



Building a ‘storehouse of wisdom’ with an environmental conscience: a work in progress

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196 — Sustainability issues in the design of libraries: the importance of creating environmentally responsible library facilities and spaces in the 21st Century — Library Buildings and Equipment Section

Abstract:

The University of Melbourne has embarked upon a bold strategy to ensure its place as one of the finest universities in the world, a strategy founded upon excellence in research, learning and teaching, and engagement. Released in July 2008, Melbourne’s Scholarly Information Future is a ten-year strategy to guide the development of the University’s scholarly information services, collections, systems, technologies and infrastructure.

The implementation of this strategy will see the creation of physical library environments that support the development of the scholarly communities and facilitate a sense of belonging as well as providing an information environment that is distinguished by ease of use, equity of access, quality of content and richness of possibility.

The University is now two years into an ambitious programme of library redevelopments. Key deliverables for these new buildings and infrastructure are linked to the effective delivery of services to support the academic community but also high on the agenda as a key deliverable is reducing the environmental footprint to improve environmental sustainability

in line with the University's environmental commitment, as well as maximising operational effectiveness in the current financially constrained environment.

As 2010 drew to a close we had delivered two new innovative libraries incorporating flexible learning spaces, each unique and a significant improvement on the original building in terms of environmental sustainability and innovative use of space. In parallel during 2010 planning began in partnership with architects and the University Property and Campus Services staff for the redevelopment of the flagship Library of the University (Baillieu Library) as well as vision for the Research and Cultural Library which will be potentially the largest capital project in the history of the University. In this planning phase significant attention is being given to sustainable building design and reducing the building footprint through the innovative use of automation as well as other environmental sustainable measures. This presentation will outline the learning from previous redevelopments and the potential we hope to realise for redevelopment of the Baillieu Library and the building of the Research and Cultural Library to continue to create environmentally responsible, innovative, integrated and flexible learning spaces.

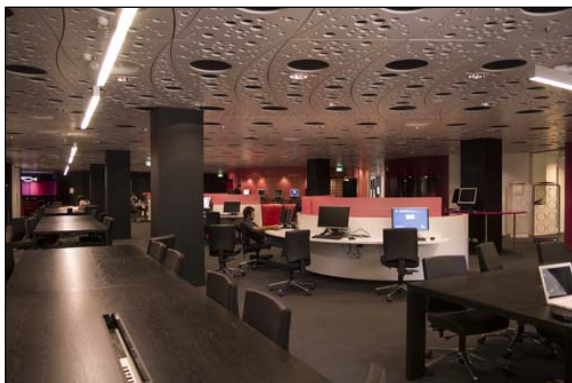
Building a 'storehouse of wisdom' with an environmental conscience: a work in progress ¹

INTRODUCTION & INSTITUTIONAL CONTEXT

In 2008, the University of Melbourne Library was large, traditional, dispersed and consequently difficult to manage. Composed of 19 branches spread across 14 sites, the buildings were generally old, the furniture and fittings were worn and the learning spaces belonged to a different era. The larger branches were based upon a traditional service model complete with a reference desk, a loans counter, a document delivery service, and Student IT support desk. It was a costly model in terms of staffing, especially in the face of decreasing loans and reference questions. More importantly, it was ill equipped to deal with the demands of a changing pedagogical landscape, ill equipped to deal with the needs of researchers and students. With aging infrastructure, it was also found wanting in the area of environmental responsibility.

The collections at the University have always been highly regarded and the Library boasts cultural collections of national significance as well as the largest non-government collecting archive in Australia. In this respect, it is indeed a 'store house of wisdom'². Electronic resources are also strongly represented as befits a research-intensive University with an international reputation for quality research. However, print collections in all categories were crowded and preservation conditions were not optimal. Opportunities for students to consult electronic resources were also constrained by a chronic shortage of computers.

In less than three years, the landscape has changed considerably. Although we still have a long road ahead, the University Library has undergone a redevelopment program that has transformed several physical spaces, providing a greater range of study options to students, more appropriate accommodation for collections and the opportunity to create a more rational and innovative staffing model.



Not surprisingly our thinking has evolved with each successive project, but each space is innovative, distinctive, created in consultation with faculty and responsive to student feedback and requirements. Where many academic libraries stress the need for maximum flexibility, University of Melbourne redevelopments concentrate on providing students with a range of choices within

¹ The authors would like to acknowledge the assistance provided by Lyons Architects (especially James Wilson) and AECOM consulting engineers in the preparation of this paper. Architectural and engineering plans and charts used in this paper have been provided by these firms and have been used with permission. Photographs of library spaces at the University of Melbourne are the work of Lee McRae, a member of Library staff.

² Sir Clive Latham Baillieu. "On the occasion of the opening of the Baillieu Library" (Excerpt from speech delivered on the occasion of the opening of the Baillieu Library, University of Melbourne, Australia, 21 March, 1959.)

the Library. Redeveloped spaces include collaborative spaces with various seating configurations; project rooms equipped to support group work; quiet study spaces and ubiquitous computer



facilities and social learning spaces to encourage a sense of community and shared learning.

Redevelopments place emphasis on quality. Using sound sustainability principles, the Library subscribes to the view that furniture and fittings must be robust, durable and of good quality.

Experience has shown that spaces are treated with respect and care when this is the norm. There are also facilities for extended opening hours, permitting parts of the Library to remain open as learning spaces after the service points have

closed.



Without doubt, the most important Library project to date is proposed for the flagship library of the University, the Baillieu Library. This project will also include the building of a new Research & Cultural Library on the same site. If the project goes ahead as hoped, it will provide state of the art facilities for both researchers and students and excellent conditions for storing and exhibiting special and rare collections. It will also facilitate the implementation of a new model for providing service to the University community. Importantly, it will also be an environmental sustainable building since this objective has informed planning from the outset. It will indeed be a 'storehouse of wisdom' with an environmental conscience.

