the BMCS monitoring.

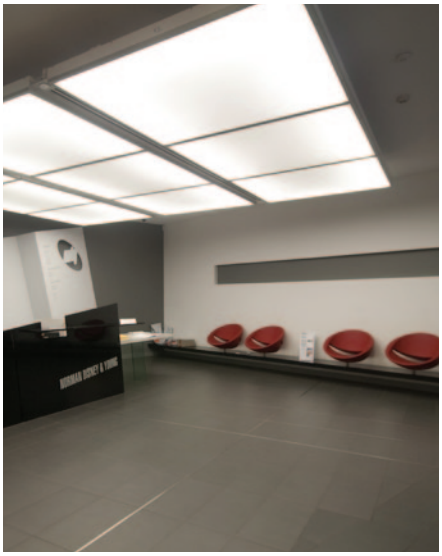
Challenges

The biggest single challenge in the construction of the building was the logistics of the materials handling given that the walls of the old building were retained. This meant that as the floor slabs were constructed, the materials for each subsequent floor had to be loaded through the windows.

From a design perspective, the challenge was to get the balance between the building fabric and the air conditioning system right to allow the passive chilled beams to perform at their optimum efficiency.

There was also discussion about the options for the HVAC. Chilled beam, VAV and underfloor displacement systems were all investigated. The displacement system option was rejected because of the complications with zoning the perimeter and exterior areas of the floors.

The VAV option for the first three levels was rejected because NDY's modelling showed that in this context, chilled beams would be more energy efficient and aesthetically more pleasing with the exposed services.



Outcomes

Energy

NDY accurately estimated the outcomes in terms of electrical energy consumption of the air conditioning systems and will investigate heating outcomes over winter.

Chilled beams coped extremely well with the heat wave in Melbourne in March 2009. The chilled beam system responded very well to the changes in ambient conditions and in this context, is found to be superior to the VAV system on the third floor.

Lighting of base building less than 2 watts per m^2 per 100 lux.

In terms of NABERS Energy rating, the building is performing better than 5.0 stars. The NABERS rating benchmark is measured in kilograms of carbon dioxide per square meter per year with 5 stars representing 101 kilograms/m^2/year. 115 Batman Street has achieved approximately 11 percent better than 5 stars with 89-91 kilograms/m^2/year.

Water

No NABERS rating has yet been conducted.

Social

Very positive feedback from the staff about the work environment.

Maintenance

The essential simplicity of the system and accessibility of plant makes for very straight forward maintenance regimes.

Commercial

Total building outgoings are less that \$60/m^2 which compares very favourably with the majority of commercial office buildings in the city and near-city locations where the outgoings are typically \$70 to \$90/m^2.

Overall

An energy efficient building is an attractive building – aesthetically, socially and environmentally.

Lessons

For NDY, the most important lesson is to think beyond the refurbishment. They believe a building must be seen as a 'living organism' and its performance monitored at all times, to detect issues and trending, so that any problems can be rectified by people who understand energy management.

It's also vital to have the design team – the architect and services engineers – working together to ensure that the building fabric and the mechanical services are fully integrated and optimised. During construction, it's vital that the builder has an understanding of the sustainability strategies that need to be applied, and to indicate any issues with materials at an early stage of the construction phase so that these can be attended to.

NDY believes that the model used in the project is applicable to all refurbishment projects. Critical to this is the owner having a sustainability services engineering expert on the team who focuses on the design initially, then during construction to ensure all parties are aware of, and deal with, the sustainability imperatives in a time-appropriate manner.

The future

The performance monitoring of the building is an ongoing process to make sure that all the systems are operating as they should and that the building stays in tune.