FEATURE

Spark of inspiration

A state-of-the-art education facility in Sydney's west has become the first to receive both a 6 Star Green Star Education Design and As Built rating. As **Sean McGowan** reports, the Ausgrid Learning Centre features cutting-edge green design for the benefit of apprentice sparkies.

The Ausgrid Learning Centre is the first project to earn a 6 Star Green Star rating under the GBCA's Education v1 tool for both Design and As Built stages.

From the ground up, the $75 million Ausgrid Learning Centre in Silverwater in Sydney's western suburbs is all about energy – learning about it, training with it and saving it.

Within its modern form are a range of flexible teaching spaces for one of the largest groups of apprentices-in-training in New South Wales, who can now learn their craft in a safe, controlled environment.

The campus-style centre situated on 1.7h was designed by DEM architects and built by Brookfield Multiplex.

As well as spaces you would expect to find in any world-class education facility, such as multipurpose classrooms, workshops, technical labs, research labs and an interactive library, the centre also incorporates areas for practical, high-risk training, including a first-of-its-kind live substation simulator, purpose-built pole yard and underground cable pits.

And while students train with electricity, the building's design is all about preserving it, with a number of sustainable initiatives combining to reduce the building's overall energy consumption by 60 per cent, making it Australia's first project to achieve a certified 6 Star Green Star rating under the GBCA's Education v1 tool for both Design and As Built project stages.

According to George Maltabarow, managing director of Ausgrid, the centre demonstrates cutting-edge environmental design and construction.

"It will be the greenest trade school in Australia – if not beyond," Maltabarow said at its opening. "Every step of its design, construction and ongoing use has focused on reducing water and energy use."

Some of the ESD features included in the project are tri-generation, 260 photovoltaic cells, groundsource heat rejection using 55 geothermal bores, and in-slab cooling. Using all of these systems in one facility has also never been done before in an Australian development.

"Brookfield Multiplex are committed to being at the forefront of sustainable design, which is why we pioneered the in-slab ducted cooling system," says Warwick Johnson, Brookfield Multiplex's regional director for Queensland and New South Wales. "We carried out a number of prototype panels off site, which gave surety to the design, detail, installation and programming of the project."

A CENTRE OF LEARNING

Spanning an area of 17,200 sq m across three levels, the facility consolidates Ausgrid's services from four previous locations into one, fully integrated learning centre.

It comprises four interconnected pavilion-style buildings that focus inwards around a series of courtyards used for various practical training exercises. This design provides good daylight penetration into the internal spaces and ensures all occupants are within 8m of a clear window.

Entry to the centre for both students and staff, as well as visitors to the interactive Energy Efficiency Centre, is through a naturally ventilated three-storey lobby that has been designed with a sense of spaciousness and transparency, providing uninterrupted views to outside courts as well as other activities.

Offices and administration areas are situated adjacent to this space, and again offer clear views for occupants to the lobby below, as well as to external training areas. Within this space, internal columns were omitted to allow flexibility in layout, as well as integrating natural and artificial lighting to reduce glare and energy consumption.

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Various teaching spaces, multi-purpose classrooms and an auditorium are located on the first and second levels, overlooking the secure Training Court flanked by teaching rooms containing some of the centre's high-voltage equipment and machinery.

A high-risk external, undercover training space is located within the Training Yard, including the pole yard and cable jointing pits designed to reflect realistic working conditions. This area also allows for other practical activities including driver training, dogging, fire safety training and parking for larger Ausgrid vehicles when required.

Naturally ventilated workshops are located throughout the centre, designed to be both secure and functional, with the extraction of fumes provided for health and safety, while a number of technical labs and classrooms complete the facility.

A COLLABORATIVE EFFORT

Along with consolidating Ausgrid's facilities into one world-class sustainable building, the original brief was to fulfil the company's strategic goal of providing "a centre of excellence that would enable a high-quality and efficient educational environment in which to attract apprentice candidates and teaching staff."

This saw 6 Star Green Star Education ratings targeted from the outset, with a Green Star-accredited professional engaged as part of the design team from the earliest stages.

As has been proven time and again, such ratings are more easily achieved through a collaborative design approach, and this project was no exception.

