

**Mudgee Learning Resource Hub:
Innovation in Education and Infrastructure Design in TAFE NSW**

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Abstract

Australian education institutions are facing the twin pressures of infrastructure renewal, and changing student demand – increasingly, within a context of sustainable practice. Research indicates increasing demand by students for environmental education; the efficiency returns from sustainable infrastructure design; and sustainable practice as a key driver of organizational performance.

The Mudgee Learning Resource Hub is the first building of its kind for TAFE NSW, achieving a 5 Star Green Star Education design v1 certified rating from the Green Building Council of Australia in January 2015 - demonstrating Australian Excellence in environmentally sustainable design. The Hub project will enable TAFE Western to enhance and expand educational delivery in Mudgee, with the Hub itself intended as a 'living laboratory' to demonstrate excellence in sustainable infrastructure renewal and environmental performance to staff, students and other stakeholders.

This case study demonstrates how the Hub was designed to respond to changing educational and employment patterns in the Mudgee region, demonstrate adaptation of TAFE Western's sustainability framework to local conditions to reduce environmental impact, and build relationships with local, regional and metropolitan stakeholders to deliver innovative, state-of-the-art infrastructure design.

Keywords: sustainable practice, Green Star, educational delivery, infrastructure, renewal

Introduction

Reorienting an organisation toward sustainable practices is a challenging leadership task with significant change management implications. Sustainability is not a 'blanket option' – it must be carefully honed to each organisation's specific circumstances (Pratt & Pratt 2010). Sustainable practice in education institutions includes operations, research, teaching, community engagement, philanthropy, and outreach, advocacy and community services. The task is further complicated by growing evidence that sustainable practice is regarded as key to becoming a high-performance organisation (for example, Pratt & Pratt 2010; Benn, Dunphy & Perrott 2011). Even when attempts are made to address these particular problems, education institutions can often remain generally unsuccessful in terms of lasting change, and are often heavily criticised for their failures, real or perceived (for example, Carpenter & Meehan 2002; Starik *et al.* 2002; Velazquez, Munguia & Sanchez 2005; Christensen *et al.* 2008; McIntosh *et al.* 2008; Sterling 2013).

However, there is also evidence demonstrating that education institutions are capable of innovation and excellence in a variety of aspects of sustainable practice. Numerous education institutions both in Australia and overseas have been recognised for their efforts in infrastructure renewal, curriculum redesign, student engagement, supply chain reengineering, and energy, water and waste management (among other sustainability initiatives) through various accreditation and award systems. These include the Green Building Council of Australia (Green Star) and the National Australian Built Environment Rating System (NABERS); the United States Green Building Council (Leadership in Energy and Environmental Design [LEED]); the Building Research Establishment Environmental Assessment Methodology (BREEAM®); the American Association of Sustainability in Higher Education Sustainability Tracking, Assessment and Rating System™ (STARS); the United Kingdom's People and Planet University League; and the International Green Gown Awards with their regional precursors in Australasia (run by Australasian Campuses Towards Sustainability Inc [ACTS]), the United Kingdom and French-speaking Europe (including Canada).

This paper examines the concept development and building design for TAFE Western's Mudgee Stage 4 Learning Resource Hub Project as it occurred within the context of incoming reforms to the vocational education and training (VET) sector under the Smart and Skilled framework; the changing nature of the business agenda for TAFE NSW institutes; and TAFE Western's own revitalised approach to educational

delivery and sustainable practice in partnership with the communities and industries that it serves – culminating in the project being awarded a Green Building Council of Australia 5 Star Green Star Education design v1 certified rating in January 2015. This Green Star certified rating is the first of its kind for a TAFE NSW institute¹.

The next sections examine sustainable practice as an element of the high-performance organisation, and current trends in sustainable practice that are more specific to higher education institutions.