It has been an exciting time to be involved with the Library, a time of renewal, re-thinking old ways and seeking innovation after a period of under-investment in Library infrastructure. Initially, environmental sustainability was not a key driver for the redevelopment of the Library. Rather, emphasis was placed upon efficient service provision leading to improved financial sustainability and the creation of innovative learning spaces for students. However in just a few years, sustainability has become a major priority. Environmental concerns are now firmly embedded in University planning and this is reflected in all new projects, including Library projects. The physical renewal of the University Library accompanied by an increasing emphasis on sustainability has been made

possible by the development of policy and strategy at an institutional level in both of the areas of scholarly information and sustainability.

A ten year strategy to guide the direction of scholarly information was endorsed by University Council in July, 2008. This strategy was a product of the Information Futures Commission, a University-wide consultative process initiated by the Vice Chancellor charged with investigating all aspects of the digital information environment.³ Importantly the Information Futures Commission also included consultation about physical library spaces. These were found to be lacking and out of step with the aspirations of the University to be an outstanding research facility with infrastructure to support research in all its forms. With regard to library spaces, the Strategy espoused the following aspiration:

‘... The library will continue to be the focal point of a networked world, providing spaces for independent and collaborative learning and research, with access to scholarly works in appropriate forms and to information professionals. Each library will be distinct, responding to the specifics of its location and clients.’⁴

Another key institutional document was released in 2008 - Campus Master Plan.⁵ This plan established the principles that would underpin the development of a sustainable campus using best practice design and technology to support infrastructure and building programs. For all new buildings, the Master Plan sets a minimum 5-star Green Star rating under the Green Building Council of Australia’s rating system.⁶ This rating equates to Australian excellence. Space planning was also given priority to ensure effective use of existing and new spaces. Further planning principles relate to waste reduction, recycling and maximising water resources. Ambitious targets in all of these areas were approved by University Council for the period 2007-2010⁷, as well as a long term plan to achieve carbon neutrality by 2030.

The convergence of these two important institutional commitments in the form of the Campus Master Plan and the Ten Year Scholarly Information Futures Strategy has had a powerful influence on the subsequent development of the physical spaces occupied by the Library. Innovative library spaces and sustainability have become dual requirements for library redevelopments.

ENERGY REDUCTION AND THE LIBRARY

In the *Environmental Sustainability Strategic Plan 2008-2010*, the University set a target to reduce its carbon footprint by 50% based on 2006 levels by the end of 2010.⁸ This target was achieved, saving

³ “Melbourne’s Scholarly Information Future.” University of Melbourne, accessed June 8, 2011 at www.informationfutures.unimelb.edu.au

⁴ O’Brien, Linda, Mark Brodsky, Margaret Ruwoldt. “Melbourne’s Scholarly Information Future: A 10 year Strategy.” University of Melbourne ePrints Repository <http://www.lib.unimelb.edu.au/eprints/>

⁵ “University of Melbourne Parkville Master Plan.” University of Melbourne, accessed June 8, 2011 at http://www.pb.unimelb.edu.au/project/documents/2008_Masterplan_Final_WEB.pdf, 26, 64

⁶ *Ibid* 64; See also the Green Building Council of Australia website Accessed 8 June <http://www.gbca.org.au/>

⁷ University of Melbourne. Achieving a Sustainable Campus. Accessed 8 June http://sustainablecampus.unimelb.edu.au/campus_sustainability/energy.html

⁸ “Environmental Sustainability Strategic Plan 2008-2010” University of Melbourne, accessed June 8, 2011 at http://safety.unimelb.edu.au/docs/Environmental_Sustainability_Strategic_Plan_2007-2010_Approved.pdf

the equivalent of 25,000 metric tonnes in carbon emissions.⁹ The reduction of energy consumed by the buildings on campus proved to be an important contributor to that achievement. Since buildings consume high volumes of energy for heating and cooling, ventilation, lighting and for associated activities such as computing and office equipment, the energy reduction program focussed on opportunities for reduction of energy consumption in campus buildings. The intention was to attain maximum benefit from the initial round of energy reduction measures. Energy reduction in buildings can be implemented within a relatively short time frame using existing technologies. Further although initial investment is required, many of these initiatives are cost effective, repaying investment within the life cycle of the product.¹⁰

Libraries on campus have benefited from energy reduction initiatives that were designed to meet University sustainability targets. Due to their long opening hours, level of occupancy, need for lighting, heating and cooling, libraries have been identified as energy intensive buildings.¹¹ The libraries at the University of Melbourne are no exception. An energy audit of 70 buildings on the main campus commissioned in 2006-7 found that seven buildings collectively accounted for 42% of the electricity consumed on the Parkville campus. Not surprisingly, the Baillieu Library (the largest library) was identified as one of the seven major consumers of electricity.¹² For this reason, the Baillieu Library has received significant upgrades to plant and infrastructure, and other libraries have received upgrades as they have been refurbished.

Lighting

Lighting accounts for approximately 19% of the emissions associated with building use. For this reason, the installation of low energy lighting has a significant impact on energy reduction, especially since it can be implemented quickly using existing technology. Although the purchase cost of low energy units is higher, they are cost effective over the life of the product.¹³ Lighting has been upgraded in all of the libraries as they are refurbished. T8 fluorescent lights have been replaced with more efficient T5 lights that are up to 30% more efficient than and have a longer lifecycle with a consequent saving in both maintenance costs and waste.¹⁴ Sensor lighting has also been installed, especially in meeting rooms and collection areas where occupancy is intermittent.