"It was the key to a successful outcome," says Inge Diamond, ESD engineer on the project with the VOS Group.

"Each building system and Green Star credit involved input from the client, along with a range of engineers, designers, contractors and suppliers. Therefore, communication and documentation were essential in delivering the project on time and meeting the Green Star target.

"Luckily we had a very motivated team, and the 6 Star target was a key driver for the client."

To achieve this ambition, thermal load minimisation was targeted, with both building configuration and architectural design integrated with the mechanical design.

"Along with the considered siting and arrangement of the buildings in response to solar access and prevailing winds, perimeter walkways were designed to shade exterior walls for long periods of the day," explains Jon Pizey, group design partner of DEM.

"External louvres, awnings, shading and high-performance glazing on the northern façade were also employed to reduce solar gain."

For the architects and designers of the facility, the ambitious 6 Star Green Star target presented numerous challenges, not least of which was the state of constant flux of many of the design parameters as each initiative and credit was reviewed and assessed throughout the design phase.

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"One issue that had a huge impact upon the building design was the exploration of using either a hollow concrete slab or a precast proprietary solution," recalls Pizey. "Each required different floor-to-floor height, which affected the elevation proportions and set-out of cladding materials."

Similarly, he says the assessment of sustainable initiatives such as photovoltaic cells and the trigeneration plant affected the roof design and spatial planning and layout of rooms.

"The building design needed to adapt to evolving technologies and initiatives without compromising the original design vision," Pizey says. "The use of recycled timber formwork, for example, necessitated the use of an applied cement render finish for internal surfaces rather than off-form concrete, in order to achieve the desired class of concrete finish.

Natural ventilation is used for the three-storey entry atrium.

"Rationalisation of competing initiatives, such as optimising natural light and minimising glare, was also required as part of the design process."

NEW IDEAS AND GREEN SMARTS

Reducing energy consumption and peak electrical demand was paramount from the earliest stages of the centre's design, and onsite energy generation was seen as an important element in delivering these reductions, as well as meeting the Green Star target.

Approximately 21 per cent of the centre's peak electrical consumption has been met through the combination of a 51kW photovoltaic (PV) array installed on the northern and western roofs and a 337kW (125kVA) CHP trigeneration system incorporating a 95kW absorption chiller.

A well as providing domestic hot water for the facility, the trigeneration and PV systems are also important training aids for Ausgrid apprentices.

To help meet the Green Star rating, the rejection of waste heat from the absorption chiller also required a non-traditional approach by avoiding the use of traditional heat rejection via cooling towers.

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Instead, 55 geothermal bores were drilled up to 100m below the site before construction. Carrying long pipes that loop beneath the site, the system pumps water from the condenser circuit into the bores and takes advantage of the constant temperature of the earth to reject the waste heat before the water is returned to the system.

