



CRC Construction Innovation
B U I L D I N G O U R F U T U R E

E-Business Adoption: Case Study Melbourne City Council

Research Report 2003-003-A-03

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Research Program: A
Business and Industry Development
Research Project No.: 2003-003-A-03
Project Name: E-Business Adoption
Date: 07/06

[inside cover]

Distribution List

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1. INTRODUCTION

The research project is an academic and industry collaboration combining the following partners: Queensland Government Department of Public Works, Queensland Government Department of Main Roads, Building Commission Victoria, Melbourne City Council, John Holland Group, University of Newcastle and RMIT University. The entire study involves 6 case studies including.

- Building Commission: RMIT
- Queensland Department of Main Roads: RMIT
- Iconic Project Melbourne City Council: RMIT
- Queensland Department of Public Works: UN
- John Holland Group: UN
- Brisbane City Council: UN

There are individual reports completed for each case study. Both RMIT and the University of Newcastle have previously presented literature review and framework reports. This is the last Case Study report for the CRC-CI E-business Adoption. It describes the reporting of the work carried out on an E-business application for green building design by Melbourne City Council. It involves interviews to assess the usefulness of web sites and portals during three building stages including (1) building design, (2) building construction and (3) building occupation. Results are presented in tables indicating attributes.

1.1 E-Business Tools in Green Building Design

As the Melbourne City Council (MCC) presently have been involved in the planning and operations of over 250 buildings, this report uses the new Council House 2 Building (known as CH2) as the main case study to gain further understanding of how the uptake and innovation of E-business can be used in encouraging sustainable development in Design, Construction, Commissioning and Facilities Management. In comparing the original Council House Building to the new Council House 2 Building, design strategies aimed to achieve an 80% reduction in energy use and a 70% reduction in water use. MCC has established an internal (intranet) website to describe innovation strategies to its own employees while also using their public website to make ongoing research reports more easily accessible - including CH2 AusIndustry's research findings with white papers and industry reports (Morison, et al., 2005).

Results of this case study show that since the Council House 2 building project began, the Internet, web portals, online databases, and tools have become influential and will continue to play an important role in achieving implementation of sustainable design throughout the building and construction industry. Although the CH2 project is reaching completion of its initial design and construction phase, the project's underpinning environmental values are expected to continue over the life cycle of the building. In addition to addressing the uptake of e-business through the design and early construction phases, this study will also address how web portals and other online tools can be used and developed for construction management procedures, commissioning purposes and facilities maintenance operations in the rapidly increasing area of corporate environmental responsibility.

1.2 Melbourne City Council and CH2

The City of Melbourne's commitment to using the 'Triple Bottom Line' concept as a means of providing sustainable development for a clean, lively, vibrant and liveable city is evident in their many initiatives related to social, environmental and economic responsibility. Most recently, the Melbourne City Council has proven its commitment through initiatives such as reducing the city corporation's energy consumption by 30% from 1996 levels by 2010 and also setting targets of 50% renewable energy demand by 2010 in undertaking the new Council House 2 as a major project – with the City of Melbourne as the client organisation.

The Council House 2 (CH2) is a new office building for the MCC's own staff that has attempted to incorporate sustainable technologies and environmental design principles into every conceivable part of its ten storeys. The particular agenda driving the Council House 2 Building project was to set a new standard for how green buildings can deliver financial, social, and environmental rewards. Using the Green Star rating tool, CH2 was awarded a six Green Star certified rating, meaning "world leader" status from the Green Building Council of Australia. The Green Star Rating System - where the minimum rating is one star and maximum is six - is an evaluation system benchmarking environmental design and performance based on criteria related to energy and water use, indoor air quality, and resource conservation, among others. This building and the Melbourne City Council have created a technology test-bed that can provide much room for innovation and research.

1.3 CH2 Project Team

The CH2 building was designed by a multi-disciplinary team lead by the City of Melbourne's principal design architect Mick Pearce and local architectural firm DesignInc Melbourne. Construction of CH2 commenced in 2005.

- | | |
|----------------------------------|---|
| • City of Melbourne | Design, Project and Facilities Management |
| • DesignInc | Architectural Design and Documentation |
| • Lincolne Scott | Services Engineering |
| • AEC | Advanced Environmental Concepts |
| • The Bonacci Group | Structural and Civil Engineering |
| • Marshall Day | Acoustics |
| • Donald Cant Watts Corke | Quantity Surveying |
| • Hansen Yuncken | Builders |

1.4 Is CH2 a test bed for innovation?

What is the current green agenda? How did it develop? What is leading-edge and state of the art? What current online tools are preferred in industry? What does this mean for the uptake of innovation? These were some of the major questions asked in this case study in terms of using the Internet, web portals, databases, and online tools as major resources to developing sustainable design practices in the green building industry. Additional questioning and brainstorming was filtered into the following so-called "mind map" (see Figure 1).

As will be discussed in this report, comprehensive and appropriate sustainability information related to the building and construction industry has not yet been fully diffused/dispersed

across the industry. The broad scope of this project considers the world-wide potential for developing new sustainable products, tools, technologies and joint ventures to show what is in fact possible. More specifically, this report aims to show how online tools, portals, resource databases for decision-making, payments, communication, presentation, reporting, and analysis are becoming increasingly available for design, construction, commissioning and on-going facilities management of a green building. CH2 has proven to be a driver for innovation and a test bed for use/application/and piloting new online business tools with contribution to the wider building industry including the Design, Construction, and Facilities Management Sectors.