⁹ "Energy Reduction Program." *Environs, The Newsletter of Property & Campus Services* (March 2010). http://www.pcs.unimelb.edu.au/data/assets/pdf_file/0005/333527/EnvironsMarch2010web.pdf

¹⁰ "Reducing US Greenhouse Gas : How Much at What cost?" McKinsey and Company, accessed June 8, 2011 at http://www.mckinsey.com/en/Client_Service/Sustainability/Latest_thinking/Reducing_US_greenhouse_gas_missions.aspx ; "An Australian cost Curve for Greenhouse Gas Reduction." McKinsey and Company, , accessed June 8, 2011 at www.mckinsey.com/locations/australia_newzealand/knowledge/pdf/1802_carbon.pdf

¹¹ Brian Edwards. *Libraries and Learning Resource Centres*. 2nd ed. (Oxford: Architectural Press, 2009), 77.

¹² "Public Report to the Australian Government." University of Melbourne, accessed June 8, 2011 at http://sustainablecampus.unimelb.edu.au/pdf/2009_EEO_Public_Report.pdf

¹³ "Reducing US Greenhouse Gas : How Much at What cost?" McKinsey and Company, accessed June 8, 2011 at http://www.mckinsey.com/en/Client_Service/Sustainability/Latest_thinking/Reducing_US_greenhouse_gas_missions.aspx

¹⁴ "Carbon Mining at the University of Melbourne." *Environs, The Newsletter of Property & Campus Services* (September 2009). http://www.pcs.unimelb.edu.au/data/assets/pdf_file/0008/176597/Environ092009.pdf

Heating, ventilation and air conditioning (HVAC)

In some buildings, heating cooling and air conditioning can account for up to 50% of energy use within the building.¹⁵ Significant reductions in electricity consumption have been gained through implementation of engineering solutions - upgrading plant and improved regulation of air conditioning. Infrastructure in the Baillieu Library was improved with the installation of variable speed drives for pumps and fans and reconfiguration of boiler and chiller operations. This equipment does not operate continuously but responds to demand based on external temperature and thermostats. The installation of this equipment at the Law and Baillieu Library buildings is expected to save 2,000 tonnes of CO2 annually.¹⁶ The life cycle of the equipment is also extended since the motor does not operate continuously, hence leading to an environmental benefit related to replacement of plant and waste.

Further, boilers located in the sub-basement of the Baillieu Library were upgraded and connected to a ring loop so that the Library plant supplies hot and chilled water for heating and cooling to other buildings in the surrounding precinct, including the adjacent Brownless Biomedical Library. This is a more sustainable solution since additional plant is not required in each building allowing economies of scale, less maintenance and ultimately less waste of plant and materials as well.

The air conditioning in the Baillieu Library has been zoned so that the area housing Special Collections and Rare Books is temperature and humidity controlled 24 hours per day. In other areas, the hours of operation for air conditioning are regulated according to demand.

Computers

In common with many academic libraries, student feedback consistently requests additional access to computers in libraries. Ultimately this poses a challenge to both environmental and financial sustainability. As part of a bid to manage the environmental and financial impact of computing, the Library participated in two important pilot programs. In 2009-10, the Library partnered with Information Technology Services (ITS) to pilot a successful program to introduce central shutdown of computers within the Baillieu Library, with resulting benefits for energy usage and staff time.

The second pilot that is currently underway is to introduce a thin client solution to student computers in the Library. Using thin clients, processing and software are located on a remote server and requested by the local machine. This means that the local machine can be much smaller in both physical size and processing power. Studies have indicated that thin clients can save over 60% of the electricity used by a conventional desktop PC, although the power required by servers counteracts some of the energy savings.¹⁷ They also have a longer life span. At present, student computers at the University have a three year life cycle, but thin clients could potentially have a life span of six years if quality hardware is purchased. This would give a large cost benefit and also have positive effect on

¹⁵ "Carbon Mining at the University of Melbourne." *Environs, The Newsletter of Property & Campus Services* (September 2009). http://www.pcs.unimelb.edu.au/data/assets/pdf_file/0008/176597/Environ092009.pdf

¹⁶ "Carbon Mining at the University of Melbourne." *Environs, The Newsletter of Property & Campus Services* (September 2009). http://www.pcs.unimelb.edu.au/data/assets/pdf_file/0008/176597/Environ092009.pdf

¹⁷ Willem Vereecken, et al., "Communication Networks: Power efficiency of thin clients." *European Transactions on Telecommunications* 21 (2010): 488.

waste. It is further anticipated that a thin client solution would be more financially sustainable since desktop support is greatly reduced.

The Library disposes of computers every three years in accordance with ITS policy, however they are sold online, contributing to recycling rather than waste.

Waste and Recycling

In this paper, there have already been several references to ways in which Library upgrades have contributed to waste reduction and recycling programs. Using products with a longer life such as lights, thin client computers and quality furniture directly contributes to waste reduction as does extending the life of plant and infrastructure. The Library has an active group of staff, the Green Team, who meet regularly to devise ways in which staff can influence the environmental impact of the Library.

As well as providing recycling receptacles, refurbished libraries also incorporate water fountains to provide chilled drinking water. The objective is to encourage re-use of water bottles since the manufacture and transport of plastic water bottles is energy intensive and they create a waste disposal issue.¹⁸ Water bottles are currently the highest selling items from vending machines on campus so the re-use of existing bottles will be significant.

Another important initiative that has been introduced by the Library is default double-sided printing for all student copying and printing. The Library manages the contract for student copying and printing across the entire University so this initiative will soon be rolled out across the University and is expected to influence the amount of paper consumed in student printing as well as the cost to the student.

