

Changes in Climate Driving Changes in Architectural Education

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Abstract:

Sustainability issues, in particular climate change, have become significant drivers of change in architectural education. It is posited that engaging in the reduction and offsetting of greenhouse gas emissions in academic institutions, particularly those responsible for the education of new generations of built environment professionals, could become an important part of creating built environments that can more effectively contribute to mitigating the causes of climate change.

Keywords: Greenhouse gas, carbon neutral, education, tertiary, emissions reduction, climate change, voluntary behavior change.

1. Introduction

Climate change will affect many aspects of life and has well documented social, economic and environmental impacts (Chapman et al., 2006; Stern, 2006). Public awareness of this and with it Government directives to address climate change issues, have significantly increased. Coupled with this is the growing realisation that the global built environment contributes significantly to the causes of climate change through construction and demolition practices, but most significantly through operational and embodied energy (Levine et al., 2007). Not only is the built environment responsible for approximately a third of global greenhouse gas (GHG) emissions, leading to climate change (de la Rue du Can & Price, 2008), it will also have to adapt to climate change impacts, as the main site of human economic, social and cultural life (Hunt, 2004). In light of this, architecture and design education will also have to change so that graduates understand both how to mitigate the causes of climate change, as well as how to devise built environments that can adapt to the impacts.

Many of the negative human caused impacts on climate and ecosystems have been described as a failure in design intent rather than available technology (McDonough & Braungart, 2002; Orr, 2002). Lowe (2000) estimates for example that reductions of 80% in carbon emissions from the built environment are possible using current technologies. It is appropriate then that a growing number of architectural education programs incorporate sustainability issues into curricula (Glyphis, 2001; Rowe, 2007). Ensuring this becomes more widespread and

comprehensive however, may need to happen more rapidly for a number of reasons. Firstly there is a growing understanding that the need to address climate change on a global scale is urgent (IPCC, 2007). Secondly, design professionals have a particularly important role to play in transitioning built environments from being agents of ecological damage, to having net positive environmental benefits (Reed, 2007; Wahl & Baxter, 2008).

This paper examines Victoria University's Faculty of Architecture and Design, in Wellington, New Zealand that in June of 2008, became the Southern Hemisphere's first certified 'carbon neutral' university campus, and the world's first 'carbon neutral' Faculty of Architecture and Design. As well as reduced environmental impact, this paper analyzes further significant anticipated benefits of the Faculty of Architecture and Design's 'carbon neutral' status. The process of becoming carbon neutral is examined for its contribution to innovation in architectural education.

2. The Carbon Neutrality Debate

The difficulties with 'carbon neutrality' achieved through offsets are acknowledged in their role as a potential green washing mechanism (FERN, 2005). Harris (2007) points out that "despite positive attributes... the role of offsetting should be only temporary, creating much needed early emissions reductions and generating awareness, whilst being only a small part of a much wider and longer term global effort to tackle climate change."

For this reason Victoria University's Faculty of Architecture and Design considered it prudent to use participation in a 'carbon neutral' certification program primarily as a platform to plan for and instigate actual reduction of GHG emissions. Offsetting was the final step in a plan that aimed firstly to avoid, then reduce emissions. 'Carbon neutrality' also provided a valuable forum to discuss and raise awareness of the issues of climate change that effect in the case of the Faculty of Architecture and Design: the built environment; tertiary education and research; and a local New Zealand context.

Although the Faculty can not claim to be an example of a highly environmentally sustainable institution in terms of the performance of its buildings yet, 'carbon neutral' certification was combined with a range of additional sustainability focused improvements and research. Several

initiatives to strengthen and expand the capacity of the Faculty to deliver a high standard of education in sustainable architecture and design had already begun, including: increasing staff numbers with specialties in aspects of sustainability; development and expansion of compulsory and senior aspects of the specialist sustainability program; and incorporating sustainability issues into architecture design studios so they become an integral part of architectural education.

