Teaching sustainability in a six star green building

Rick Best

Bond University, rick_best@bond.edu.au

Follow this and additional works at: http://epublications.bond.edu.au/fsd_papers

Part of the Architecture Commons

This work is licensed under a Creative Commons Attribution-Share Alike 4.0 License.

Recommended Citation

http://epublications.bond.edu.au/fsd_papers/258
TEACHING SUSTAINABILITY IN A SIX STAR GREEN BUILDING

Rick Best  
Centre for Comparative Construction Research, Bond University, Australia  
ribest@bond.edu.au

Abstract: The building that houses what was the School of Sustainable Development (now part of the Faculty of Society and Design) at Bond University on Queensland's Gold Coast opened in 2008 and was the first educational building in Australia to achieve the maximum six star rating under the Green Building Council of Australia's Green Star rating scheme. It serves as a living model of the potential that green building design offers as part of the push to reduce greenhouse emissions and as such has been a key element in the School's development. While it has served well as an exemplar it is not without its problems. In this reflective paper the author, an academic who has worked in the building for the past six years, looks at what has worked and what has not from the perspective of students and staff. A small number of semi-structured interviews were conducted with representatives of both groups of users to ascertain opinions of those closest to the building.

1 INTRODUCTION

Bond University opened its School of Sustainable Development (SSD) in 2007. The School, which is no longer a separate entity but a loosely defined unit within the Faculty of Society and Design, offers programs in property, building, urban design, project management and environmental management. The university commissioned the design and construction of a new building to house SSD (Bond 2015a) and it was officially opened in 2008. It comprises around 1500m² of fully enclosed space (mostly staff offices and teaching spaces) and several covered but unenclosed outdoor spaces. The building was intended to exemplify 'world's best practice in sustainable development' (Arup 2008) and the intent was to achieve a maximum six Green Star rating under the Green Building Council of Australia rating system (GBCA 2015a). It was the first education building in Australia to achieve a six Green Star (Design) rating (more or less equivalent to Platinum LEED) and won a number of local awards as well as the RICS 2009 Global Award for Sustainability.

The building design included many ‘green’ building attributes including photovoltaic panels, a recycled water system, a small wind turbine, fly ash concrete and recycled reinforcing steel (Best 2010). One key component was never actually installed: the manufacturer of the proposed bio-diesel generator refused to provide a warranty as they would not accept the university's guarantees of the quality of the fuel which was to have been processed from waste cooking oil. Since the occupation of the building some other systems have disappeared; the waste water treatment plant experienced problems early and was removed and never replaced while the wind turbine was taken away when a new building was built adjacent to the SSD building. Although a newer turbine has been installed in the university grounds it is some distance from the SSD building and has no physical connection to it.

During the five years following the opening of the SSD building academic staff conducted guided tours of the building, averaging 60-80 tours per year. The tours were for groups from other universities (students, staff and facility managers), local schools and international visitors among others.
2 KEY CHARACTERISTICS OF THE BUILDING

The Green Star rating tool is based on points that are awarded in relation to an extensive list of attributes including some, such as proximity to public transport, that are not related to building design. As the building was to be an example of what could be achieved in green building design every opportunity to collect Green Star points was explored. These included the use of natural light and ventilation, use of recycled and low impact materials and provision of a bicycle store and showers to encourage people to ride to work.

The building has three floors with teaching spaces at ground level and offices, meeting and utility rooms on the upper floors. A sophisticated building management system (BMS) controls various building functions including switching to natural ventilation mode when external conditions (temperature and humidity) are such that 100% outside air can be utilised. Most spaces have manually operated windows and individually switched ceiling fans. These are independent of the air conditioning system which is available in enclosed offices via individual occupant controlled units and in other spaces, such as teaching rooms, on an as-needed basis. Most of the artificial lighting in the building is controlled by movement and lighting level sensors.

