

COUNCIL HOUSE 2 (CH₂), MELBOURNE CBD : A GREEN BUILDING SHOWCASE IN THE MAKING

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Abstract

The Council House 2 (or CH₂) is a leading green building commissioned by Melbourne City Council. This paper outlines the leading edge technologies and approaches that have resulted in this building. It outlines the initiatives and passes on some of the main stories and lessons from the project, which is due for completion in late 2005. The lessons and the information in this paper have been obtained through a researcher, funded by the Australian Greenhouse Office, from the Centre for Design at RMIT University who worked in collaboration with the CH₂ project team to document their experience. This was facilitated by the strong commitment by the client, Melbourne City Council and the rest of the project team. The stories highlight the business case for CH₂, the pre-appointment phase, appointment of project team, team building workshop and the design development phase. The method for collecting the information included reviews of relevant documentation and interviews with key agents, including Melbourne City Council (MCC) staff, the project designers and other consultants. Finally this paper outlines some of the best practices in the implementation of green buildings aiming to incorporate technological innovation while maintaining focus on the human values - continuing to design for the user. It is hoped that this building will also provide a platform that leads to further research into the relationship between the environmentally responsible, energy efficient performance of buildings and the physiological aspect of human beings such as comfort, humidity and eventually productivity at the workplace.

Keywords : Green building, Technological innovation, Energy efficient, Environmentally responsible.

1. Introduction

The City of Melbourne has set a formidable task for itself - to build a revolutionary new building that harvests sunlight, cool night air, water, wind and rain to create a lasting landmark for one of the world's most liveable cities - through the design of Council House 2. It is affectionately known as CH₂ to differentiate it from the currently used Council House building, which is on the adjacent site and has become known as CH₁, both are located on Little Collins Street right in the heart of Melbourne Central Business District. This striking building will set a new international standard in ecologically sustainable design. It also offers a financially responsible way of meeting the Council's long-term need to house staff and will breathe life into an under-used part of central Melbourne.

Construction of CH₂ began early in 2004. It made a large step towards meeting its sustainability goals when the Green Building Council of Australia gave the design stage of the building a preliminary 'six star rating' - world leader status - under the new method of comparing the environmental performance of commercial properties, called Green Star. The Green Star rating aims to become a national standard for Australia for green buildings. The tool's comprehensive evaluation process rates the building in relation to its planned management and commissioning, the health and design for well being of its occupants,

accessibility to public transport, water usage, energy consumption, the responsible choice of materials, land use and pollution.

The aim of this paper as a whole is to give those who participated in the project a voice in telling its story. It is part of a larger research project including a report outlining the main processes, lessons and outcomes of the design phase. This comprehensive report will follow once the building is completed. Further, monitoring of CH₂ operation is also being planned for the future. This paper will specifically outline the leading edge technologies and approaches that have resulted in this building. Furthermore, it not only outlines the initiatives but passes on some of the main stories and lessons from the project that is due for completion in late 2005.

2. CH₂ Building Project

CH₂ is to be a leading edge example in the procurement of sustainable buildings. The aim is for the building to become a 'lighthouse' design for future central city developments in Melbourne. The approach taken towards sustainability is one that incorporates and draws on social, economic and natural aspects. CH₂ visually and functionally reflects the sustainable principles its design embodies as this paper will highlight. There were many aims for the building. These were distilled to four key themes established through the initial two week workshop:

People: provide a healthy, comfortable, adaptable and stimulating working environment for its primary users (staff) and visitors. The building should be welcoming, accessible and easily navigated, and should provide a positive social environment.

Eco exchange: the building should respond and interact with its natural environment, in a responsible way, throughout its life cycle. It should do this with: its use of natural resources (e.g. materials, water), efficiency of form and design, efficiency of construction and operation, the ability for effective reuse, the minimization of waste, the maximization of the use of renewable energy sources during its operation and an overall aim to reduce carbon dioxide emissions to zero.

Green print: it should also provide at least the same area of green cover as its footprint bearing in mind that this area can be measured vertically as well as horizontally. That is, there should be as many leaves on the building vertically and horizontally as if the land was still under native vegetation. Further the building should be read as a work of art, including where possible inspiring works and influences. And finally the building should inspire a new relationship between the city and nature.

Eco-nomics: the idea of 'more from less' - that is, no longer having a focus on minimizing costs but balancing costs with good building construction, optimal operating condition and focusing on people and the environment while maximizing value and benefits throughout its life cycle.