Sustainable Practice and High-Performance Organisations

Legislative and regulatory compliance have been identified as strong motivators for adopting more sustainable practices (for example, Post & Altman 1994; Stead & Stead 1994; Benn, Dunphy & Griffiths 2006), however there is also strong evidence linking sustainable practice and financial performance. Avery (2005), Judge and Elenkov (2005), Pratt and Pratt (2010), and Benn, Dunphy and Perrott (2011) note several research and case studies demonstrating that the more that firms integrated sustainability concerns into their strategic planning processes, value and supply chains, internal management systems and technological portfolios, the better the firms' financial performance as well as environmental performance. This means that organisations able to demonstrate achievement of sustainability objectives may be more likely to realise healthier business returns, cleaner/more efficient operations, reduced costs, higher repeat/new business, increased levels of customer loyalty, improved community relationships, and lower employee turnover (Benn, Dunphy & Griffiths 2006; Werbach 2009; Pratt & Pratt 2010; Benn, Dunphy & Perrott 2011; Sukhdev 2012).

Example organizations include Putumayo (world music supplier), Dilmah Tea (single-origin sustainable tea production), Patagonia (outdoor clothing), Allianz (global finance), Fuji-Xerox (imaging equipment), IKEA (furniture and storage solutions), Interface (flooring technology), Yarra Valley Water (water and sewerage services) and Novartis (pharmaceuticals) (Avery 2004, 2005; Pratt & Pratt 2010; Benn, Dunphy & Perrott 2011). These organisations are notable for their level of commitment to sustainable practice from both the strategic and core business perspectives. However, as noted by Sterling (2013), the higher education sector in many ways is yet to match the performance of these organisations, despite the many pockets of excellence evident around the globe.

Sustainable Practice in Education Institutions – Current Trends

Education institutions are not immune from the pressures of market competition, and must also engineer a position for themselves whereby they attract and retain stakeholder loyalties. This includes students (consumers), but also employees, communities, industry, government, professional/accrediting associations, regulators and others. However, the benefits for education institutions of being sustainable extend beyond stronger competitive advantage in the marketplace.

By engaging in sustainability initiatives, education institutions are able to contribute directly to society through being models of sustainable practice; through deploying teaching and learning practices that contribute 'sustainability aware' graduates to society and the workforce; through expanding the sustainability frontier in the course of undertaking research activity and engaging in partnerships with commerce and government; and through supporting and encouraging sustainability initiatives in the community through engagement, outreach and advocacy programs. As a result, the decision-making that drives the development and implementation of sustainability programs in education institutions tends to be complex, as education institutions are attempting to address more than potential gains in relation to financial savings and increased operational efficiency. The decision-making impacting these programs is also affected by issues such as each institution's mission and values; perceptions of moral obligation to the student body, key stakeholders, and to society at large and the aspiration to be leaders in relation to sustainable education, research and practice. These types of decisions need to be properly costed, evaluated, consulted upon and re-evaluated several times before final solutions are agreed and implemented.

¹ Refer Green Building Council of Australia Green Star Project Directory <https://www.gbca.org.au/project-directory.asp>

In addition to the links between sustainable practice and organisational performance as discussed in the previous section, two other current trends are increasingly influencing the decision of education institutions to engage in sustainable practice in a more holistic manner:

1. Changing student demands in relation to curriculum and learning spaces;
2. Ageing infrastructure and the need to renew building stock to ensure educational delivery is matched by appropriate facilities.

Student demand and modern facilities are directly linked to issues of financial viability, reputation and competitive advantage, as well as environmental performance and sustainable practice.

Student Demand

There is conflicting evidence regarding student attitudes towards the environment and issues of sustainability in the broad Australian community, and higher education sector generally. Butt, More & Avery (2013) note that students are not deeply involved in university sustainability initiatives from a broad base of participation, while Devinney, Auger & DeSailly (2012) note that sustainability is of greater concern to older people and those with higher levels of education. The *Gen Green Survey 2011* published by the Dusseldorp Skills Forum suggests that employers, government, the market and educators are contributing to the problem by failing to provide consistent guidance, direction and incentives to young people, and in particular, neglecting to encourage their engagement with sustainable practice.