For a variety of reasons it was a very expensive building, costing close to AUD10,000/m². By comparison, in 2008 a tertiary education building in this location with similar facilities, services and fitout would have cost around AUD2500/m² (Rawlinsons 2008). The high cost was not due to it resembling a luxury hotel (it is, in fact, quite a plain, utilitarian sort of building – see Fig.1) but because of the push to achieve the maximum Green Star rating. At the time of its design there was no Green Star tool for education buildings and as it turned out the tool that now exists was developed in tandem with the building design. Almost every step of the Green Star validation process was new to the design team and consultants were regularly asked to undertake tasks that were new to them, for example, to gain maximum points for avoidance of PVC in the building the client had to pay an independent auditor to assess how much PVC (in dollar terms) would have been used had the specification been typical of similar conventional buildings constructed at the same time and then to compare that to the value of PVC actually used. Similar comparisons were made in many instances and all these steps meant additional cost to the client.

Murugan and Kato (2010) surveyed occupants of the SSD building and two conventional buildings at Bond and compared the responses. They found that the green building scored better in regard to nearly all the factors in their survey which included temperature, lighting, incidence of fatigue, headaches and colds and general satisfaction with the workplace.

Best and Purdey (2012) conducted a post-occupancy evaluation of the building by surveying resident users (staff and research students) and transient users (day students). Their focus was on occupant comfort. They found that users were generally comfortable in the building although there were some issues with noise (internal and external) and glare in daylit teaching spaces. Noise and glare are common problems in buildings of this nature (Baird 2010).

While the building’s occupants are generally happy with it as a place to work and study, the SSD building would be unlikely to achieve any Green Star rating in its current condition. By the end of 2013 the following building components (apart from those already noted earlier) were compromised or missing:

- The stormwater detention/filtration pond had deteriorated considerably due to lack of maintenance
- The secure bicycle store had been turned into a general storeroom
- The interactive touch screens that displayed real-time data on building operations (electricity generated, energy used, rainfall and temperature recorded and so on) were inoperative and/or displaying information that was obviously wrong, such as zero rainfall in the previous year
The building management system (BMS) had largely ceased putting the building into natural ventilation mode – it was originally programmed to disable the air conditioning and open upper level windows in corridors when outside conditions of temperature and humidity meant that the building could run just on fresh air. Due to some failed sensors and an incremental narrowing of the comfort band (due to differing requests from occupants) the BMS was no longer doing its job.

The original low VOC paint that was originally specified, and which was used for repainting or patching when required, had been replaced by conventional paint.

A program aimed at restoring the building’s features was commenced early in 2014 and a number of problems were fixed; however, there are no plans to replace the water treatment plant or to connect the new wind turbine to the building. The touch screen displays remain on the wall but are inoperative.

3 SUSTAINABILITY ON CAMPUS

The idea of universities ‘greening’ their campuses is not new. Sharp (2002) investigated moves towards more sustainable campus operations at more than 30 universities in the US and Europe and there are many other similar studies (e.g. Shriberg 2003, Owens and Halfacre-Hitchcock 2006). Christensen et al. (2009) looked at the gap between the stated intention to improve sustainability at one Danish university and the subsequent loss of momentum and lack of action. Most Australian universities claim to be working towards sustainability on their campuses; see, for example, University of Melbourne (2015), UNSW (2013) and UTS (2014).

Bond University is no exception. It has a sustainability policy (Bond 2011) and it did have a campus-wide sustainability committee; however, the committee has not had a meeting for several years and it only ever published one report and that was in 2009 (Bond 2009). In 2013 the university opened a new building, the Abedian School of Architecture (Bond 2015b), which is located immediately adjacent to the SSD building. The original brief called for a six Green Star (As Built) rating and the staff in the two schools were strongly in favour of the building being 100% naturally ventilated. This, and a Green Star rating one step above that of the SSD building, would have represented both an affirmation of the university’s commitment to sustainability and a raising of the green design benchmark set by the SSD building. Sadly, the brief was changed and the new building is fully air-conditioned and has no Green Star rating of any kind.