3. A 'carbon neutral' Faculty

Victoria University's Faculty of Architecture and Design is made up of the School of Architecture (architecture, building science, landscape architecture and interior architecture program) and the School of Design (digital media and industrial design programs) with both undergraduate and postgraduate programs. The Faculty is housed separately from the rest of Victoria University on the Te Aro Campus, located in central Wellington, New Zealand. Two connected buildings make up the campus, which contains lecture theatres, design studios and computer suites, a workshop, library, offices, and exhibition space (Fig. 1). Approximately 1200 students are enrolled in courses in the Faculty and more than 100 academic, general and technical staff are employed.

Since 1997, a specialist elective course in Sustainable Architecture has been offered. This course is open to all students in the University beyond



Figure 1: Victoria University's Faculty of Architecture and Design.

first year and is designed to give an introduction to the philosophy and concepts of sustainable and regenerative architecture. In late 2006, the course coordinator began to investigate the possibility of the course becoming 'carbon neutral' as an opportunity to engage the students in debate on the concept of carbon trading as part of the educational program concerned with climate change. Senior faculty management

and academic staff became involved and the decision was made to try to expand the project to include not only one course, but the entire Faculty. After wider university management involvement, it was decided that the Faculty would act as a pilot in assessing the feasibility of future GHG offsetting and emissions reduction planning for Victoria University of Wellington's four other campuses.

3.1 Offsetting options

Several avenues were explored in determining an appropriate method for reducing and offsetting GHG emissions. Because becoming 'carbon neutral' was intended to be an educational exercise, it was thought that involving students in the offsetting part might be appropriate. For this reason, carbon sequestration through tree planting was initially investigated with the idea that students could take part in plantings. Although research has been done to define methods for calculating carbon stored in trees and forests (Brown, 2002; Landcare Research, 2006), it was thought that tree planting in projects not specifically dedicated to carbon sequestration would be problematic and would not be a robust method of carbon offset. It was also difficult to calculate how many trees and of which species would be suitable in a local context taking biodiversity issues into account. After further research and advice, the decision was made to source carbon credits from Gold Standard projects instead.

The Gold Standard is a certification scheme that registers projects in the Clean Development Mechanism (CDM), Joint Implementation (JI) and voluntary offset markets and is endorsed and supported by non-governmental organisations. Gold Standard accepts only energy efficiency or renewable energy projects and is not open to forestry projects, mostly due to the impermanence of forests (Bellassen & Leguet, 2007). Gold Standard verified projects are selected because they provide additional social, economic or environmental benefits beyond just emissions reduction "lest offsetting become a zero sum game where emissions are reduced in one place while they continue in another" (The Gold Standard, 2006).

In New Zealand, Meridian Energy supplies Gold Standard third party verified emission reductions (VERs) carbon credits from their wind farms in Te Aro and White Hill. It was decided this method of offset was more relevant to students of architecture and design, who may be responsible for the future energy performance of the built environment and will be making decisions about energy sources and energy related technologies. Meridian Energy were approached for sponsorship potentials and agreed to supply carbon credits to offset the Faculty's emissions. To increase the educational and research collaboration potential

of the agreement for both parties, a Memorandum of Understanding was drawn up between the Faculty and Meridian Energy subsidiary Right House, who are household energy efficiency consultants.

3.2 GHG emissions calculations

Faculty wide emissions were calculated by analyzing external and internal accounting records. Direct emission sources were identified as gas (used for boilers and in the workshop) and vehicle fleet. Indirect emission sources included taxi use, the hiring of buses for field trips, flights, and waste. Emissions for 2007 were calculated to be 341 tonnes of carbon. Major emissions were identified as the burning of gas in boilers (41%); GHG emissions from decomposition of waste (32%); and the burning of fossil fuels used in international flights (26%).

Electricity for the Faculty is supplied by Meridian Energy, 100% of which is generated by wind and hydro sources. Meridian Energy themselves are New Zealand's first certified carbon neutral energy company (Meridian Energy, 2007). Electricity use was therefore measured for the Faculty, but was not recorded as requiring offset. Increasing energy efficiency for electrical equipment was however included in the GHG Emissions Reduction Plan.

