Major Completed Projects

Albury Wodonga Campus Relocation Program

Project:	**Academic Accommodation 3**
School/Division:	School of Business and Information Technology
Location:	Thurgoona
Time line:	Completed Oct 2008
Project cost:	$4.25m
Building area:	
Project Status:	Completed
Project contact:	Neil Wright (newright@csu.edu.au)

Consultants

Architect: Wayne McPhee Architects
Engineers: Northrop Engineers
QS: Mitchell Brantman
Managing contractors: Zauner Constructions

Project Description[1]

Charles Sturt University's (CSU) Thurgoona Campus is a developing, dynamic model of how communities can address environmental concerns and sustainable living in inland Australia. Over the past 12 years on the Thurgoona site, CSU has courageously tackled the ongoing development of this campus in an environmentally responsible manner that is both useful for community and academic learning as well as delivering a pragmatic demonstration of sustainability and provision of spaces that promote wellbeing.

Over this period, CSU has been willing to investigate and learn from the actual performance of the original buildings. With the accumulation of these lessons and through further exhaustive study, the design team and construction contractors of AA3, under guidance from the CSU project management team has delivered the new CSU flagship of sustainable design and creation of a comfortable and healthy working environment.

This new academic office building at Thurgoona is the first building to be constructed as part of the current phase of the Albury-Wodonga Campus relocation program (AWCRP).

Objectives of AA3

The main objective of AA3 is to provide additional office accommodation for the School of Business and Information Technology academic staff. The building configuration has been designed to link with the existing office accommodation on site as well as present a strong corporate image that encourages further linkage with the local business community.

[1] Project Description prepared by Greenlight Consulting Services, Oct 2008

In keeping with CSU's research and sustainability goals and the campus development principles, another prime objective was to design AA3 with an industry partner in a way that that could achieve the highest rating under the GreenStar rating scheme. This is to be achieved through the use of sound design principles and the innovative use of state of the art materials.

While the existing rammed earth buildings on campus have been seen as being environmentally friendly designs, their performance to date, leaves a lot to be desired (specifically in regard to energy use). To overcome this deficiency the CSU Division of Facilities Management (DFM) developed a new and innovative process to ensure that the new building will meet strict energy usage targets whilst delivering best practice thermal comfort conditions. This process is centred on the use of comprehensive computer modelling and optimisation studies.

Implementation of this new process resulted in the identification of an opportunity to work together with industry partners to help achieve an extremely low energy building whilst using conventional yet "clever" materials and construction methods. In addition, in order to demonstrate "real" and tangible results, it is DFM's intention to scientifically monitor the performance of the building and to make this data available for further research or validation of computer modelling.
There is a number of industry rating schemes for environmental buildings, the most applicable to office buildings is the Green Building Council of Australia (GBCA) Star rating scheme. This is particularly significant, as the GBCA rating scheme has been benchmarked off two other international schemes, and a building design achieving 6 Stars is perceived as having international significance. CSU is currently preparing the second round submission of the Green Star accreditation process for this building.

Project Statistics

Gross Floor Area – 880m^2
Accommodation for 40 staff
Two storey steel frame and concrete slabs and precast walls.
Roof insulation – R5.6
Wall insulation – R3.6
Thermal comfort std – ASHRAE55

Typical Office Building 3 Star ABGR	Best Practice Office Building 5 Star ABGR	Predicted Greenhouse gas emissions of AA3
135kg/ m^2	71kg/ m^2	**24kg/ m^2**