It appears that this loss of momentum is not uncommon. Sharp (2002:130) said this:

‘The journey to succeed in building a showcase green building at your university is a very different journey to successfully institutionalizing a university-wide commitment to have all future buildings built green.’

Ms. Sharp could hardly have summarised the Bond experience more perfectly. While the SSD building stands as an example of what is possible, the rest of the campus exemplifies ‘business as usual’ with buildings that have lights on during the day even when no-one is there, and that are mechanically cooled to what some feel are uncomfortably low temperature levels at the same time that the SSD building has only emergency lights on (required by law), the air-conditioning system unavailable and the windows open.

4 USING THE SSD BUILDING AS A TEACHING AID

Degree programs taught by staff that have their offices in the SSD building are mainly delivered in the teaching spaces within the building. These programs cover construction management and economics, property/real estate, urban design and planning, environmental management and project management. While there are obvious concerns about what has happened in terms of both the state of the building now and the unfortunate changes made to the design of the new building next door, the building has served well in various ways and continues to be used as a reference point and a living and accessible example of environmentally-aware design.
Before the restoration program began in 2014, staff who had routinely conducted building tours as part of their regular activities began to express doubts about the propriety of telling people about how well the building worked when they knew that many of its key green features were either absent or inoperative. While that perception has eased somewhat as building systems have been restored, for whatever reason, the demand for building tours has dropped and staff now conduct them only occasionally. This could simply be that it has now been operational for over six years and is thus ‘old news’. Also several other Australian universities have opened green buildings that are arguably more advanced (see, for example, the Tyree Building at the University of NSW (UNSW 2014) and the Sir Griffith Building at Griffith University (Griffith 2015)) but it is difficult not to think that the university’s sustainability credentials may have been eroded by the apparent change of direction since its flagship green building was opened.

The building has continued to serve as a very useful teaching tool, even though some of that value may now lie in the fact that it demonstrates not only how some basic design decisions, such as optimal orientation of the building, can produce real benefits but also how things can go wrong, particularly with more complex systems such as water treatment, the BMS and sophisticated but unstable data logging and display equipment.

Healy (2011), a services engineer involved in the early stages of the SSD design, believes that the building is ‘over-engineered’ inasmuch as the successful operation of the building relies too heavily on a large number of sensors and switches that inform the BMS and allow the building to function as intended. Not only does the failure of any of these components compromise the functionality of the building but monitoring and replacing these items is quite expensive due to both the cost of the labour involved and the high cost of purchasing replacements.

The dangers of the sort of ‘over-engineering’ that Healy was concerned about were identified more than 20 years ago by Vaughan and Jones (1994:39) who wrote:

‘There is often a preoccupation with intricate or exotic solutions or devices which actually have less impact on building performance than fundamentals such as building orientation.’

Some of the best features of the building are the abundance of natural light in most spaces and the way the building, particularly on the top floor, catches every available breeze, which is a key comfort factor in a building located in a sub-tropical climate with warm, humid summers. These are passive features that produce ongoing benefits for occupants and the building’s owner yet they require no ‘exotic solutions or devices’ and, indeed, correct orientation of the building is one of the key factors.

5 VIEWS FROM THE CLASSROOM

In this section several interviews with teaching staff and students are summarised. It concludes with the author’s personal reflections on how the building has been integrated into subject delivery.

5.1 Property/real estate

This person teaches property management and valuation. For her, the building provides an immediate example of what a green building is and what features make it green. This feeds into general discussions on the potential economic value of such buildings. The very high initial cost of the building is discussed and the point made that such a building could only be economically viable for an institution such as a university, i.e. one that is prepared to wait many years to recover its initial investment through continued use and reduced operating costs.