FINANCIAL SUSTAINABILITY & THE SERVICE MODEL

Many of the sustainability initiatives outlined in this paper also contribute to the long-term financial viability of the Library. Following an initial investment in infrastructure and materials, reduced energy charges, longer life lighting and computers all bode well for the future of the Library. However, some other benefits are also worthy of mention. As a sustainability initiative, the Campus Master Plan refers to the need for space planning to maximise the effective use of space on campus and has instituted space charging to curb the burgeoning footprint of the University.¹⁹ Space charging has prompted the consolidation of small library spaces into larger buildings that are able to provide longer hours using a more efficient service model. This consolidation is taking place progressively with the integration of four small Science libraries due to integrate into the larger ERC library within 12 months.

The redevelopment of library spaces has also provided an opportunity to change the way in which the Library provides services to patrons. Automation of transactional services and self-service have been given priority with the installation of returns sorting machines and self-check outs. Self-service holds and Reserve systems have been implemented with the result that the Libraries no longer need

¹⁸ "Carbon Mining at the University of Melbourne." *Environs, The Newsletter of Property & Campus Services* (September 2009). http://www.pcs.unimelb.edu.au/_data/assets/pdf_file/0008/176597/Environ092009.pdf

¹⁹ "University of Melbourne Parkville Master Plan." University of Melbourne, accessed June 8, 2011 at http://www.pb.unimelb.edu.au/project/documents/2008_Masterplan_Final_WEB.pdf 64

to have a separate Loans counter, Reference desk and Document delivery desks. All of these desks have been conflated into one service point that is staffed by librarians and Student IT. The librarians are all qualified to at least Library technician level and are able to assist with complex reference questions. They are not expected to transact simple loans and the desk is not set up for this purpose.

The service point in the newly refurbished Baillieu Library now features a model where the staff member stands or sits beside the Library patron sharing the same computer screen. The intent of this configuration is to encourage a sense of partnership and collaboration with students and researchers. This model is much leaner and more cost efficient, especially at quiet times of the day and we have been able to reduce the staffing of service points considerably. Yet there is not a diminution of services, in fact quite the opposite since all of the staff will be specialists in either information or IT support.

The investment in redeveloping library spaces is considerable, but the investment has led to improvements in the ongoing operating costs of the Library.

DESIGNING AN ENVIRONMENTALLY FRIENDLY LIBRARY: REDEVELOPING THE BAILLIEU LIBRARY WITH A NEW RESEARCH & CULTURAL LIBRARY

The Baillieu Library was the first modern, post World War II purpose built academic library in Australia. Designed in 1959 by F.D. Scarborough and Partners, the floor plan was particularly flexible permitting two major extensions and several refurbishments in the intervening 50 years.²⁰ In planning for the redevelopment of the Baillieu Library and the new Research and Cultural Library a great deal of work and planning has been put into developing a vision and key principles to inform

the design brief. The Baillieu Library will continue to provide collections and services to the Faculty of Arts but the new Research and Cultural Library will be designed to preserve and share the cultural heritage of the University by housing special and rare collections that will meet the highest preservation, security and exhibition standards. It will also be built to exacting environmental standards.

As the Baillieu Library sits in a prominent position in the south west quadrant of the campus, the University seeks an elegant and beautiful building to house the new and enlarged Research & Cultural Library. The design must incorporate a sympathetic treatment of the heritage features of the original 1959 Baillieu Library as well as excellent urban design to ensure that it complements the surrounding lawns, pedestrian walks and heritage 19th century buildings in the immediate vicinity. A key element of the urban design for the new library on the existing site is to maximise the links to the Library from the street.

Lyons Architects, a Melbourne-based firm, have created the concept plans for the whole project and have refurbished the Ground floor as part of Stage One completed in 2011. They are supported by a team of engineers and consultants with expertise in environmental engineering. There are several noteworthy features of this development that will contribute to both its environmental sustainability and the financial sustainability of the Library into the future.

²⁰ Brian Edwards. *Libraries and Learning Resource Centres*. 2nd ed. (Oxford: Architectural Press, 2009), 98-99. This section gives the history of refurbishments to the Baillieu Library.

Re-Use of the existing building

Of necessity, building construction causes significant interference with biodiversity through mining, forestry and agricultural production for building materials. There is significant embodied energy latent in the production and transport of materials such as steel and concrete for new buildings. Moreover, buildings are responsible for 40% of the world's waste.²¹ For all of these reasons, the re-use and re-purposing of a building carries a significant sustainability benefit.



Preliminary decision making related to this project was guided by a needs of the Baillieu Library to 2035. A heritage and conservation evaluation was also conducted by a firm of architects specialising in heritage assessment importantly, a decision was made to retain the original 1959 portion of the Baillieu Library with its glazed curtain façade, considered to have

social and cultural significance. The 1959 building appears in the photograph above. Although the project involves demolition of both of the later extensions to the Baillieu Library, the retention of one-third of the space comprising the 1959 footprint constitutes a major re-use of existing buildings and this carries a sustainability benefit.

Automated Storage & Retrieval System (ASRS)

As work progressed on some of the preliminary design concepts, it became clear that much of the building would be devoted to large runs of open stack shelving unless storage density could be increased. Although the Library has access to off-site storage, the building still needs to accommodate approximately 1.5 million items. An investigation into the option of installing an Automated Storage and Retrieval System (ASRS) commenced as a way of keeping books on site while still reducing the library's footprint and cost of construction.