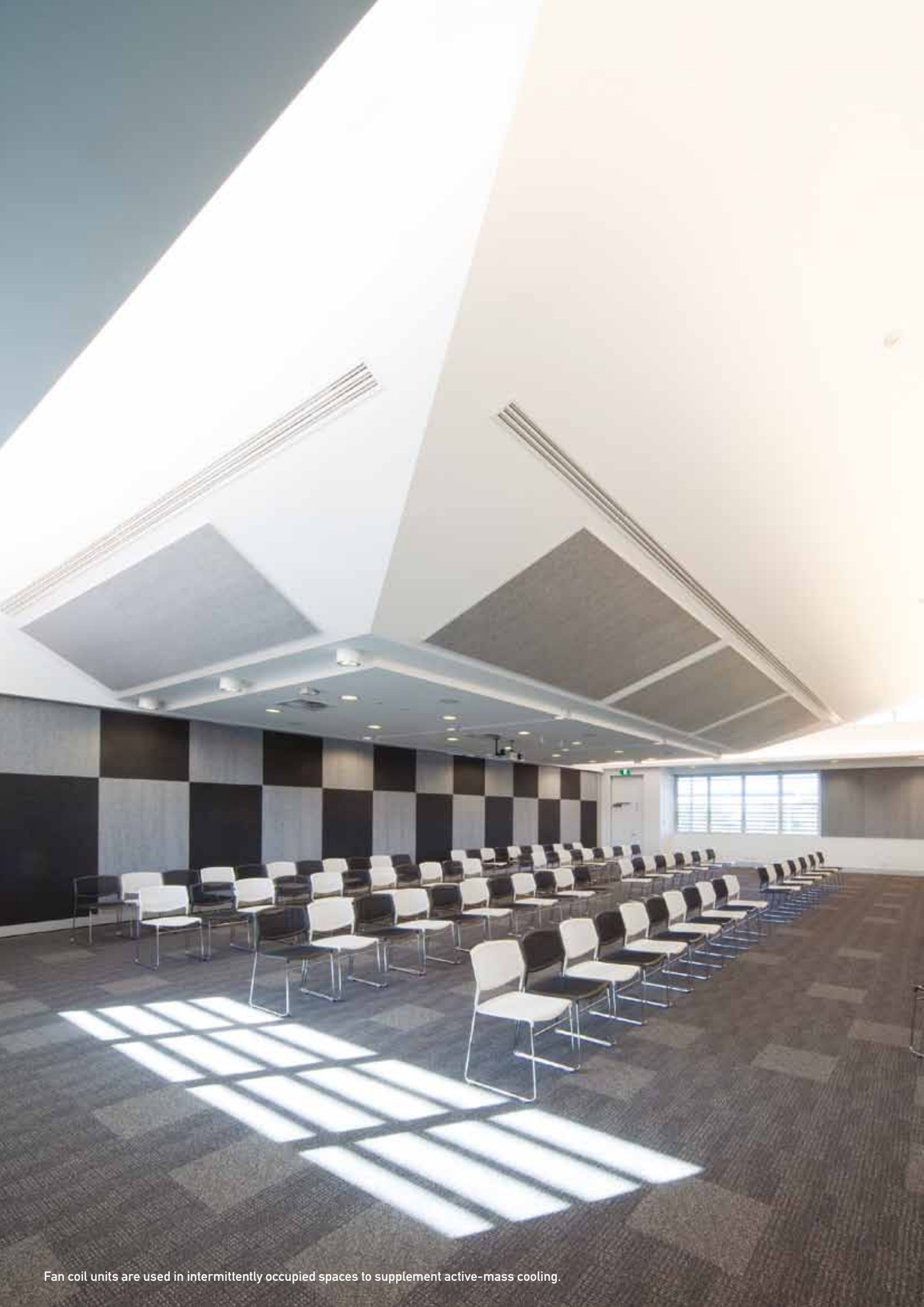
Due to the efforts in reducing the heat load of the centre through its design and positioning, passive cooling and thermal mass have been used to not only optimise the building's energy performance, but also to deliver the indoor environmental quality sought.

Hollow concrete slabs below the ground floor and level-one teaching and office areas serve 4,400 sq m where the most constant demand for cooling exists, providing a form of active-mass cooling.

Featuring a core of metal ducting, the slabs absorb internal heat during the occupied period before purging this heat after hours using cooler, outside night air or by mechanical means using air-cooled chillers. The slab may also be pre-cooled using cooler outside air or via the chiller to reduce peak cooling load.

NOISE AND CONTROL

Because it's home to a wide range of training activities, many of which are noisy, the acoustic treatment of the centre's various spaces was also



Fan coil units are used in intermittently occupied spaces to supplement active-mass cooling.

Spaces such as this computer room have demand-controlled ventilation, using sensors and the BMS.

given much consideration. Within the workshops, for example, an environmentally sustainable acoustic finish to the slab soffits assists in maintaining acoustic levels appropriate for the training being undertaken, as well as providing an acoustic buffer for adjacent spaces.

To further reduce energy requirements for heating and cooling, natural ventilation is used for the walkways, the three-storey entry atrium in the lobby, circulation areas and workshops. Elsewhere, fan coil units are used for intermittently occupied spaces to supplement active-mass cooling.

These spaces have a demand-controlled ventilation system using CO_2 sensors, and a room booking system within the BMS, as well as motion sensors, are used to minimise the operation of fan coil units.