5.2 Construction technology/sustainable building design

Changes to the curriculum over the past five years have reduced the emphasis on the SSD building for this lecturer. At one time he taught a subject called ‘Sustainable Construction’ which became ‘Sustainable Design’ and the building was often used an example of the application of various methodologies related to energy efficiency, renewable energy technologies and material selection. More recently the focus has
The focus has shifted for several reasons: one is that staff felt that the course required more emphasis on the practice of building, another was perception that as sustainability has become closer to 'business as usual' that the tight focus on it had become a little dated. A third reason was that students expressed some dissatisfaction with what they called 'greenwash'; through student evaluations they let staff know that they were hearing the same things about green buildings, often several times over from different lecturers and they were getting tired of it.

In the current curriculum this lecturer uses the building as a target for the students to complete an energy audit with reference to Section J of the Building Code of Australia (BCA). Section J is the part of the code, added in recent years, that addresses energy efficiency in buildings. It is not as stringent (yet) as similar codes in other places (e.g. California) but it is expected that benchmarks will be pushed upwards incrementally in the years ahead as the push towards wider adoption of sustainable practices in the property/construction sector continues. Having free access to a building that is more efficient than the average makes this audit exercise a more significant learning experience, particularly if it is used as a benchmark against which the performance of more conventional buildings can be measured. It also gives students hands-on experience in the application of Section J and a deeper understanding of that section of the BCA in practical use.

Furthermore, students can easily appreciate the use of recycled materials, particularly timber, as there are roof and elevated walkway framing timbers, timber flooring and decorative timber wall treatments clearly visible all around the building. These are discussed in the context of construction processes and the development of building specifications.

5.3 Environmental management

In this case the lecturer used to make regular references to the building, mostly in relation to its renewable energy and energy efficiency features. He used the now defunct touch screens and the weather monitoring system that fed data to those screens as a live example of an environmental management system. As the screens no longer work the building is now seldom mentioned in his teaching.

5.4 Postgraduate student

This student says that the building was an important factor in her decision to come to Bond. She completed a masters degree in construction and is currently working on a doctorate that is focused on sustainability and indigenous/vernacular architecture. When she was considering study at Bond she read about the SSD building on the university website and was attracted by the tangible evidence of the School's (and thus the university's) commitment to sustainability in the built environment. As a coursework student she recalls staff regularly using the building as an example of various aspects of green design and construction but she is less enthusiastic about the current situation. She is very critical of the move away from sustainable design exemplified by the adjacent architecture building. She also notes that there is, in her opinion, not nearly enough information given to users of the SSD building in regard to the operation of the building, e.g. few users really understand how to manage the natural ventilation and air-conditioning systems to their full potential.

6 PERSONAL REFLECTIONS

I came to the SSD building in January 2009. In the past six years I have taught a variety of subjects including a couple of technical skills subjects, a building services subject and a final semester subject that includes some material on integrated design teams for building projects and emerging technologies in the construction field.
As I have been teaching material related to environmentally-sensitive building design since 1993, having a living example of best practice as a workplace has been very useful and was one of the factors that attracted me to the university. I have often made reference in class, and continue to do so, to many aspects of the building itself and the design process that made it a reality. Here is one example: in the context of building information modelling (BIM), which is a major topic in my final semester subject, I talk about the advantages of interoperable design software that makes the calculation of daylight and solar heat entering a proposed building considerably faster and more efficient and then refer to the building as an example of correct orientation (long axis running E-W) and discuss the inclusion of the covered atrium on the northern side of the building (it’s in the southern hemisphere so the sun is to the north). This atrium allows solar gain in the cooler months while shielding the north-facing windows in the summer. Delivering this content in a space which is directly affected by these design decisions and where the students can instantly connect the theory with practical experience is very effective, as one would expect.

Similarly, the discussion about integrated design teams is readily illustrated by reference to the team approach that produced the SSD building design. This leads to further discussion, however, in regard to the complexity of the systems in the building and the reliance on expensive and complex systems and components that can and do fail.