[we distilled it] to four instead of sixteen objectives. At the end of the workshop, they knew four characteristics of this project, and all of them knew them—even the secretary.

Greg Foliente, Principal Research Scientist, team leader EVERGEN, CSIRO

This two week workshop, otherwise known as charrette, set the framework for the project. The people who were involved were¹:

- i. Melbourne City Council departments: City Projects and Arts and Culture and the Design Team Leader and in the Project Management role
- ii. DesignInc – Architectural

¹ The website is www.melbourne.vic.gov.au for those seeking further information on these organizations.

- iii. Donald Cant Watts Corke - Quantity Surveying
- iv. Bonacci Group - Structural and Civil Engineering
- v. Lincolne Scott - Services Engineering
- vi. AEC - Ecological Sustainable Design
- vii. TDC - Vertical Transport

3. Our approach to the paper

This section highlights the crucial preparation and planning activities, particularly the design planning through a charrette, describe the innovative design methods, elements and technologies and conclude with the lessons from the project.

3.1 Approach to the review of project design

The preliminary phase is a critical stage of the project in ensuring that the project team understands the brief, the timelines and the expectations at every stage of the project. At the preliminary stage the project team needed to gain a detailed understanding, through discussion with the Joint Steering Panel and other key people, of the strategic goals and objectives of the project against which the project will be evaluated. These reflected the Council's commitment to 'triple bottom line' (TBL) sustainability, including environmental, social and economic objectives. In addition to the goals that are formally articulated in the design brief the expectations of other stakeholders such as rate payers, residents, visitors to the city, the business and design communities, environmental organizations, state and federal governments (among others) were taken into account.

To capture the lessons from this preliminary phase, it was agreed that there would be a series of interviews carried out with key players in the project. These interviews asked questions designed to bring out their stories and their experience, both positive and negative. The aim of the interviews was to uncover the behind-the-scenes experiences of those participants in the design and construction phases of the project.²

3.2 Approach to the review of design phase of CH₂

The main aim for this phase was to review and document the Council's unique approach to the design of CH₂, focusing on: the critical issues, obstacles encountered, how these obstacles were overcome, and key lessons learned throughout the design process. Things that were reviewed included:

- The business case for CH₂
- Pre-appointment phase
- Appointment of project team
- Team building workshop
- Design development phase
- Planning approval process
- Documentation phase; and
- Tender selection phase

The methodology included a review of relevant documentation and interviews with key agents, including Melbourne City Council staff, designers and other consultants. The output was a report including schematic illustrations of the processes. This paper forms the summary of the larger report.

² To facilitate the ethical implementation of this research technique an ethics approval was sought and received from RMIT University. This ensured that the rights of those participating were protected.

4. Description of Process and Technologies

CH₂ has been designed to be a highly energy efficient and sustainable building, with all its systems and spaces forming an interconnected and inter-related whole. Much like a living organism, the building requires all of its limbs and organs to be fully integrated and able to function in unison. We use the term 'biomimicry' to describe this attempt to learn from nature and 'mimic' it into the design. Below is a brief outline of this biological synergy (where relevant to the paper, some of these are elaborated on later in the text):

- Leaf structure: air cleaning and processing, combined with collecting energy and dissipating heat.
- Growth plane: roof terrace supporting living plants and grasses for the enjoyment of building inhabitants.
- Bronchia: enclosed duct spaces for delivery of vital gases.
- Root: network of connections to ground, provision of public services, buttressing to the city plane, sewer mining for non potable water.
- Stem: primary core structure and arterial volume providing network of reticulated fluids, gases and nervous system of building for control of cooling, heating and ventilation.
- Epidermis: external layer of skin for protection from the elements.
- Dermis: sub-layer of skin composed of enclosed spaces to filter wind, light and sound.
- Antennae: vertical mast carrying vegetation and weather monitoring equipment for control of cooling, heating and ventilation.
- Bark: external ventilation module for waste and toilets, with inhabitable external balconies.
- Soft body: the internal activity zone of the building where climate is modified for people.

The primary influence on the design was the natural termite system. Mick Pearce, MCC design champion, had previously used this concept successfully, in for example the 'Eastgate' building in Harare, 1992-1997. He transformed the simple design and system termites build to control the temperature of a mound into the air conditioning systems of the building. The main principle used is very simple: cold air descends, warm air ascends. The physiology of a termite mound is that they build towers that are comparable to human lungs – including a function based on the same principle as gas membrane diffusion. They 'outsource' the function of digestion to fungi that they cultivate in gardens in their mound. These work like our digestive system. Temperature and humidity control is essential for their survival and the survival of the fungi. They also mine water for drinking and cooling. Thus, termites have evolved an architecture that harvests solar and wind energy, water and food through fungi using symbiosis.