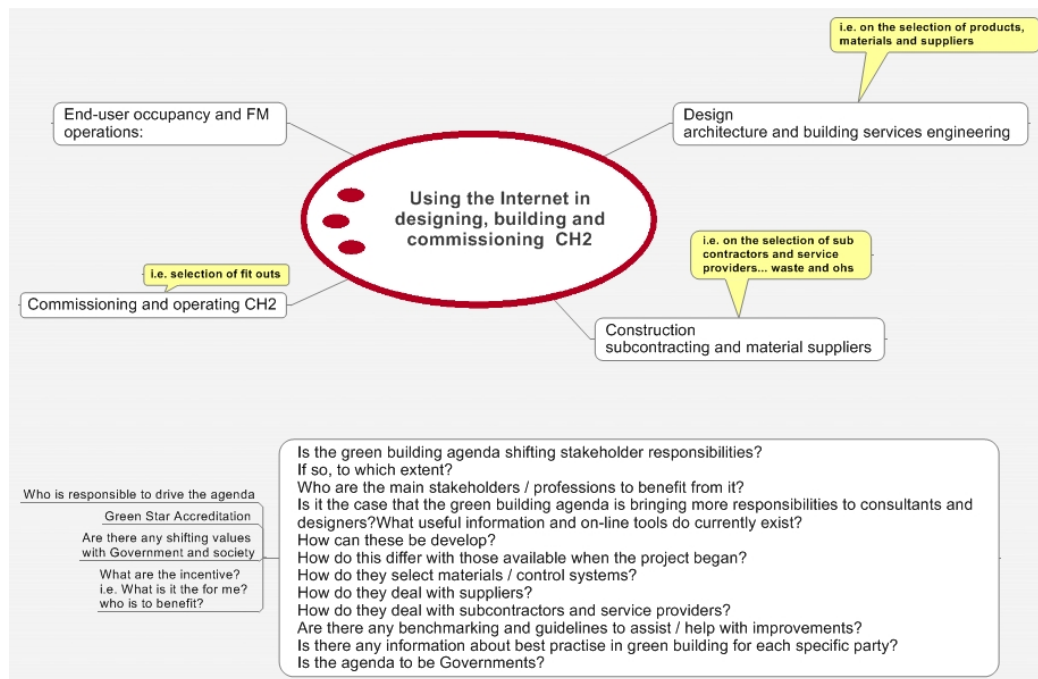


Figure 1 Interview agenda - discussion prompts

2. GREEN BUILDING WEB APPLICATIONS

What current online tools such as Internet portals to facilitate designer's decision-making are preferred in industry?

In aiming for a six Green Star pilot project, and becoming the first office building project in Australia to achieve such a rating, as stated previously, the CH2 building has become a technology test-bed and provides opportunity for innovation and research. For example, DesignInc, The Centre for Design at RMIT University, EcoRecycle Victoria and the Society for Responsible Design - in combination with the developments of the Australian Environmental Labelling Association Inc. in setting up the Good Environmental Choice Label - have helped standardize and identify environmental products and environmentally-preferred materials for design and construction through internet portals such as EcoSpecifier. The Melbourne City Council and other project players have taken up the enormous research task of sourcing and providing a decision-making tool for hundreds of products that have had to meet increasingly stringent standards in order to possibly be 'given the go-ahead' for the high-profile CH2 project.

The following table represents the set of tools used throughout the project. Web portal development took place during the course of CH2. These online business tools are organized into the following categories: design, construction, and facilities management.

Table 1 Online Tool Attributes

Attributes Table	Logometrix	Ecospecifier	Aconex
Design		✓	
Construction			✓
Facilities Management	✓		

This section discusses Internet portals as a decision mechanism for the selection of products, materials, construction suppliers and service providers. In the case of CH2, a great deal of the process was completed through research involving internet web searches. A six star rating was achieved when the design team only aimed for a five star certification, and it is believed this was partially due to the principal consultants attending an initial two-week workshop, followed by weekly design meetings that ran for eight months, to ensure a truly collaborative effort and integrated design approach.

2.1 Design Project Stage: EcoSpecifier [www.ecospecifier.org]

Before 1999, very few *Internet portals and search engine* tools were available to aid design teams in their research into green materials. EcoSpecifier was in its earliest days of development and had only 80 products listed, and there were no other local resources available. At the beginning of the CH2 design process, it was claimed that no internationally successful program for labelling sustainable construction material had yet been achieved, despite several attempts. This led to intensive research and the development of a tool called EcoSpecifier which has increased its database from 80 environmentally certified products to over 1000. DesignInc undertook the enormous research task of vetting all potential products and materials that might be used on the project. EcoSpecifier then became a joint initiative of the Centre for Design at RMIT University, EcoRecycle Victoria and the Society for Responsible Design.

A rolling research and development program was designed, commencing in 2000. The key elements of this program were to:

- i. establish a methodology for side-by-side comparison of products through the environmental performance questionnaire (EPQ), discussed below;
- ii. establish a peer-review process to ensure transparency and accountability, and limit liability, through the involvement of the Commonwealth Scientific and Industrial Research Organisation (CSIRO);
- iii. shortlist potential products and issue a questionnaire as a condition of consideration to suppliers for completion. There would be ongoing issues of the EPQ to other suppliers throughout the project as relevant;
- iv. establish in-house systems that would enable effective storage, referencing and use of data through easy access and inter-personal communication; and
- v. integrate data into effective decision-making in the project in a timely manner through coordination and project reviews.