Furthermore, the building provides a good case study when we discuss the importance of lifecycle costing. In Australia, and the same is true of many places, green buildings generally still cost more to build than conventional buildings and that extra cost has to be justifiable. It is typical that the economic argument for ‘going green’ rests on avoided operational costs in the future, particularly in relation to reductions in energy and water costs. Payback periods can be long and it is often argued that only owner-occupied buildings will realise these long-term savings. With the SSD building it is easy to show that, as an institutional building which the university would expect to own and use for many years, a longer payback period is acceptable as once that period has expired the university can expect to make significant savings for years to come.

The immediacy of these examples does, in my view, increase the impact of the points that we discuss with students. Unfortunately, however, the combination of the new ‘non-green’ building next door and the somewhat degraded state of the SSD building has reduced the impact that the building has as a teaching tool. Some aspects of the building have always caused some difficulties for staff and students, notably the problems encountered when the data projectors are used in the teaching spaces. As the lights are controlled by motion and light level sensors it has generally been difficult to keep light levels so that the detail of the projected material is easily read while maintaining enough light for people to take notes. Until very recently there were no light switches in the studios (part of the green design) and when the incoming natural light was bright enough to make it hard to read the screens, the only alternative was to close the blinds. This darkened the room somewhat but that caused the BMS to increase the level of the artificial lighting and the problem remained. Several years ago a request for lighting controls was lodged, however, initial approval was reversed because there was a fear (unfounded) that installing switches would compromise the building’s Green Star rating. In fact this is not the case as the Green Star rating was for the original design and small modifications will not affect that rating. Had the rating been for performance, changes to the building could affect the rating as a Green Star – Performance rating is only valid for three years and performance must be monitored during the three years and then a re-assessment is required if the rating is to be renewed (GBCA 2015b). With no wind turbine, no generator and no water recycling the building would have little or no chance of maintaining a performance rating even it had achieved one in the early years of its operation.

7 CONCLUSION

The SSD building at Bond must be judged a success but its success has been somewhat diminished in recent times. It won a number of awards, local and international, and generated a considerable amount of excellent publicity for both the university and the fledgling school which it housed. It continues to provide comfortable and functional space for academic activities and has continues to provide a living example of many aspects of what is taught in the degree programs offered by the sustainable development unit.
The 2013 retirement of the founder of the original School of Sustainable Development, who also chaired the now apparently defunct university-wide sustainability committee, inevitably led to a loss of momentum in regard to sustainability not only within SSD but across the university. A temporary drop in student numbers around 2011 put some stress on budgets and the building was not serviced to the extent required. This led to a degrading of some of the building’s attributes and this in turn reduced the value of the building as an example of best practice.

Further damage was done when the decision was made to abandon the Green Star aspirations that were embodied in the original brief for the new architecture building and endorsed resoundingly by the academic staff. During its construction staff were often asked about the green credentials of the new building, with outsiders typically asking how many Green Stars the university was targeting in the design of the new building; the embarrassing answer was that no rating was being sought. This coupled, with the state of the SSD building, was not good for staff morale and could well have had a lasting impact on the public’s perception of Bond as any sort of ‘green’ institution.

Personally, I have found the building to be an excellent place to carry out my academic work and, in particular, I find my office to be a very comfortable and productive working environment in almost all weather conditions throughout the year. In six years I have activated the air-conditioning in my office on no more than six occasions and that has always occurred during the coldest part of the (admittedly mild) Gold Coast winter. With good management I believe the building will continue to serve the university, and its staff and students well, well into the future.

References

Bond 2009. 2009 Sustainability Report
University of Melbourne 2015. *Achieving a Sustainable Campus*
http://sustainablecampus.unimelb.edu.au/


Fig. 1 The Sustainable Development Building, Bond University (Source: author)