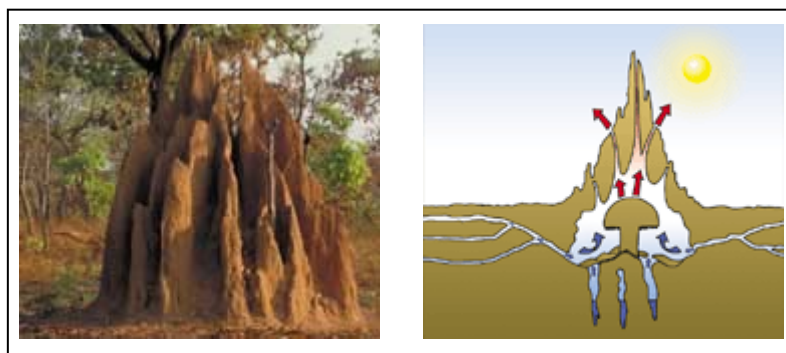


Fig.1 The Termite Mound and physiology working process

Before the initial meeting with the full design team, Mick Pearce utilized this previous experience and synthesized it into a working design. The sectional diagram below describes the process and technologies being included in the design.

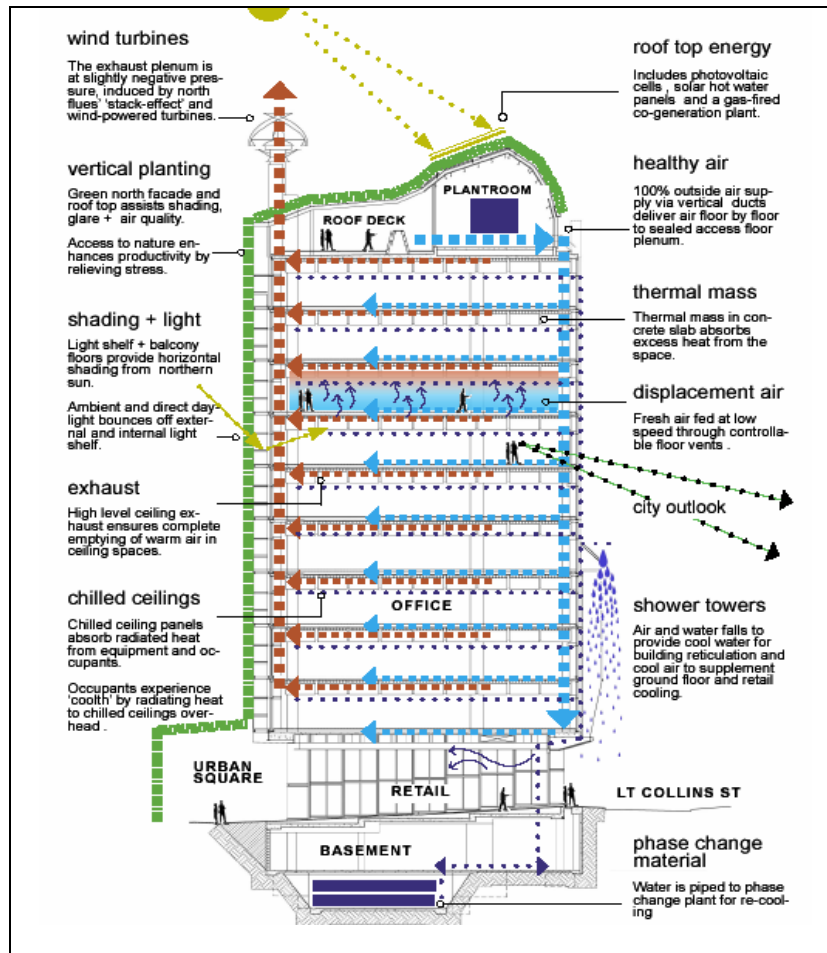


Fig.2 Translation of termite mound concept into CH₂ building (DesignInc)

Other elements of the thermally efficient design concept for CH₂ were the use of thermal mass, ventilation stacks and water for cooling through chilled ceiling panels, beams – the water cooled by the coolth stored in phase change material tanks. We briefly outline these elements as follows:

Thermal mass. The vaulted 'wavy' ceilings are made from pre-cast concrete and therefore have high thermal mass that, as it is in contact with the indoor air, helps the building spaces to remain cooler during the day as the thermal mass absorbs some of the excess heat. This heat is then released during night purging.