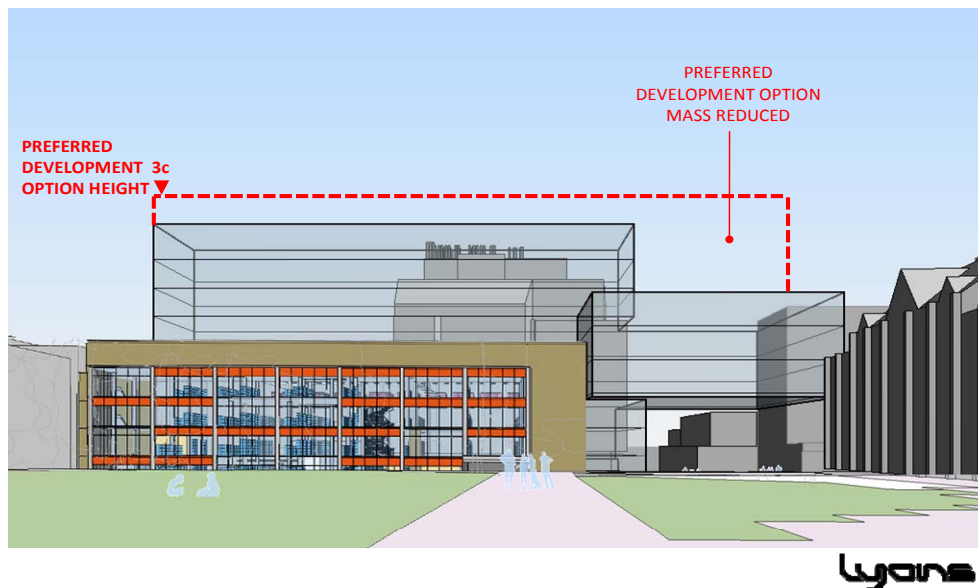
As the business case for the ASRS developed have several advantages became evident. The inclusion of an ASRS would significantly reduce the overall size of the building leading to a reduction in the capital costs of construction. The new library with an ASRS would have a gross floor area is 22,718 square metres and would cost \$166 million to build. Without an ASRS, however, it would have a gross floor area of 30,343 square metres at a cost of \$204 million to build. The savings in building and construction costs alone has been estimated to be in the vicinity of \$38 million.

²¹ AECOM. "The University of Melbourne, Baillieu Library: ESD Workshop outcomes and path forward." (Unpublished paper presented at the University of Melbourne 30 March, 2011.)

There are also substantial cost savings in the ongoing service charges for the new Library. This is easily calculated at the University of Melbourne where space charging has been implemented for all space occupied by faculties and divisions. These charges are intended to focus attention on the true cost of occupying space in an inner urban area.²² If the new Library includes an ASRS for high density storage, at the current rate of ‘rental’ the annual space charge for the whole building would be approximately \$7 million, but it could be as high as \$9.3million per annum for the larger building that would be required without an ASRS. This saving of 2.3 million per year would be ongoing savings for the Library, leading to improved long term financial sustainability.

Reduction of the building footprint by 7,645 square metres also represents a major environmental benefit as less construction materials are needed with less impact on biodiversity, and reduced embodied energy. There are also major ongoing savings in energy consumption since lighting, heating; ventilation and cooling are all reduced.

The image below gives a visual representation of the floor space that has been saved by incorporating an ASRS instead of open shelving. The resulting building is much less dominating and has fewer issues related to shadowing of lawns and surrounding buildings.

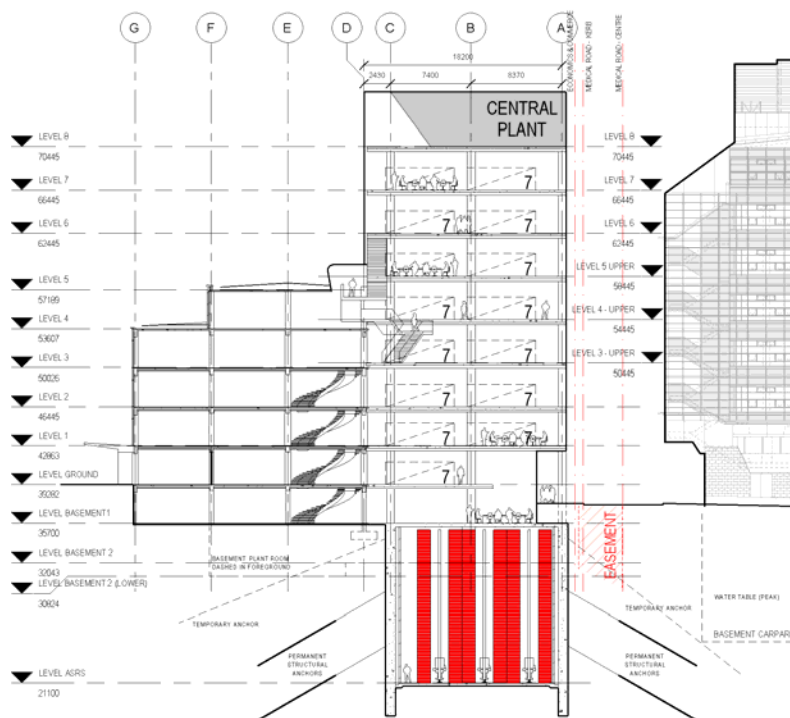


These findings are consistent with decision making at other universities where ASRS have been built. The first library in Australia to install an ASRS is Macquarie University in Sydney’s North West. Macquarie recognised that the ASRS would give additional flexibility to create more students learning spaces and to build an environmentally sustainable library and would give them green star credit points. The ASRS would reduce the building footprint by 38% and would result in savings of embodied energy of 211.717 gigajoules and annual savings of greenhouse emissions of 817 tons per year.

²² “University of Melbourne Parkville Master Plan.” University of Melbourne, accessed June 8, 2011 at http://www.pb.unimelb.edu.au/project/documents/2008_Masterplan_Final_WEB.pdf 64

The Halle Library at the Eastern Michigan University was influenced in favour of an ASRS solution by space and cost considerations, finding that the cost “including programming of hardware and software was US\$1.6 million. We estimated that the cost to put in enough floor space to house an equal number of books would be US\$4 million. “²³. The authors also noted that an ASRS would enable the Library to create space for other activities such as training rooms, computer labs, and student seating rather than collections. The National Library of Norway also decided to install an ASRS as it would only require 20- 25% of the base area that is used for normal open access storage. In fact the increased storage capacity enabled 50% more material than was originally estimated to be stored in it, making it even more cost effective.²⁴

There are clearly both financial and a sustainability argument in favour of an ASRS and this has been incorporated into a basement vault as shown in the following plan view.