DesignInc used a slightly modified Environment Australia 'environmental performance data sheet' (EPDS) as their environmental performance questionnaire (EPQ) to generate standardised responses from suppliers. (Morison, et al., 2005 pp.16-18).

By 2004, the EcoSpecifier website had received over 100,000 visits and feedback from industry has shown that the site is the industry's leading resource on environmentally preferable materials. Currently, a commercial database of over 1000 building products exists that has been independently vetted against sustainability criteria, and provides guidance on the environmental impact of commonly available building products.



Figure 2 Ecospecifier

- online guide
- Used to source and increase use of environmentally preferred materials in the construction sector
- Helps architects, designers, builders, specifiers and consumers shortcut the materials sourcing process to find products that reduce environmental impacts and create healthier and more productive living and working environments.
- The most comprehensive list of environmentally preferred commercially available in Australia.
- Used to select materials with least environmental cost
- Used to gain an understanding of the principles of selection in order to identify, research, and develop alternative materials.

The site's ongoing development has seen major upgrades including powerful new functionality in the site's search engine, access to full product data, manufacturing details, and case study links for types of facilities. This includes education, commercial, health and aged care, industrial, laboratory, residential, and retail facilities.

2.2 Construction Stage: Aconex collaboration with Subcontractors and Material Suppliers [www.aconex.com]

This phase of the project involves the selection of subcontractors and service providers. Issues that usually arise during this phase involve collaboration with suppliers and subcontractors and good document management practices become paramount. Project members decided to use a web-based platform for collaboration throughout the design and construction process. Aconex was used as the preferred document management provider. The main reason was because it is an application designed for use across various project phases but also:

- it is an online collaborative information management service that is secure and easy to use
- it provided a collaboration solution for construction and property management stages
- it is web based which allows to receive, transmit and manage construction correspondence, drawings, and other data
- it simplified document control, resources and project management
- it provided an easy way to save time and money on the project.
- technical support and training
- added credibility, as of August 10, 2006: 27,584 companies on 3953 projects, with 21.14 million current documents (excluding distributions) and 16.2 million correspondence items
- Aconex is working with the Facility Management Association to research current and future information management practices in the industry



Figure 3 Aconex introductory webpage

2.3 Facilities Management and Operations Stage

[www.logometrix.net]

An important phase of a project that often does not receive the attention it deserves is the commissioning phase. Personnel from CH2 have been involved in this phase for the past six months and will continue to be involved throughout the occupancy *to engage in through tenancy*. Understanding the initial operating of the building - after the experts who designed and built it are usually off the project and already taking up new projects - can often be the most difficult task. A great deal of learning will have to be undertaken for CH2 as there are many new innovations defining the building physics of this potential high-performance building. Issues discussed here include selection of fitouts, contracting of mechanical/electrical/cleaning, and especially understanding how reused water moves throughout the building in terms of use for the shower towers and cooling the air as a couple of examples.

In CH2, over 2000 sensors are now installed that will tell building operators what is happening. However, it will still be difficult to understand because of its complex arrangement and interface for operations. In fact, the City of Melbourne will be using an external subcontractor in order to address the blackwater treatment. Some topics that facilities management will attempt to take ownership of include the development of energy audit tools; sustainability checklists to improve operations; user lists stating possibly “Five things the individual occupant can do to make the building more sustainable” (which could possibly be produced online as a constant reminder for users – RMIT IT recommendation); comparison of post occupant surveys and operations surveys collected by CSIRO 9 months ago for CH1 to CH2 as an e-business tool; and lastly, but also most importantly, finding a way to get base data in real time.

The web based performance measurement system Logometrix was developed by Hansen Yuncken (contact: Shane Power – 03 9658 8626), and Logometrix is the tool being used for CH2 performance measurement - the Melbourne City Council Facilities Management team has been using this tool for two years.

Logometrix is a collaborative research project into performance measurement of local government facilities. Partners include eight local councils, a software developer and a law firm. The outcome is a software application that can be accessed by local councils using the internet to monitor real-time data and measure the performance of their facilities using a browser interface. They are able to benchmark their performance in facilities management against other participating councils.

Logometrix

The Problem

Councils have a significant investment in the construction and maintenance of facilities. Facilities such as Aged Care, Health Care, Child Care, kindergartens, Sports and Recreation, Arts and Culture all are used to provide services to the community. Irrespective of whether those services are provided directly or by third parties, ultimate responsibility lies with the council.

While traditional asset management systems record the "bricks and mortar" aspect, they are not designed to answer service delivery questions such as:

- Is the facility meeting the expectations of the community
- Is it located in the right area
- Should a facility be built, redeveloped, closed or relocated
- What is the impact of closing a facility and improving another
- How does the performance of our facilities compare with those of other councils
- How do we prioritise capital works expenditure

The Solution

The Logometrix program is an award winning system that is simple to implement and maintain by your non-technical staff. Being a web based application, there is no requirement to install software and upgrades. It is all handled for you.

You determine which facilities and services are included, and who is authorised to do what on the system. The core of Logometrix is a set of predetermined questions, ensuring that a comprehensive survey is conducted within a consistent 'best practice' framework.