Partnering Initiatives

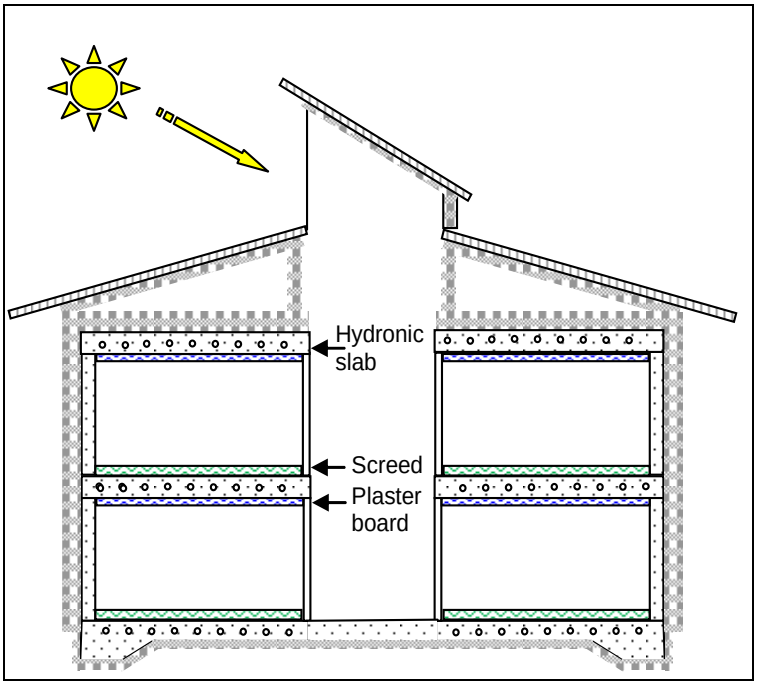
In CSU's drive to facilitate applied research with industry partners, an opportunity to work together with BASF, the largest chemical company in the world, was pursued and successfully negotiated. In the search for a cost effective and energy efficient conditioning system, the design team found that BASF had developed an innovative lightweight "thermal mass" building element. This is known as SmartBoard. SmartBoard is a gypsum plasterboard product that contains BASF Micronal Phase change granules.(PCM) These PCM granules have the ability to absorb large amounts of heat resulting in a 15mm Smartboard panel having the same thermal capacity as a 100mm slab of concrete, yet is can be worked as a conventional building material.

Negotiations with BASF Australia resulted in an agreement being reached whereby CSU was provided with SmartBoard, Micronal PCM granules for use in the conditioning system and substantial expert technical knowledge to support the design of a world first installation.

How does the building conditioning system work?

Over the18 month period, CSU worked with BASF to develop a new approach for achieving super low energy office buildings, particularly focussing on ways in which PCM SmartBoard and Micronal microcapsules can be incorporated within a building as a "working" element.

PCM SmartBoard has been used to form the ceiling and the microcapsules have been embedded in the floor screed throughout, effectively doubling the buildings thermal storage. Whilst the use of PCM SmartBoard 23^{o}C as a ceiling is a first for Australian office buildings, the use of Micronal in the floor screed is a first in the world!



The floor screed and ceiling act as oversized radiators to cool or heat the internal occupied office spaces. During a summer's day, as the ambient air temperature increases, the temperature of the building fabric remains constant at 23^{o}C whilst the latent heat is absorbed.

Hydronic pipes that have been cast into the concrete slabs have the role to "re-charge" the phase change material overnight using off-peak power. The evaporative cooling system runs during the cool of night to maximise efficiency of the system and the PCM then stores this "coolth" for release during the warm days.

A network of temperature sensors has been installed in the strategic positions in order to monitor actual performance of the various materials throughout the structure. The data from these sensors will form the basis of a research project to further advance the development of PCM, how it is used and its contribution to reducing Greenhouse gas emissions.

Additional Notes:

What is different about the design, the conditioning systems and modes of operation in order to reduce energy usage and improve thermal comfort?

- The building works like an "esky". The building structure and thermal mass is enclosed in a well insulated envelope, minimising fluctuations of temperature and humidity

- Operating temperatures inside building will be between 21 – 23^{o}C in winter and 23 – 26^{o}C in summer.
- No refrigerative cooling will be used. Substantial “clever” thermal mass is used as a radiator to distribute coolth or warmth throughout the building
- These “radiators” are cooled or heated at night using off-peak energy
- Cooling will be achieved through the use of an indirect evaporative system that will chill water to be circulated through the slabs in a hydronic network
- Retention of internal heating loads (computers, lights, people, etc) will significantly reduce the heat load requirement in winter periods
- The new building continues the features previously used on the Thurgoona campus, such as natural ventilation and daylighting, “healthy” finishes and construction that works-in with the environment.
- Natural ventilation is achieved using very high quality appropriately sized windows to control heat and air flow. This assists in providing spaces that promote well-being and minimise energy usage.
- Window sizes and position have been optimised for day-lighting, thermal performance and the creation of a natural, healthy and yet productive office environment

Key points of the design:

- ENERGY
  - Reduction in energy use and greenhouse gas emissions. 65% lower than ABGR best practice CO_2 emissions
  - Minimisation of office lighting consumption whilst providing sufficient light levels
  - Peak energy demand reduction
- INDOOR ENVIRONMENT QUALITY
  - Humidity control and Natural ventilation
  - Minimisation of formaldehyde in products
  - Low/no volatile organic compounds (VOC’s) used throughout
  - Low internal noise levels achieved
  - All offices have external views
- MATERIALS
  - Sustainable re-use of materials, eg: Re-cycled concrete
  - UPVC minimised
  - Sustainable timber utilised
  - Comprehensive waste management system (even during construction)
- WATER
  - Water tank installed to collect runoff for reuse (toilet flushing)
  - Reuse water for cooling towers