²³ Linda Shirato, Sarah Cogan, Sandra Yee. "The impact of an automated storage and retrieval system on public services." *Reference Services Review* 29, no. 3 (2001): 253–261. A similar finding was also reported at the Lied Library at University of Nevada at Las Vegas. See Haslam, Michaelyn, Myoung-ja Lee Kwon, Michael Pearson Marilyn, Maria White. "The automated storage and retrieval system (ASRS) in Lied Library." *Library Hi Tech* 20, no. 1 (2002): 71-89.

²⁴ Kari Mathisen. "From traditional stacks to an automated storage and retrieval system." *Library Management* 26, no. 1/2 (2005): 97-101.

Green Star Certification

The Green Star rating system is a national system established by the Green Building Council of Australia, providing rating tools in different categories to evaluate the design, construction and ongoing maintenance of buildings.²⁵ The University has been a leader in pursuing Green Star certification within Australian higher education, and The Spot building shown at right, designed for the Faculty of Business & Economics was the first in Australia to win a 5 Green star pilot rating in the Education category. The new Brain Institute for Neurosciences is being commissioned this year has also achieved a 5 Green star design rating which is all the more commendable since it incorporates laboratories and an animal house.²⁶



All new buildings at the University of Melbourne are required to meet a minimum 5 Green Star rating, equivalent to Australian Excellence. However if it proceeds as planned, the Baillieu and Research & Cultural Library project will be built in stages with delivery of the whole project occurring over many years. To allow for the development of new technologies and sustainability initiatives in the intervening years, the project team decided to aim for an aspirational 6 Green star rating, equivalent to world leadership. Energy ratings have been calculated for both 5 Green star and 6 Green star ratings.

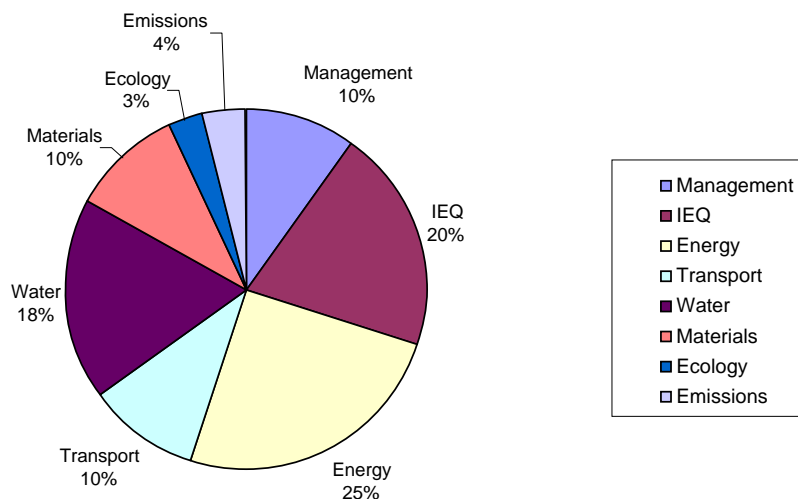
As an academic library, this project will be assessed using the Education rating tool. The environmental impact of the project including aspects of its site, design, construction and maintenance are measured according to eight categories – Management, Indoor Environment Quality (IEQ), energy, transport, water, materials, land use and ecology, emissions and innovation. Throughout, the architects have ensured that the project is informed by sound design principles as well as appropriate engineering considerations. Each of these categories will be examined separately.

Each category is allocated points that are weighted according to their impact in improving the environmental performance of the building adding up to a weighted score of 100 points in total. Figure 1 indicates the relative importance attached to each category. It is clear that the categories related to energy, IEQ and water are weighted most heavily, warranting serious attention to these areas in the design.

²⁵ Green Building Council of Australia. Accessed June 8, 2011 at <http://www.gbca.org.au/>

²⁶ University of Melbourne. "The Melbourne Brain Centre" *Sustainability Update* (Winter edition, 2011) http://sustainablecampus.unimelb.edu.au/resources/sustainability_updates/Winter%20Edition%202011%20June.pdf

Green star categories and weightings



The following analysis gives an indication of the projected performance of this Library project in each category. However, it must be remembered that this is only a preliminary Green star analysis, designed only to demonstrate a possible pathway to certification.

Management

To score points in this category, the design team must include a green star accredited professional. Lyons Architects have staff with this expertise and have engaged engineering consultants, AECOM who have green credentials to work with them to design electrical, mechanical and hydraulic services for the building. This category also covers the commissioning and ongoing environmental management of the building including educating users in the appropriate use of the building and creating systems and documentation for maintenance. This project also plans to recycle 80% of demolition and construction waste.

Indoor Environment Quality

The environment within the building must be fit for purpose and must suit the needs of users. This category of the Green Star guide examines issues such as air quality, acoustics, thermal comfort and other issues that are relevant to occupant comfort and safety.

According to the engineering consultants to this project, the air quality within buildings typically contains five times more pollutants than the outside air, so improvement of air quality is important for occupant comfort.²⁷ Although natural ventilation is not currently planned for this project, the engineers have calculated for a 100% improvement in ventilation rates based upon the current Australian standard.