"Logometrix is a highly useful tool for measuring the performance of facilities and services"

Garth Brodbery
Manager
Facilities Management
City Of Melbourne

Figure 4 Logometrix

- This tool assesses performance of buildings, and how they meet the requirement of the users and designers
- Management tool
- Allows local councils to evaluate the performance of their community facilities in relation to service delivery.
- The Logometrix software application can be accessed using a web browser interface.

3. SITE AND PORTAL RATINGS

Users: In theory vs. in practice (i.e. what actually happened in the project)

1. Have you used it?
2. What do you think about it?
3. Was it a useful tool?
4. If so, Why?
5. If not, Why not?
6. Awareness of potential benefits?
7. Does it open new communication channels?
8. Is there market incentive for using this tool? (are there financial returns?)
9. Does it make things easier for you?
10. Impediments to using this tool?

Tool Developers: Table (Internet portal description-from site developers)

1. Aims for tool?
 2. What is being promised on website?
 3. What is it meant to do?
 4. The potential benefits and capabilities?
- Users Table

Finding the alignment between users (i.e. design team) and site/portal developers:

1. Discuss lessons learned.
2. Comments for revision and further development.

Table 2 Case Study Participants

	Developers	Users	Potential Additional Participants (Time-Permitting) – maybe outside CH2 Project – Their experiences with these tools vs. other tools
<u>Design EcoSpecifier</u>	www.ecospecifier.org/ RMIT Centre for Design	<ul style="list-style-type: none"> • DesignInc • EcoRecycle Victoria • Society for Responsible Design • AusIndustry Materials Research Paper written by: Andrew Walker Morison, Dominique Hes, Margaret Bates • Natural Integrated Living: David Baggs and Mary-Lou Kelly / Carolyn Hayles 	i.e Green Procurement Products Database http://www.greenprocurement.org/ This database is a free resource of environmentally preferable products in Australia. The green procurement database takes a unique approach by providing meaningful and quantifiable evaluation of each product's environmental performance in addition to providing contact details and technical information about products.
<u>Construction Aconex</u>	http://www.aconex.com/	<ul style="list-style-type: none"> • Garth Bradbury, City of Melbourne FM Manager • Shane Power, Hansen Yuncken • CH2 Construction Manager 	i.e. Aconex vs. Another electronic document management system tool called Citadon (www.citadon.com), an easy to use web-base system that can dramatically improve the efficiency, speed, and accuracy of exchanging and managing information processes to help execute on-time and on-budget projects. - Aconex shows feedback “quotes” on their website about experiences with the tool.
<u>Facilities Management Logometrix</u>	www.logometrix.net Institute of Social Research at Swinburne University (Australia) UNITEC (NZ) A Group of Victorian Local Government Authorities	<ul style="list-style-type: none"> • Garth Bradbury, City of Melbourne FM Manager • Allen McCowan, City of Melbourne, Facilities Management 	i.e. http://www.beims.com/fm_news/news_stories/company_profile_2005.pdf “Australia’s Premier Facilities Management Software System, a consistent winner of many prestigious ‘Awards for Excellence in Victoria’” www.beims.com Aconex will also be working with the Facilities Management Association Press Release: http://www.aconex.com/content/view/282/107/

Table 3 Key to E-Business Tools Attributes

<p>Glossary of Additional Internet Tools, Portals, Databases and Links to Pertinent Organizations and Contributions to Sustainable Development in Building/Construction Industry</p>	<p>Who is it useful to?</p> <p><u>A</u></p> <p><u>B</u></p> <p><u>D</u></p> <p><u>C</u></p> <p><u>FM</u></p> <p><u>U</u></p>	<p>Scale: 1 to 5:</p> <p>✓✓✓✓✓</p> <p>Low -> High</p>	<p>Short description</p>
--	--	--	--------------------------

Who is it useful to?

- A Relevant to All
- B Useful as Background Information
- D Relevant to Designers
- C Relevant to Construction
- FM Relevant to Facilities Management
- U Relevant to everyday User

Rating of how useful for daily project use

Scale: 1 to 5:
 ✓✓✓✓✓ Low -> High

Table 4 International Portals

Rating of how useful for project application: Scale: 1 to 5: ✓✓✓✓✓ Low -> High

GLOBAL ENTITIES			
<p>Global Reporting Initiative (GRI) http://www.globalreporting.org/</p> <p>A Common Framework for Sustainability Reporting The Amsterdam Conference on Sustainability and Transparency October 4-6 2006</p> <p>Keynote Speakers: http://www.grig3.org/speakers.html</p> <p><i>“This report has been prepared in accordance with the 2002 GRI Guidelines. It represents a balanced and reasonable presentation of our organization's economic, environmental, and social performance.”</i></p>	<p><u>A</u> [relevant to all]</p>	<p>✓✓✓</p>	<p>Disseminates globally applicable Sustainability Reporting Guidelines. The Guidelines are for voluntary use to report the economic, environmental, and social dimensions of an organisation's activities, products, and services. A database of the organizations using the guidelines exists, containing only those reports that both reference the use of the GRI Guidelines, and that have registered with the secretariat for inclusion on the list. GRI collaborates with the United Nations Environment Programme (UNEP).</p>
<p>United Nations Environment Programme (UNEP) Sustainable Building and Construction Initiative http://www.unep.fr/pc/pc/SBCI/SBCI_2006_InformationNote.pdf</p> <p>Sustainable Building and Construction Forum http://www.unep.or.jp/ietc/sbc/Resource_Link.asp</p>	<p><u>A</u></p>	<p>✓✓✓✓✓</p>	<p>In partnership with international leading companies, UNEP initiated the Sustainable Building and Construction Initiative (SBCI) to promote and support sustainable solutions in the building and construction sector. Paris, 21 February 2006 – Construction giants Lafarge, Skanska and Arcelor are among the founding members of the Sustainable Building and Construction Initiative (SBCI), which aims to promote environmental friendly practices across this vast industry.</p>
<p>International Initiative for a Sustainable Built Environment (iiSBE) http://greenbuilding.ca/</p>	<p><u>A</u></p>	<p>✓✓✓✓</p>	<p>Provides Documentation and Announcements on Green Building Challenge/Sustainable Building previous conferences including SB05 and SB08. Also provides the Sustainable Building Information</p>