In contrast, Drayson *et al.* (2013) demonstrate in their report *Student Attitudes Towards and Skills for Sustainable Development* that university students in the United Kingdom clearly indicate their interest in sustainable development and their view that education institutions need to be more active in integrating sustainability into curriculum. Higgins *et al.* (2013, p.208) note that the People and Planet Green League – an annual ‘green’ ranking of universities in the United Kingdom, run by the United Kingdom’s largest student environmental network – ‘is credited with putting climate change on the desk of every vice-chancellor in the country’.

However, a study conducted by the Organisation for Economic Cooperation and Development (OECD) published in 2011 indicated that in Australia, the VET sector was the more natural and proactive educational leader in sustainable practice, rather than universities (or universities and VET providers in partnership); and that the VET sector had also been more proactive and strategic in relation to ‘green’ qualifications and employability than the university sector. Sack *et al.* (2014) noted in their *Gen Green 4 Australia* report that within the VET sector itself, there was strong demand for sustainability skills from apprentices and trainees in particular. However, the OECD (2011) and Sack *et al.* (2014) also noted that overall there was still a need for greater responsiveness from the higher education sector as a whole in driving change to support sustainability education and skills development.

The Smart and Skilled reform agenda introduced into the NSW VET environment in 2015 has also accelerated the change from ‘student’ to ‘consumer’. In the race to attract clientele and demonstrate competitive business strategy against a background of student entitlements and changing course pricing, there is also increasing pressure on education institutions from an asset management perspective. Provision of cutting-edge educational delivery infrastructure, as well as the need to reduce the costs of operating and maintaining building stock, has also become a serious driver of the ‘green building’ era in the higher education sector.

Infrastructure Renewal

The United Nations’ Environmental Program (UNEP) noted in its 2011 report *Towards a Green Economy* that the concept of the green economy – where ‘material wealth is not delivered...at the expense of growing environmental risks, ecological scarcities and social disparities’ (p.14) – is increasingly gaining traction. Within this context, the building and construction industry is key to more efficient resource use, given that it comprises over 30% of global energy end use and resource consumption. UNEP (2011) also notes that green building construction and retrofits can achieve significant savings in resource

consumption, waste generation and operating/maintenance costs; health and productivity benefits; and creation of new jobs. However, green building design and construction faces a number of challenges, particularly in terms of affordability; supply chain management in urban versus regional areas; availability of supporting infrastructure and public transport; access to the required level of design and construction expertise; and the variable nature of global urbanisation – i.e. urban development in developing countries and emerging economies is occurring at a rate two-three times faster than in developed countries (UNEP 2011). Despite significant innovation and efficiencies opportunities – and the increasing pressure to transition to the low carbon, green economy – issues such as the lack of usage of integrated design methodology, assessment of occupancy patterns and behaviour, control of technical systems and a current lack of accurate multi-sector data on green building performance and costs are other factors inhibiting engagement with the green building sector (UNEP 2011; Newton & Newman 2013).

However, research by Newton and Newman (2013) also indicates that green economy issues – including technology, changing market trends and consumer preferences, competition, accurate sustainability performance reporting, carbon pricing, changing regulatory requirements, the emergence of sustainable investment and financing, sustainability skilling of employees and contractors, cost management and resource efficiency, supply chain risk, and innovation – have been key drivers of change in built environment organisations' business models in recent years. Newton and Newman (2013) also note that the changes have been more prominent in private organisations than public sector organisations; and in international organisations than Australian organisations.

The introduction of the Green Star rating system in 2003 by the Green Building Council of Australia (GBCA) was designed to 'drive the adoption of green building practices through market-based solutions'². GBCA has since conducted research on the impact of the Green Star rating system on Australia's built environment to quantify results from 428 certified projects. GBCA's (2012) research noted that Green Star certified buildings, when compared with the average Australian building:

1. Produce 62% fewer greenhouse gas emissions;
2. Use 66% less electricity;
3. Use 51% less potable water;
4. Recycled 96% of their construction and demolition waste on average.

This research coincided with the commencement of the Mudgee Stage 4 Learning Resources Hub project by TAFE Western and early conversations regarding its concept potential as a Green Star opportunity with project partners including NSW Public Works, Government Architect's Office and NSW Department of Education and Communities Asset Management Directorate.