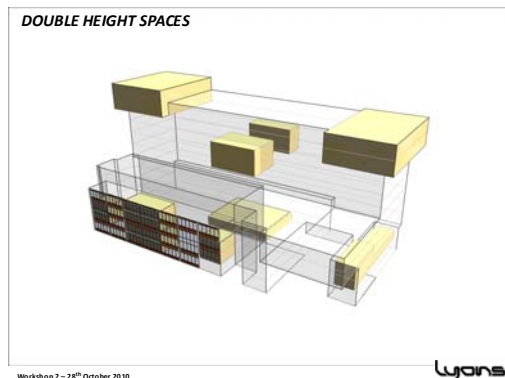
²⁷ Anne Hellstedt. "Baillieu Library sustainability workshop." (Presentation delivered to University of Melbourne, 4 March, 2011.)

Acoustic control is essential for a library building and achievement of this objective will be achieved through judicious use of selected materials such as carpets and ceiling treatments as well as through management of high traffic zones. Placement of shelving will also be used to buffer noise. For example, dense shelving has been placed on the first floor in the area surrounding the open void to the Ground floor. This has created a quiet zone on the first floor that will minimise noise being carried down to the foyer area on the Ground floor through the open void.

Throughout the project, attention has been paid to the provision of adequate levels of lighting including the provision of low energy and sensor controlled lighting. In particular, every effort has been made to maximise the natural daylight available to students by placing seating around the window areas and increasing the penetration of daylight. As shown in the image to the right, the original 1959 building used double height ceiling



spaces to maximise the penetration of natural daylight deep into the Library and to provide a spacious and open ambience. The architects for the new building works have retained the existing



double height spaces and have designed new ones in the new building. This passive design element forms one of the design links with the 1959 building and the new building space, but it also has an environmental benefit.

All paints, sealants, furnishings and flooring used in the development will have low levels of volatile organic compounds (VOCs) to ensure that they do not contribute to internal pollution. This has already commenced in the Stage One refurbishment with the

selection of low VOC products. For example, marmoleum has been selected as the primary floor covering since it replicates the feel of the original 1959 linoleum yet is an environmentally stable, eco-friendly product.

Energy

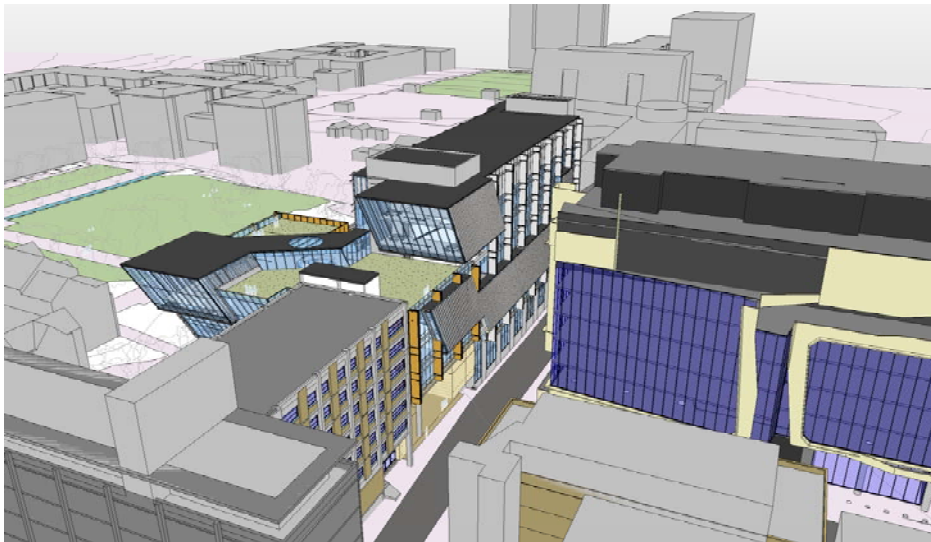
The use of low energy and sensor electric lighting throughout the project has clear benefits for the minimisation of energy consumed in lighting. However the situation with regard to the use of natural daylight is not so clear cut. The Library site faces east and west, and the large expanses of glass that provide both natural daylight and wonderful views across the lawns pose a problem for thermal control and glare. Various measures have been proposed to improve thermal control.

External treatment of the 1959 façade is not an option since the façade has been described as of social and cultural significance in the heritage report.²⁸ For this reason, automated internal blinds have been installed in the original section of the Library. For the new building, the innovative solution proposed by Lyons Architects uses automated external shutters made of perforated metal. These will provide up to 75% shading over the windows when the full impact of the sun is present, and fold up completely for the remainder of the day when they are not required. The shutters will be linked to the Building Management System (BMS), and will respond to numerous inputs including wind sensors, external light sensors and internal mechanical systems.

Another passive design element is evident in the way in which the northern end of the new Library is raked to an angle calculated to maximise the northern winter sun in the outdoor cafe area under the Library whilst providing shade from the summer sun. The design also incorporates a roof garden accessible from the exhibition space and the staff area. This will improve the amenity of the building and improve the thermal control of the building.

Perspective

Aerial – North West



Lyons

As well as architectural controls, the project will also incorporate engineering controls to reduce the energy demands of the Library.

A trigeneration power plant that will be large enough to supply the heating and cooling needs of 18 buildings in the precinct is planned. The Baillieu Library currently houses plant that supplies most of the heating and cooling for five neighbouring buildings, but the new project will significantly increase the scale and sophistication of this plant.

²⁸ Lovell Chen Architects and Heritage Consultants. "Baillieu Library, University of Melbourne: Conservation Analysis." (Unpublished paper presented at the University of Melbourne, May 2010.)

Trigeneration plants generate electricity on site using natural gas fuelled generators. The waste heat created by the burning the gas is then captured for use in hot water and heating, or into absorption chillers for efficient cooling. There are several environmental gains in this process.

Generating power from natural gas is preferable to using the coal-fired mains power that is commonly supplied in the state of Victoria. According to the engineers for the project, AECOM, the greenhouse gas emissions ‘associated with the consumption of one gigajoule of energy produced by natural gas is approximately seven times less than that of mains power’ that is predominantly coal-fired.²⁹ Trigeneration would also reduce peak demand on the power grid.