GLOBAL ENTITIES			
			System –The SBIS database is designed to provide users with non-commercial and objective information about sustainable building practices around the world. http://www.sbis.info/index.jsp
Energy Conservation in Buildings and Community Systems http://www.ecbcs.org/contacts.htm	<u>D</u> [relevant to design team]	✓✓✓✓✓	All contact info provided for representative in each country. The function of ECBCS is to undertake research and provide an international focus for building energy efficiency. Tasks are undertaken through a series of annexes that are directed at energy saving technologies and activities that support their application in practice. Results are also used in the formulation of international and national energy conservation policies and standards.
International Council for Research and Innovation in Building and Construction (CIB) http://www.cibworld.nl/website/	<u>C</u> [relevant to construction]	✓✓✓	Sustainable Construction has been a CIB Priority Theme since 1995. Amongst others this has resulted in two worldwide agenda setting publications: the CIB "Agenda 21 on Sustainable Construction" and the joint CIB-UNEP "Agenda on Sustainable Construction in developing countries". Both publications and executive summaries can be downloaded for free [accessed on July 2006]. Provides a global network for international exchange and cooperation in research and innovation in building and construction, in support of an improved building process and of improved performance of the built environment. There are 17 existing CIB endorsed student chapters as of December, 2004.

GLOBAL ENTITIES			
International Energy Agency (IEA) http://www.iea.org	<u>B</u> [good as background information]	✓✓✓	An intergovernmental body committed to advancing security of energy supply, economic growth and environmental sustainability through energy policy co-operation.
Intergovernmental Panel on Climate Change (IPCC) http://www.ipcc.ch/	<u>B</u>	✓✓	The Intergovernmental Panel on Climate Change (IPCC) has been established by WMO and UNEP to assess scientific, technical and socio- economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation.
<p>1983-1987 1972 World Summit on Human Development (Stockholm, Sweden). http://www.ipcc.ch/ “Our Common Future” – 1987 Commission Report (Norway) convened by UN General Assembly in response to 1983 Resolution – “Process of preparation of the Environmental Perspective to the Year 2000 and Beyond” “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” http://www.are.admin.ch/are/en/nachhaltig/international_uno/unterseite02330/</p> <p>1992 World Summit on Environment and Human Development (Rio De Janeiro, Brazil) http://www.un.org/geninfo/bp/enviro.html</p> <p>1997 Earth Summit +5 & Agenda 21 - Special Session of UN General Assembly (New York, USA) http://www.un.org/esa/earthsummit/</p> <p>2002 World Summit on Sustainable Development (Johannesburg, South Africa). www.johannesburgsummit.org/</p>	<u>B</u>	✓✓✓✓✓	A Brief History on the Largest International Forums/Meetings related to outcomes and developments of the concept of Sustainable Development.

GLOBAL ENTITIES			
2005	<p>The World Sustainable Building Conference SB05- Sustainable Building 2005. Hosted in Tokyo, Japan; the first city in the world to reach a population of 10 million. www.sb05.com/</p> <p>2008 The World Sustainable Building Conference SB08. This conference is now held every three years and will be held in Melbourne in late 2008.</p>		

Rating of how useful for project application: Scale: 1 to 5: ✓✓✓✓✓ Low -> High

Table 5 Australian Sites and Portals

Australia			
Green Building Council of Australia (GBCA) and GreenStar Rating Tools http://www.gbcaus.org/	<u>A</u> [relevant to all]	✓✓✓✓✓	Developed by the GBCA, Green Star is a voluntary rating system which evaluates the environmental performance of various types of buildings. Evaluation is based on a range of criteria.
Australian Government Department of the Environment and Heritage Sustainable Construction http://www.deh.gov.au/settlements/industry/construction/	<u>C</u> [relevant to construction]	✓✓✓✓	The Department's work with the building and construction industry employs three essential instruments; providing information; providing education and training; and providing tools. Developing a sound mix of these instruments is a goal of the Department as it endeavors to work in partnership with the industry to achieve sustainable development.