TAFE NSW Western Institute

TAFE Western's vision is to provide education and training that changes lives, and currently enrolls around 25,000 students a year across 24 colleges. The institute combines face-to-face delivery with recognition for prior learning, online/distance learning, workplace delivery and assessment and mobile learning units to expand its range of educational options for individuals and communities. TAFE Western has been recognized with a number of awards for its ability to create innovative education opportunities and delivery methodologies for Aboriginal students in particular, and more broadly for remote and regional Australia through platforms such as TAFE Western Connect – 'more choices in more places'.

TAFE Western services over half of NSW, covering the Central, North and Far Western regions – an area the approximate geographical size of Germany. TAFE Western's footprint includes some of the most isolated and remote communities in Australia, with variable access to services and the kinds of environmental management solutions available in metropolitan centres.

The design phase of the Mudgee Stage 4 project commenced in August 2013 – at that time, TAFE Western's *Strategic Plan 2011-2013* listed 'demonstration of leadership in ecological sustainability' as a

² <https://www.gbca.org.au/about/>

strategic priority. The 2012 review of its sustainability portfolio was conducted with this priority in mind, culminating in the launch of TAFE Western's Sustainability Charter and Framework. TAFE Western defines sustainability as a philosophy of change – what is done, how it is done, influencing behaviour and ultimately, changing lives. The institute's revitalised sustainability portfolio identified Facilities and Infrastructure as a Key Program Area, and was founded on the principles of:

- Sustainability as part of core business;
- Partnerships based on participation and shared responsibility;
- Responsiveness;
- Openness, transparency and accountability;
- Caring for Country;
- Practicality;
- Integration;
- Resource stewardship.

These principles and priorities have been continued under the new *Strategic Plan 2015-2018*, and the updated *2015 Sustainability Charter and Framework*.

Following the commencement of the design phase of the \$7 million Mudgee Stage 4 Learning Resource Hub project in August 2013, and given TAFE Western's renewed focus on sustainability, the project partners identified a significant opportunity with the Green Star system to design a new type of building for TAFE NSW that would combine educational and environmental aspects in an innovative design. The aim of the project was to achieve a 5 Star Green Star Educational design certification, the first of its kind with GBCA for a TAFE NSW building.

Mudgee Stage 4 Learning Resources Hub Project

The Mudgee region is home to 23,000 people in Central West NSW, with average temperatures ranging from -2 degrees Centigrade in winter to 42 degrees Centigrade in summer. Tourism is a major industry, with around 500,000 visitors journeying to the area each year to experience the cellar doors, museums, historic areas, local produce tastings, art and craft galleries, major events, markets, locally brewed beers and a wide range of cafes and restaurants. Other major economic sectors in the region include agriculture (including lucerne, olives, honey, cattle and sheep), viticulture (some 5,000 hectares under vine and 40 cellar doors), mining (coal), equine (horse breeding and training), retail, and major events including A Day on the Green and the Mudgee Small Farm Field Days.

Although analysis of Australian Government industry and employment projections through to 2018 by TAFE Western notes an average increase in employment of 7.7% in the Central West and 4.1% in the Far West and Orana across all industry areas, some areas are projected to grow while others are projected to decline. Growth areas include education and training, rental/hiring/real estate services, retail and wholesale trade, professional/scientific/technical services, utilities services, arts and recreation services, and construction. Areas projected to decline include agriculture, forestry, fishing, mining, information and communications technology, transport, postal, warehousing, financial/insurance services and manufacturing.

Project Objectives

The existing Mudgee College comprises two sites, a 19th century two-storey building in the town that is no longer appropriate for VET delivery, and a rural site at Ulan Road approximately five kilometres from the town centre. The project was primarily aimed at achieving significant improvement to educational delivery at the Mudgee College by consolidating two sites to one and building a new Student Hub to support improved service provision to students – particularly in relation to library, academic skills and counselling services – and the wider community. Other objectives included the reduction of the overall footprint of the Mudgee College, increased facilities utilisation rates and more strategic use of resources through the generation of economies of scale for infrastructure and equipment maintenance.