Fig.3 Southern and northern facades (DesignInc)

Ventilation stacks. Ventilation stacks have been designed to the north and south of the building. To the north the stacks have been designed to be dark increasing in size up the building to support air movement, whilst reducing windows sizes. That is, largest windows at street level where there are the least natural light gradually reducing window sizes until at the top there is the most natural light and therefore the smallest windows.

Chilled beams and ceiling panels. Cold water will be used to remove most of the unwanted heat from the building. The panels and beams simply run chilled water through them: the water absorbs the heat from the air cooling it and taking the heat away.

Phase change material. The design includes the use of a phase change material to cool the water for the chilled beams and panels. This is often referred to as the 'battery' of the building – storing the coolth generated from the shower towers and chillers to be used when needed. Thus it will efficiently help to keep the water circulating through the chilled panels and beams at the desired temperature.

Shower towers. The final feature of the design that aids in the control of the indoor air environment is the shower towers on the southern façade. Outside air is drawn in from 17 metres or more above street level and channelled into the shower towers on the south side of CH₂. The towers are made from tubes of light-weight fabric 1.4 metres in diameter. As the air falls within the shower tower it is cooled by evaporation from the shower of water. The cool air is supplied to the retail spaces and the cool water is supplied to the phase change material 'battery' where the 'coolth' is stored for the rest of the building when required.

The brief descriptions above inform us that the construction materials and elements used are not unusual. On the contrary, these are common materials but put to use in an innovation way. Furthermore, materials were selected using a review process developed by CSIRO and product guidelines such as EcoSpecifier were used.

5. Main Lessons Learnt for Discussion

The building is currently being constructed; and it receives a lot of interest from all parties across the globe. Our research has brought out key lessons learnt from the design stages of CH₂ and are presented as six factors below.

Lesson 1: Participatory design exercise

For the design of CH₂, it was decided from the beginning that participation from all design team members was needed to pursue the design goal. A comprehensive communication network was set up starting with a workshop known also as charrette, which allowed everyone involved to have the same concept of the project. Furthermore, it allowed the raising and resolving of any issue to be achieved collaboratively.

*“the process was supported by a relatively simple but clear brief:
the building needed to be greenhouse neutral
a lighthouse project
improve employee wellbeing
analogous to industry transfer”*

Mick Pearce, Design Champion, City of Melbourne

The charrette process, through its coordinating function between all the design team, significantly reduced the resources and time needed to complete the design stage.

... once we had that team on board, we said 'now we stop the process, your fees are frozen we are now going to pay over and above your fees, to sit with us for two weeks and work as a team in a charrette and just put everything back on the table. ...nothing at this stage is sacrosanct'... it was then January...we said 'don't tell us in November there was a better way of dealing with this...we're paying you over and above your fees so you now have got to put it all on the table'... and that two weeks bonded the team in a way that we hadn't really anticipated, ..., it all happened very quickly, but it worked.

Rob Adams, Project Director, City of Melbourne

When asked why such a positive experience was had by all the consultants of the charrette process, and why such unexpectedly good results we achieved through open collaborative solution development, Rob Adams said:

I'd like to think it's the way you treat people ...There's no assumption that anybody actually knows the answers ...I think quite a genuine open discussion that says everybody's point of view is valued. Doesn't matter whether you've just walked into the office two days before, if you've got a point of view, stick it on the table, we want to hear it, and we also, I think a lot people took risks. I mean we say... the risk ...to make a mistake....

Rob Adams, Project Director, City of Melbourne

In the initial stage, allowing explorations of ideas and suggestions without feeling intimidated had made way for a dialogue and solution development that otherwise would have been much more difficult and limited – it also supported initiatives by all the consultants involved. In all, the charrette contributed towards team building, an important element in the progress of this project.