<p>Australian Building Greenhouse Rating (ABGR) Scheme http://www.abgr.com.au</p>	<p><u>D</u> [relevant to design team]</p>	<p>✓✓✓✓</p>	<p>Administered by the NSW Department of Energy, Utilities and Sustainability, ABGR rates office buildings for their energy efficiency and provides accredited assessments of the greenhouse intensity of the buildings by awarding a star rating on a scale of one to five</p>
<p>Building Sustainability Index (BASIX) NSW Planning System www.basix.nsw.gov.au/</p>	<p><u>D</u></p>	<p>✓✓✓</p>	<p>NSW planning system, BASIX (the Building Sustainability Index), is a web-based planning/assessment tool that measures the potential performance of new residential dwellings against sustainability indices.</p>
<p>National Australian Built Environment Rating System (NABERS) http://www.nabers.com.au</p>	<p><u>D</u></p>	<p>✓✓✓✓</p>	<p>NABERS is a performance-based rating system that measures an existing building's overall environmental performance during operation using a set of key impact categories/series of headings with "scores" of one to five stars under each heading.</p>
<p>2006 Building Code of Australia http://www.greenhouse.gov.au/buildings/code.html</p>	<p><u>A</u> [relevant to all]</p>	<p>✓✓✓✓✓</p>	<p>A new comprehensive strategy being undertaken by the Australian, State and Territory Governments to reduce greenhouse gas emissions through the use of minimum energy standards and requirements.</p>
<p>Nationwide House Energy Rating Software/Scheme (NatHERS) www.housenergyrating.com/domestic.htm</p>	<p><u>D</u></p>	<p>✓✓✓</p>	

AccuRate http://www.hearne.com.au/products/accurate	<u>D</u>	✓✓✓✓✓	AccuRate (by CSIRO) enables you to comply with the energy efficient residential building design rules in the new 2006 Building Code of Australia. AccuRate is the long awaited update for NatHERS and is the standard against which all new Australian residential building energy simulators are judged and verified.
Detailed Product Information http://www.selector.com	<u>D</u>	✓	
Greening the Building Life Cycle http://buildlca.rmit.edu.au/ See Links	<u>A</u> [relevant to all]	✓✓✓✓✓	Life cycle assessment tools in building and construction
Environment Design Guide http://www.architecture.com.au/i-cms?page=1.21.60	<u>D</u>	✓✓✓✓	An environmental performance guideline/checklist. The award winning <i>BDP Environment Design Guide</i> is the most comprehensive single source of information on environmental design issues specifically tailored to the needs of Australia's planning and building design professionals. A product of the Australian Council of Building Design Professions, it provides reliable, timely and accessible information, all written with the design practitioner in mind.
Energy Efficient Appliance Decision-Making Tool http://www.energyrating.gov.au	<u>U</u> [the everyday user]	✓✓✓✓✓	Australia's guide to choosing an energy efficient appliance.
Ecospecifier www.ecospecifier.org/	<u>D and C</u>	✓✓✓✓✓	Sourcing environmentally preferable materials - includes recycled materials.

<p>Australian Labelling Association (AELA) Inc. and Good Environmental Choice Australia (GECA) Label www.aela.org.au</p>	<p><u>D and C</u></p>	<p>✓✓✓✓✓</p>	<p>“[products] that have been certified for their environmental merit by a third party recognised by the Green Building Council of Australia, such as the Australian Environmental Labelling Association Inc., which awards the ‘Good Environmental Choice Label’.”</p>
<p>Green Procurement Products Database http://www.greenprocurement.org</p>	<p><u>D and C</u></p>	<p>✓✓✓✓</p>	<p>This database is a free resource of environmentally preferable products in Australia. The green procurement database provides meaningful and quantifiable evaluation of each product's environmental performance in addition to providing contact details and technical information about products.</p>
<p>‘Your Building’ Portal and Construction 2020 Document http://www.construction-innovation.info/ http://www.construction2020.construction-innovation.info/</p>	<p><u>C</u> <u>[relevant to construction]</u></p>	<p>✓✓</p>	<p>Currently being developed- potential for ✓✓✓✓✓ Construction 2020 is a report on “A Vision for Australia’s Property and Construction Industry”</p>

<p>LCAid – Life Cycle Assessment Tool</p>	<p><u>A</u> [relevant to all]</p>	<p>✓✓✓</p>	<p>Embodied Energy/Emissions Estimation Tool; links to CAD system. The Australians have developed LCAid, a promising life-cycle assessment (LCA) tool for building designers. LCA assesses the environmental impacts over the entire life cycle of a product or building, including all inputs of raw materials, energy and water, and all outputs, such as waste and emissions to air, water and land. LCAid assists environmental decision making in the initial phase of building design and provides a benchmark of building performance. With LCAid, users can quickly provide input to the design process during design, and the program allows for a fast assessment of the generated design solutions. LCAid can be linked to CAD files; can read model files from the extensive The program reports results in two ways: it compares the proposed design to a benchmark building, and it presents the environmental impacts of the design, thus identifying the life-cycle stages that make the greatest contribution to a building's overall environmental impacts. carlie.eldridge@dpws.nsw.gov.au.</p>
<p>Energy and Greenhouse Management Toolkit – Sustainability Victoria www.sustainable-energy.vic.gov.au/advice/business/EGMToolkit.asp</p>	<p><u>A</u></p>	<p>✓✓✓</p>	<p>Toolkit web database</p>

<p>Online examples of business tools recommended by the NSW Government include the:</p> <ul style="list-style-type: none"> • Commerce eTendering Website https://tenders.nsw.gov.au/commerce/index.cfm • Smartbuy NSW Government e-marketplace Website http://www.smartbuy.nsw.gov.au • and the Asset Client Tools Website http://www.asset.gov.com.au <p>Online example of Sustainability Online Software and Data Management Tools: http://www.systar.com.au/products.html with Live Demos</p>	<p><u>A</u></p>	<p>✓✓✓✓</p>	
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Rating of how useful for project application: Scale: 1 to 5: ✓✓✓✓✓ Low -> High