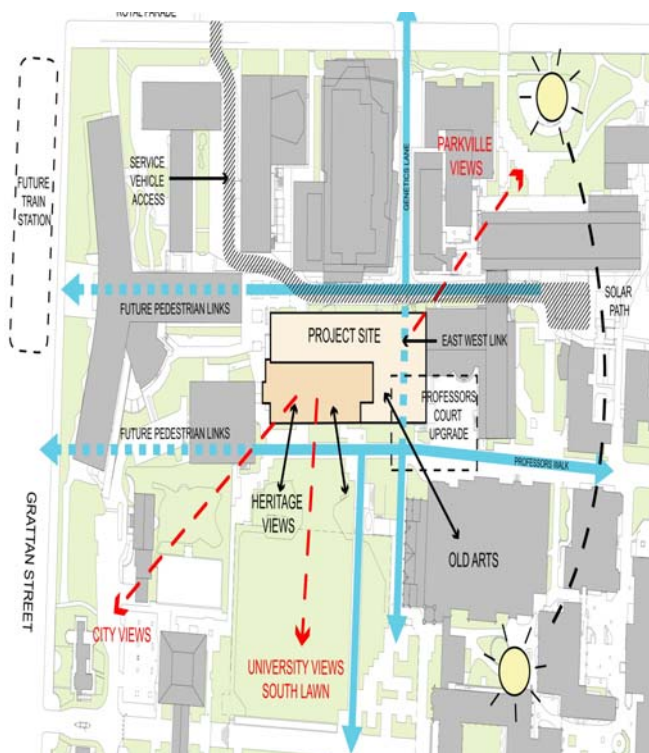
Trigeneration will be supplemented by the use of solar photovoltaic panels on the roof of the new building.

Transport

In this category to earn Green star points, access to mass transport options is advantageous. The University is fortunate to be situated close to the urban centre in Melbourne and is well served by a number of public



transport routes. As part of the urban planning for this development, pedestrian access from public transport to the Library will be improved by the provision of a new pedestrian walk from the entrance to the street.



Bicycle use will also be encouraged since the building design allows for secure storage of bicycles for up to 10% of the staff who will work within the building. Showers will be provided for the benefit of staff who cycle to work. There is also already provision for additional storage of bicycles in the immediate vicinity of the building. No car parking will be provided within this development

²⁹ AECOM. “The University of Melbourne, Baillieu Library: ESD Workshop outcomes and path forward.” (Unpublished paper presented at the University of Melbourne 30 March, 2011.)

Water

Australia is predominantly a dry country and is particularly vulnerable to drought. It has been estimated that buildings are responsible for using 12 % of the world's water. In Australia the figure is slightly accounting for 15% of total water use, so managing water use in buildings is an extremely important environmental issue.³⁰ Further, the Baillieu Library is one of the heaviest users of water on the campus due to the large numbers of people using the building. The project will of course use efficient taps and amenities. There is an increasing focus on reducing the use of drinking quality water for building systems such as toilets, irrigation systems and cooling towers. In this development, the engineers propose to use rainwater harvested from the Library and surrounding buildings for these purposes, as well as grey water. A black water treatment plant that would treat sewerage for building systems is also under consideration if a six Green star rating is pursued.

Materials

As noted earlier in this paper, retention and re-use of one third of the original building contributes to reduction in embodied energy in materials and also reduces waste and disposal. The production of construction materials such as concrete and steel is energy intensive and the engineers propose to use forms of these materials that minimise the embodied energy used in production. High strength steel to reduce the volume of steel required in the building. Steel and PVC will be sourced from a best practice supplier. Materials specified for joinery, flooring and furniture will also be of low environmental impact and timber used in the project will be from a sustainable or recycled source. Receptacles for storing recyclable materials will be provided.

Land Use & Ecology

This category relates to land use and is of significance if there is a change of land use or ecological impact. This does not apply in this case as land usage is not significantly changed by this development.

Emissions

This category refers to the outputs from the building. The engineers will specify systems that do not contain ozone depleting refrigerants or thermal insulants. Less water will be used in the building leading to a lower flow to the sewerage system. Watercourse pollution will be minimised.

The realisation of this project would greatly improve services and facilities provided by the Library to the University community. In developing the concept plans, the architects have been particularly responsive to the needs of the Library to ensure that the building meets the requirements of Library staff as well as shared learning spaces. They have also been mindful of the need for environmental sustainability from the very start of the project. This will ensure that green initiatives will be fully integrated in this remarkable Library building.

³⁰ Anne Hellstedt. "Baillieu Library sustainability workshop." (Presentation delivered to University of Melbourne, 4 March, 2011.)

CONCLUSION

The convergence of University policy regarding sustainability and scholarly information has been particularly beneficial in stimulating a Library redevelopment program that has become increasingly focussed on the achievement of environmental targets. Building a 'storehouse of wisdom' with an environmental conscience is indeed still a work in progress, but there is no doubt that great progress has already been made, and more exciting developments are in store if the Research & Cultural Library proceeds as planned.

The pursuit of sustainability targets in redevelopments at the University of Melbourne Library is undoubtedly good for the planet, but it is clear that this is not the only benefit to be derived from the implementation of building green infrastructure. After initial investment, most sustainability initiatives are also beneficial for the financial sustainability of the Library in managing the ongoing costs associated with maintaining and operating Library buildings and services. Further, the opportunity to redevelop these spaces has permitted consolidation of library spaces and re-thinking of service delivery models that are both cost-effective and more attuned to modern University needs. The Library looks forward to participating in the achievement of even greater sustainability targets for the University in the years to come.

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