Designing for Innovation in Education and Infrastructure

Phase 1 – to March 2014

Design work commenced on the Mudgee Stage 4 project in August 2013 and was completed in December 2014. Initial work was focused on defining the building as a fully flexible floor space for the long-term, in which space utilisation itself was flagged as a primary sustainability strategy. That is, the building needed to be designed and constructed in such a way that the internal spaces (other than fixed areas such as plant, bathrooms and computer laboratories) could be easily reconfigured to support different types of educational delivery, service provision and/or community events. Other key design principles at this stage included:

- Incorporating lessons learned from previous experiments in green building design and construction that had not had satisfactory long-term outcomes – for example, insufficient solar power to support grid offset, poor siting of buildings in relation to climate and geography, inadequate ventilation, and insufficient design modelling, particularly in relation to issues of thermal and acoustic comfort;
- Intelligent building management;
- Responsiveness to issues of cultural and access sensitivity;
- Stakeholder involvement;
- In-built capacity for 24/7 operation;
- Connection of Stage 4 to the rest of the campus – visually and physically;
- Connection of the building's interiors and exteriors;
- Resource efficient design and construction, with a particular focus on energy and water;
- Space to support integration of different mobile learning units with the building to enhance educational delivery options (e.g. access to power, undercover, secure, accessible flows between mobile unit delivery space and internal building learning space and accompanying facilities).

The project stakeholder group was broadened at this stage to include NSW Public Works, Government Architect's Office, NSW Department of Education and Communities Asset Management Directorate, TAFE NSW Strategy and Performance, Mid-Western Regional Council and the staff and students of the Mudgee College itself. The Project Control Group also included key internal stakeholders such as the Student Hubs team, ICT Client Services and local college management. Monthly meetings of the Project Control Group were held in Mudgee to support broader consultation with staff and students as the project progressed.

Early-stage concepts illustrated the realisation of the initial design, incorporating external entertainment/social areas, flexible learning spaces of different sizes, dedicated computer learning spaces and laboratories, the Student Hub (including reception, course information, library, counselling, private and group learning areas and academic skills support), mobile learning unit integration and plant and other facilities. Early-stage concepts had also focused on sustainable design elements such as construction and fitout materials, daylight and façade modelling, stormwater management and ventilation as part of ensuring the building would be responsive to Mudgee's climatic and geographical context.

By the time the design project was at 50% documentation for tender (March 2014), the design was also subject to a Green Star feasibility assessment to determine the potential for pursuing a 5 Star Green Star Education design rating. The Green Star — Education v1 rating tool assesses the environmental attributes of new and refurbished education facilities in Australia³ and uses a series of identified space benchmarks to assess performance. The feasibility study indicated that the project was already achieving a 4 Star Green Star Education design v1 rating and that pursuit of additional design enhancements relating to building management (e.g. commissioning, waste management and maintainability), indoor air quality (air change effectiveness and thermal comfort), energy management (including further reductions to modelled greenhouse gas emissions and peak energy demand), transport design and planning,

³ Ibid

materials (recycled content and reused products and materials) and reductions in light pollution could result in the project achieving a 5 Star rating.

Phase 2 – to June 2014

Phase 2 of the project design focused on fine-tuning the building's layout, functions and services in consultation with project stakeholders, and conducting additional modelling and design work to address suggested design enhancements resulting from the March 2014 Green Star feasibility assessment, in order to bring the project to 95% documentation for tender and test its 'buildability'. Critical to Phase 2 was ensuring full integration between the educational and environmental design elements to ensure that the building would meet both learning and teaching, and environmental performance, expectations given that the building would also be intended as a 'living laboratory' to demonstrate excellence in sustainable infrastructure renewal and environmental performance to staff, students and other stakeholders. Central to these expectations was the provision within the design of learning resources about the building, including the ability for staff and students to gain 'read' access the Building Management System itself to learn about what the building is doing in 'real time'.