Table 6 US Sites and Portals

United States			
<p>US Green Building Council (USGBC) and LEED Rating Tools www.usgbc.org</p>	<p><u>A</u> [relevant to all]</p>	<p>✓✓✓✓✓</p>	<p>Throughout its 13-year history, USGBC has been at the forefront of green building - introducing the LEED Green Building Rating System in 2000 and launching Greenbuild in 2002. Their <i>Sustainable Building Technical Manual</i> offers step-by-step guidelines for energy- and resource-efficient building during predesign, design, construction, operations, and management.</p>

The Whole Building Design Guide http://www.wbdg.org/productguide/	<u>D</u> [relevant to design team]	✓✓✓✓	ProductGuide is the first and only online source of building products <i>compliant</i> with Unified Facilities Guide Specifications (UFGS) . The UFGS set-out the requirements for building products used in DoD, military agencies, and NASA construction projects. The database is free to users as a service of Whole Building Design Guide.
Building for Environmental and Economic Sustainability (BEES) http://www.bfrl.nist.gov/oa/software/bees.html	<u>D</u> [relevant to design team]	✓✓✓✓	A software that implements a technique for balancing the environmental and economic performance of building products. Developed by NIST (National Institute of Standards and Technology) Green Buildings Program, the first version of the tool, BEES 1.0 is now available.
Buildings for the 21 st Century and Million Solar Roofs Initiative United States Department of Energy http://www.eren.doe.gov/buildings/	<u>B</u> [good as background information]	✓	A Department of Energy initiative to increase energy efficiency of new homes by 50% and existing homes and new and existing commercial buildings by 20% by the year 2010.
GreenSeal http://www.greenseal.org/	<u>D</u>	✓✓✓✓	Non-Profit Organization that develops increasingly stringent GreenSeal Certification and Standards and provides a database for certified products.
GreenSpec Directory http://www.buildinggreen.com/menus/	<u>A</u>	✓✓✓✓	GreenSpec is Building Green's premiere product information service. It contains detailed listings for more than 2,000 environmentally preferable building products with descriptions, manufacturer information, and links to additional resources. All listings are screened and written exclusively by our staff.
National Fenestration Rating Council Products Directory	<u>D</u>	✓✓	The National Fenestration Rating Council was

http://www.nfrc.org			formed to develop a voluntary, national rating system for windows, doors, and other fenestration products. NFRC's uniform energy performance rating and labelling system allows builders and consumers to compare the efficiency of fenestration products. <i>NFRC Certified Products Directory</i> contains information on the U-value of more than 20,000 certified products.
LEED Certified Building Case Studies http://www.buildinggreen.com/hpb/results.cfm?search=LEED	<u>B</u> [good as background information]	✓✓✓✓	Best Practice Case Studies
Green Building Resource Guide http://www.greenguide.com/about.html	<u>D</u>	✓✓✓	The Green Building Resource Guide is designed around four user interfaces familiar to architects: Site Plan, Elevation, Floor Plan, and Section. A database of more than 600 green building materials and products
Sustainable Building Tool Kit http://www.ciwmb.ca.gov/GreenBuilding/ToolKit.htm	<u>A</u> [relevant to all]	✓✓✓✓✓	This tool kit was created by the California Sustainable Building Task Force to assist project managers and provide quick, direct access to helpful information and documents.
Building Materials Reuse Association Directory http://www.buildingreuse.org/	<u>C</u> [relevant to construction]	✓✓✓	The BMRA is a non-profit educational organization whose mission is to facilitate building deconstruction and the reuse/recycling of recovered building materials.
Green Building Encyclopaedia http://www.whyygreenbuildings.com/	<u>A</u>	✓✓✓✓	
Home Energy Saver http://HomeEnergySaver.lbl.gov/	<u>U</u> [relevant to	✓✓✓	Web-based do-it-yourself energy audit tool

	everyday user]		
Online Scoring Sheet for RFQ Applicants http://www.ciwmb.ca.gov/GreenBuilding/Design/CAEECScore.xls	<u>A</u> [relevant to all]	✓✓✓	
UC Berkeley Green Design/Sustainable Architecture Resources http://www.lib.berkeley.edu/ENVI/GreenAll.html	<u>D</u> [relevant to design team]	✓✓✓✓	Resource Database
Green Building Report – Resources http://www.pprc.org/pubs/greencon/resource.cfm	<u>A</u>	✓✓✓✓	Resource Database

Rating of how useful for project application: Scale: 1 to 5: ✓✓✓✓✓ Low -> High

Table 7 UK sites and portals

United Kingdom			
Building Research Establishment and BREEAM http://www.bre.co.uk/service.jsp?id=9	<u>A</u>	✓✓✓✓✓	Building Research Establishment. BRE's mission is to build a better world and “our vision is our unmistakable imprint on a highly regarded and sustainable built environment”.
SMARTwaste http://www.smartwaste.co.uk	<u>C</u>	✓✓✓✓✓	Measuring, managing and reducing construction waste
Sustainable Construction Task Group Report http://www.bre.co.uk/pdf/ProgressReport.pdf Sustainable Construction http://www.bre.co.uk/service .	<u>C</u> [relevant to construction]	✓✓✓✓✓	
Sustainable Building Conference (SB2000) Case Studies http://projects.bre.co.uk/sb2000/index.html	<u>B</u>	✓✓✓✓✓	Case Studies