Lesson 2: Leadership and policy implementation

The significant step taken by the Melbourne City Council for the development of CH₂ demonstrates its vision, mission and values as stated in the 'City Plan 2010 – towards a thriving and sustainable city'. In reviewing its accommodation options, the MCC set the following requirements for the new premises:

- Accommodation to meet statutory requirements and occupational health and safety regulations
- Accommodate majority of staff except small core of staff to manage councillors' needs
- Modern interactive flexible work environment which is responsive to organisational needs and change
- Latest environmentally sustainable design features
- Long term operational efficiency at least cost
- Comply with planning schemes

The CH₂ proposal therefore had to meet these criteria as well as those set up in response to environmental strategies including the requirements to meet at least a 5 star energy level and the energy targets set out under the Energy Management Strategy and accompanying Energy Policy to guide corporate change. Specific targets being:

- 20% Reduction of energy consumed in Council buildings by 2005 (based on 1996 levels), and
- 5% Increase in the use of renewable energy by 2005 and 10% increase by 2010

The MCC also has a target of zero emissions by 2020 and a strategy called Watermark aimed towards sustainable water management by 2020.

At another level of leadership, MCC is fortunate to have committed people in their team such as their champion designer, Mick Pearce, project director, Rob Adams and finance director, Mark Anderson, among others. Mick Pearce, provided detailed preparation in developing the vision of this project, drew this from

his other projects while simultaneously integrating his other passion – ensuring buildings meet the needs of the users. He is considered by all those interviewed in the project as the visionary for the project:

"[he was] Very, very, very good, a good driver you need someone like him that can think about things – a thinker and a bit of a dreamer ... with enough pragmatisms to actually get things done".

Chris Arms, CJArms and associates, hydraulic engineers

Lesson 3: Business Case

Apart from the leadership quality of the Melbourne City Council in designing the building to meet the needs of its staff, MCC also wanted to achieve other sets of objectives stated earlier. The framework term financial requirements of the council. Thinking about the long term is important in building the business case for a 'green' building project. What should be aimed for is best value over life not the lowest initial cost. The investment in CH₂ was decided on after evaluating every possible accommodation option for MCC over the properties available throughout the city. In short, MCC needed to either do major renovations to all of its accommodation to bring it up to current regulatory requirements, lease new accommodation or build a new building. Several options based on the accommodation requirements of the MCC were short listed: refurbish or staying at current building, lease or purchase another space or redevelopment of the existing council house. The last option was the best scenario as it achieved all objectives, gave the highest ranking in the MCC assessment method and was seen as the option which would provide best environment for council's staff.

The main hurdle was to show the financial credibility of such decision. Getting the finance director, Mr Anderson, on board was the main challenge for the CH₂ team. They needed to convince him that it was a sound investment for the Council to make. The basis for the conversation with Mr Anderson was the investment fund which the Council set up when they sold their electricity company. This fund is strictly administered in a conservative portfolio, part of which is in property. Rob Adams describes the discussions with Mr Anderson and how the business case was presented:

The key...was our finance director Mark Anderson. We needed to convince Mark that we were not going to build CH₂ because we were good designers or good project managers, or for that matter that even that it was good urban design.

What was needed was a business case that used Council's investment funds. This fund provides \$200m which can be invested on strategic projects as long as they give a return of 150% of the current bank rate.

Being a local government, it would be untenable to use monies from Council rates. Therefore Council needed to show through a rationalisation of the property holdings within the investment portfolio that they could provide a sounder investment for Council by constructing CH₂. Much of the current building stock is aging and consists of a number of small buildings distributed throughout the City. In many cases these properties are not producing a good return on investment. The suggestion was that by using this prime central city site for a building with low ongoing operating costs, in particular low energy consumption, would be a better investment for Council. It was argued that as the building contains a mixture of car parking, retail and administrative offices, it would hold its value over its life. Given its construction and energy savings it would be a good investment for the City.

Rob Adams, Project Director, City of Melbourne

This enabled Mr Anderson to stand in front of nine councillors and confidently say "this is a good investment". Given Mr Anderson's credibility and sound financial management, such an endorsement from

the chief financial officer gave the project credibility needed for the Council to approve the project going ahead.

We believe that in years to come, similar discussion or conversation will take place, where triple bottom line issues will challenge any single aspect decision making principles in business transaction. The increasing awareness of corporate social responsibility will further enhance the quest towards sustainable accounting and contribute towards sustainable built environment.

Lesson 4: The charrette process – involving a diverse group of people

Another reason for the success of the charrette process was the diverse group of people who were involved, each adding their own perspective, for example artist. Artists continue to be involved in the project documenting the construction of the building and having input into works to be used in the building.