Key features built into the design during Phase 2 included:

- Thermal zoning and the use of buffer zones to enhance thermal comfort;
- Mixed-mode ventilation to reduce energy consumption and maximise flow-through of external air when outdoor climate conditions are suitable;
- Reduction in the heat island effect through maximised use of pervious surfaces, and light-coloured roofs, paving and walkways. Trees and other landscape features were also designed to promote natural shading of the building;
- 60kW of solar PV to offset grid power demand;
- Use of solar thermal to support a (smaller) electric boiler in generating hot water;
- Landscaping to support bio-filtration and enhancement of natural habitat, using native species with low water requirements and in line with local biodiversity assessments;
- Use of deciduous landscaping on the northern façade to provide summer shade and winter solar gain;
- Optimised building orientation, mass, shape and use of interior colours and finishes to optimise controlled natural day lighting – including the use of light shelves to bring natural light down into the central area;
- Application of automated horizontal and vertical shading to the façade combined with large, full-height openings for natural ventilation, daylight and visual amenity;
- Energy efficient lighting, appliances and equipment;
- Bicycle storage and accessible access to shower and change room facilities;
- Centralised waste sorting and storage;
- Provision of outdoor sheltered communal spaces;
- Rainwater harvesting (112KL) to support garden irrigation and toilet flushing;
- A Building User Guide and accompanying training resource;
- Water efficient fixtures and appliances;
- High performance building envelope, including high levels of insulation, double performance glazing, external shading and reduced infiltration;
- Environmentally-preferenced materials, including those that are non-toxic, contain high levels of recycled content or are themselves highly-recyclable, such as:
 - Low (or no) volatile organic compound finishes for paints, adhesives, sealants, floor products and furniture;
 - Low (or no) formaldehyde content in products and furniture;
 - Sustainable timber or timber composites;
 - Rapidly renewable materials;
 - Concrete with recycled content (e.g. crushed aggregate or flyash) to reduce the amount of Portland cement.

Fine-tuning of design elements and materials/system modelling was conducted following review of the 95% documentation and 'buildability' testing conducted during May-June 2014. Green Star capability and experience was also built into the final tender documentation and selection process, including the requirement that subcontractors also have sufficient experience in working on green building projects to ensure the final construction mirrored the approved design.

Project Achievements and Lessons Learned

Green Star assessment

The Mudgee Stage 4 project was submitted for a Round 1 assessment in October 2014, with the aim of achieving a 5 Star Green Star rating. Feedback on the Round 1 assessment required clarification on a small number of design elements, and the Round 2 assessment was submitted in November 2014.

In January 2015, the GBCA advised TAFE Western that the Mudgee Stage 4 Learning Resource Hub had been awarded a 5 Star Green Star Education design v1 certified rating, representing Australian Excellence in environmentally sustainable building design. High scores were achieved for indoor environment quality, energy management and water management, with building management, transport options, materials, land use and ecology and emissions management also achieving credit points for the project.

Reference to the GBCA's certified project directory highlights that this is the first 5 Star Green Star certification of its kind for a TAFE NSW building project.

Lessons learned

Despite the success of the design phase for the Mudgee Stage 4 project, TAFE Western also identified a number of key lessons to be incorporated in any future projects:

1. Consult building occupants (staff and students) often and early, and consider the use of a pre-project occupancy survey. While staff (TAFE Western and other agencies) were consulted from the start of the project, student consultation proved to be a significant project challenge, and in the early phases of the project there was a lack of understanding amongst the project stakeholders about the combined innovation approach to educational delivery and environmental management on a whole-of-project basis;
2. Early design concept testing and modelling – both from a technological and stakeholder perspective – is critical to ensuring the project achieves its intended objectives. The feasibility study conducted by GBCA at the 50% stage ensured that TAFE Western designed a custom 5 Star Green Star educational building that the intended occupants would be comfortable with;
3. Client control of project governance is critical.

Future Directions and Opportunities

Construction commenced on the Mudgee Stage 4 Learning Resource Hub in May 2015, with Zauner Construction being awarded the project tender. As part of commencing construction, work has also commenced on pursuing a 5 Star Green Star Educational As-Built certified rating for the project upon completion (expected in mid-2016).

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