"This is a multi-component system that was selected for providing a low-carbon and low-water-usage supply of air conditioning," Diamond says.

"There are several points available in the Green Star Education tool awarded to projects that do not have a water-based heat-rejection system, so our system also had to accommodate that aim."

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A comprehensive building management system is used to control these sustainable design initiatives and automated louvres, with two roof-top weather stations assisting the system in energy-related calculations. Electrical sub-metering has also been incorporated to provide information for building users, so that high-use areas can be identified and addressed accordingly.

As would be expected, efficient lighting, including isolating switches and occupancy sensors, has been installed across all areas of the building.

OTHER INITIATIVES

Along with energy consumption, water management across the centre was given much consideration by designers. Rainwater and greywater systems were modelled to optimise sizing and re-use potential, as well as minimise the occurrence of mains water backup.

Rainwater is harvested via roof catchment and stored in a 150,000 litre capacity underground tank. This water is treated and used throughout the centre for toilets and urinals, as well as garden irrigation, while 21,000 litres is dedicated to fire testing.

The rooftop accommodates interactive spaces.

Up to 2,200 litres of greywater each day is also collected from the centre and reused for flushing toilets and urinals.

Due to the proximity to the site of the Duck Creek natural waterway, biofiltration swales have been used in place of standard storm-water channels to maximise flow residence time and promote pollutant removal via filtration through vegetation. This ensures any stormwater leaving the site is as clean as possible.

The project also made substantial CO_2 emissions reductions in association with the concrete used on the project, by reducing Portland cement content by an average of 45 per cent. Furthermore, 30 per cent of the aggregate used was replaced with recycled concrete or blast furnace slag, while the steel used throughout featured approximately 70 per cent post-consumer recycled content.

Sustainable timber was also used extensively, combining reused, recycled and certified timber.

More than 95 per cent of demolition and construction waste generated onsite was recycled or reused, while workstations were reused from other Ausgrid sites.

> Total building energy consumption is expected to be approximately 60 per cent less than a benchmark building, representing an annual saving of $60,000 and greenhouse gas emissions savings of some 350 tonnes annually

Also, 10 electric vehicle charging stations are located in the basement car park, as well as dedicated small car spaces to encourage the use of smaller, more fuel-efficient cars.

The ALC is home to a wide range of training.

BREAKING NEW GROUND

Following practical completion in early 2011, the Ausgrid Learning Centre became the first project in Australia to be awarded both the 6 Star Green Star Education Design v1 rating and As Built v1 rating.

Due to the energy-efficient design and technologies implemented across the Ausgrid Learning Centre, a significant reduction in energy and water consumption as well as CO_2 emissions has been achieved.

While building performance continues to be measured by BMPX as part of the tuning process, total building energy consumption is expected to be approximately 60 per cent less than a benchmark building, representing an annual saving of $60,000 and greenhouse gas emissions savings of some 350 tonnes annually.

Similarly, annual water consumption is estimated to have been reduced by 57 per cent compared to a benchmark building.

Of note is the "sustainable premium" or cost of achieving the 6 Star Green Star rating, which added just 2.5 per cent to the overall project budget.

PROJECT AT A GLANCE

THE PROFESSIONALS

Owner: Ausgrid

Architect: DEM

Main contractor: Brookfield Multiplex

Project manager: APP

Building services engineer: VOS Group

ESD consultant: VOS Group

Structural engineer: Taylor Lauder Bersten Engineers

Façade engineer: Arup

Civil engineer: C & M Consulting Engineers

Mechanical contractor: Allstaff

THE EQUIPMENT

Absorption chiller: World Energy

Air-cooled chillers: Powerpax

Air-handling units: Air Design

BMS: Alerton

Combined heat & power (CHP) Unit: Tedom Cento

Fan coil units: Temperzone

Swirl diffusers: Krantz

Geothermal loops: QPS Geothermal

One of the workshops.

Despite a lower profile than similarly awarded commercial buildings around the nation, the fact that its designers have delivered these spaces while realising their 6 Star Green Star Education rating ambitions is why the Ausgrid Learning Centre will stand as a landmark green building for some time. And why the building itself can teach lessons to those who are willing to learn. ▮

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