... some of the good things, and one of them was the role of the artists... they added humour to the meetings, and that had the effect of breaking down barriers between everybody. That enhanced the whole morale of the group, and I think that stayed, to some extent into the whole of the project...It was terrific that the artists were able to appreciate where all the designers and engineers were coming from, and they were clearly coming up with solutions that were taking those sorts of things into account. And that was quite fascinating for me ...

Peter Boxall, Project Consultant, EVERGEN, CSIRO

One of the main issues raised, which would have improved the charrette process, was that it needed more initial preparation and planning. This would have ensured a clearer concept, aims and objectives of the project as envisaged by the client (MCC).

With the workshop itself, things happened very fast, especially in the beginning. We finalised certain things in December, then there was a break, and then the workshop took place in the first two weeks of January. So there was a problem in that Melbourne City Council and I didn't really have enough time to plan the workshop to get the most out of it. Nonetheless it was an innovative idea to have two weeks rather than two days. I think that most projects, throughout the world, tend not to devote adequate time to this initial planning.

Greg Foliente, Principal Research Scientist, team leader EVERGEN, CSIRO

The sharing of information at the earliest possible stage can help reduce the uncertainty at the start of the project. That started with the charrette as the 'ice breaking' session and continued throughout the design process. In fact, because of this initial problem solving time facilitated by the charrette, the design team finished the whole design and documentation, including a guaranteed bill of quantities, within nine months. This included the change over of sites in the first three months. This change of sites was the result of the open questioning of assumption supported by the charrette process. The design team questioned the risk of rebuilding the old Council House and therefore having to relocate all the staff for a considerable amount of time, over the construction of the building on the neighbouring vacant site. This meant some redesign and the building becoming a little smaller than was originally hoped for, but the savings in costs (\$A13M) and mitigation of risk supported this decision.

Lesson 5: Documentation using File Transfer Protocol website

The design time was also reduced through the use of a common electronic plan protocol such as the FTP site for the design and documentation development. The system has been developed to be user friendly so that everyone involved with the project could adapt it to their working methodology. In the design stage this meant that every consultant was responsible for their own drawings and uploading the latest version

from the FTP site to work on – this avoided a lot of double handling. In the construction phase ACONE is being used for much the same coordination function. There are numerous examples of such construction project management databases available in the market that would allow for complete access and updates to project documentation by consultants.

Lesson 6: Evaluation System - developing a common language

A common language with which to describe environmental initiatives is crucial because sustainability is so complex and there are so many people working on a project of this size. The Green Star rating schemes provided that language, but caution needs to be taken that it is not the star rather than the environmental benefit that becomes the objective. This applies to any rating system of building performances in general. It is in danger of becoming simply a rating tool rather than a reflection of the building's sustainable design process.

Even though CH₂ is considered 'leading edge' having been awarded a preliminary 6 star design rating by the Australian Green Building Council, it still would use 2.5 earths in terms of earth resources in the eco-footprint scale. Such potential complacency must be constantly reawakened and reasserted in the policies and guidelines of future building projects, either newly built or refurbishment. On the other hand, this is a big step towards building and developing habitats that will bring the eco-footprint to one earth. To this effect, the Green Building Council Australia is continually improving the indicator elements to suit changes in the industry and other contexts by conducting feedback exercises to include the widest range of stakeholders possible.

The other caution for systems such as Green Star is to ensure it does not stifle innovation. This could be mainly attributed to the effect of building regulation on construction industry in general. A building may have the potential to improve its sustainability beyond the Green Star framework, if it is just the star rating which is aimed for then a project may not meet this potential. For example CH₂ has been awarded all 5 of the innovation credits available, this means that from a purely pragmatic point of view there is no further incentive to develop or integrate any further innovation.

6. Conclusions

To embark on a project of such a scale requires well founded preparation and transparency in the planning, design and tendering stages. CH₂ has provided a good example of a 'local authority in action', where a knowledgeable client becomes a catalyst for a sustainable project, and where working with stakeholders and the design team in a collaborative environment provides the best possible solution. A decision for a building such as this should only be reached once all aspects are considered based on a triple bottom line approach; and that this approach is understood by all players involved. It is important that all parties are kept informed in the beginning; in this case the groundwork was laid by the intensive charrette. Even though the charrette did not entirely dictate the final outcome of the project (yet to be completed), it has provided an opportunity for a strong direction towards achieving its sustainability agenda. More importantly, the vision of creating a beacon in sustainable building in Melbourne must be followed through with commitment to implement progressive policies and make decisions based on these policies.

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