UK Government Site on Contributions to Sustainable Development http://www.sustainable-development.gov.uk/	<u>B</u> [background information]	✓✓✓✓	The Government's Approach
Invest	<u>D</u>	✓✓✓✓✓	Used for assessing environmental impacts of a building at early design stage. Demo Available online.
Environmental Profiles	<u>D & C</u> [relevant to design and construction]	✓✓✓✓✓	A universal method of measuring the sustainability of all construction products and materials. This method presents environmental data to cut through the confusion of claims and counterclaims about the performance of building materials.
The Green Guide to Specification	<u>D & C</u>	✓✓✓	an easy-to-use publication, providing guidance for specifiers, designers and their clients on the relative environmental impacts of over 250 elemental specifications for roofs, walls, floors.
Environmental Management Toolkits	<u>A</u> [relevant to all]	✓✓✓	Toolkit Web Database
MaSC http://projects.bre.co.uk/masc/index.html	<u>C</u>	✓✓✓	To Help Construction Companies improve business through sustainability

4. INTERVIEW RESULTS

4.1 CH2 Goals

The overall CH2 goals of:

- increasing the understanding and awareness of green building benefits
- increasing confidence in the selection of *green* and *eco-preferred* products
- increasing trust in the long term benefits
- facilitating information to justify the higher initial costs against life cycle costs, thus strengthening a business case
- alleviating the current situation of poor local availability of green building supply
- increasing understanding/communication across disciplines and with the client, and
- indicating incentives for sustainability and general impediments to innovation

The above goals have been achieved, however room for improvement still exists.

4.2 Areas for Improvement

The following issues need to be addressed:

- lack of consistency in rating tools, regulations, and planning requirements
- behavioural issues related to industry/consumers *not acting on long-term value*
- lack of advice/tools not about products but about *management of investment*
- lack of advice as to existing *building stock being poor* and its applications for re-use

According to the AusIndustry's CH2 Materials Report (Morison, et al., 2005) no internationally successful program for labelling construction material has been achieved yet, despite several attempts. The main problem with labelling construction materials is that subject to context and location, especially in terms of life cycle and performance expectations. Greater success has been achieved using specification or material choice support tools such as EcoSpecifier and the US Environmental Building News, and guidelines such as the Aurora Material Selection Guideline and the US Federal Government's environmentally preferable purchasing (EPP) database. Labelling of materials is almost always completed by a third party independent from the manufacturer or its professional organisations, and usually includes some kind of certification.

4.3 Observations

To assist in improving construction, commissioning, and facilities maintenance,

- need good policies and programs, real-time data, standards, benchmarks and online tools for decision-making
- for FM, most of the current online systems and tools can predict potential performance, but do not assess actual performance during construction and operation including affordability and costs.

CH2 Total building costs: \$51.045 million

(Including \$11.3 m on Sustainability Features – 22.1% of costs)

Payback period claim: It is estimated that in 10 years time the sustainability features will have paid for themselves. Further benefits that could reduce this payback period include:

- healthier staff – less time lost to colds, flu and other illnesses;
- increased workplace effectiveness;
- less costs for public domain and infrastructure; and
- the value of this building as a guiding light in sustainable building.

It is clear that the Melbourne City Council is making a considerable effort that will lead Australia towards:

- cutting Greenhouse Gas emissions and
- reducing the use of Non-renewable Energy

A follow-up study would suggest revisiting Melbourne City Council to ask pertinent questions such as:

- Which online tools have been useful in facilitating the CH2 green building agenda?
- Ecospecifier was developed and tested during the design and building of – has it changed because of CH2?
- To what extent has this type of project contributed to laying the foundations for the use of the Internet to support the Green Building Agenda?
- For the Architect, Engineer, Construction Manager, Commissioning Manager, and Facilities Maintenance Manager: how do you see your contribution in general terms in achieving the Green Building Agenda?

5. CONCLUSION

This study has discussed the role of web portals to facilitate decision making during three building stages (1) the design process – especially on the selection of sustainable materials, (2) the construction process – especially on the collaboration between client, contractor, subcontractor and suppliers and (3) facility management – especially on building commissioning and occupation.

As a cause of the recently introduced green building and environmental legislation new possibilities for energy savings, improved employee green practices are amongst the incentives and the areas adding market value of e-business within the industry. Although it is hard to ascertain whether CH2 will remain within its \$51 million budget (including \$11 million on sustainability features) due to delays in the completion of the project, the Melbourne City Council has claimed that up to \$11 million could be recovered within 10 years due to energy cost savings and productivity gains. In this case study e-business practices enabled informed and building performance decisions. Web-based tools were here reviewed and summarised.

Identified practices which are likely to accelerate e-business adoption include:

- use case studies to demonstrate use of specific online tools
- facilitate training
- allow time and space for error when introducing new practices
- increase organisations awareness of research publications on e-business uptake
- offer follow up expert consultation
- establish quantitative correlations on the use of specific e-business practices and improvements on green building performance
- highlight collaborative decision-making
- use e-business as communication tool to ensure improved service to the client.

It's been proposed that building projects like CH2 are the *test-beds* for innovation and in this particular case it certainly has been the catalysts for the development and uptake of some of the e-business tools investigated.

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