3.3 The carboNZero process

To ensure the most robust and transparent process of reducing and offsetting GHG emissions, the Faculty obtained certification from carboNZero (Fig. 2). The carboNZero program was established by Landcare Research, a New Zealand Crown (Government) Research Institution. This ensured that calculations were correct and that planning procedures for reductions and offsets met international best practice based upon a third party verified process.

A Greenhouse Gas Emissions Inventory Report was completed in April 2008 in accordance with International Standard ISO 14064-1 (2006) and the GHG Protocol for Corporate Accounting and Reporting (2004). As stated, the Faculty also prepared a Greenhouse Gas Emissions Reduction Plan. This incorporated comments and suggestions by interested staff (such as lowering the heating set point of the buildings), included several student initiatives to reduce GHG emissions (such as a reassessment of existing recycling systems and suggestions to set up ride-share commuting networks), and involved negotiations with and advice from the University Facilities Management Team.

Targets were set to reduce GHG emissions in terms of intensity per student and staff member by 25% (of 2007 figures) or to exceed that by 2012. This is in line with the New Zealand government's Kyoto Protocol obligations requiring a return to 1990 emissions levels by 2012. The objectives of the plan were to target both the most significant and easiest to address emissions, and also to target emission sources that are significant, but considered to be outside the scope of the Faculty's

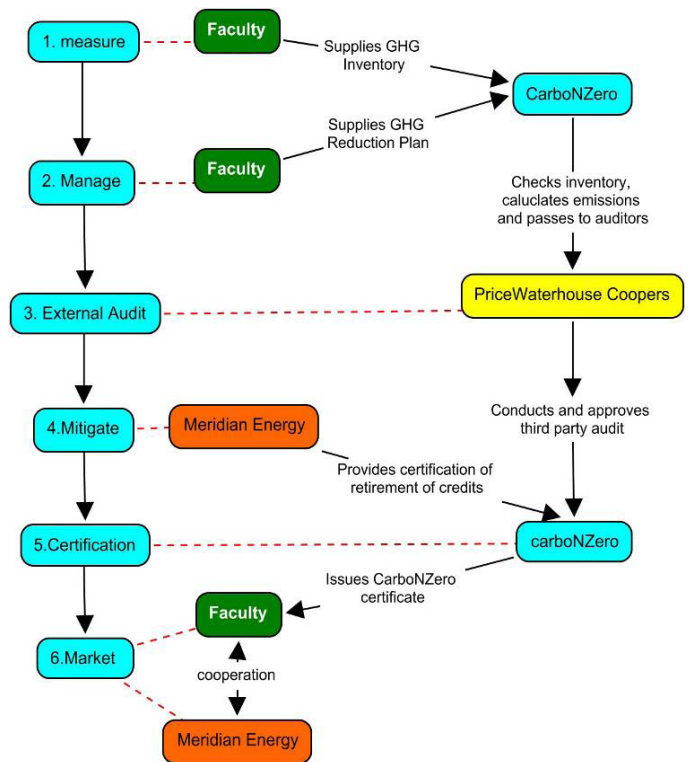


Figure 2: carboNZero process.

operations such as commuting. The Faculty became carboNZero certified in June 2008 to coincide with International World Environment Day (Pedersen Zari, 2008b).

4. Incorporating carboNZero Status into Teaching

As architecture and design educational institutions embark on strengthening capability to deliver sustainable design education, it is important that their own operational conduct is brought into line with what is taught. Cortese (2003) suggests that if a university engages in improving its sustainability performance in terms of operations but does not engage the faculty and students as an integral part of the process and as an educational opportunity, then most of the ongoing value of the initiative is lost.

Being an early adopter of voluntary carbon offset and GHG emissions reduction measures provided a platform for the Faculty to bring attention to and debate climate change issues in a positive forum and to enhance the reputation of the Faculty, while providing learning and research opportunities for students. Development of new teaching methods to encourage behavior change through architectural education was undertaken, both to include students in the carboNZero process but also to give students a way to engage meaningfully with climate change at a local and more tangible level.

The Faculty's main building on campus is already designed to be an educational tool and is studied in depth by building science students in particular. The pipes and ducts are exposed, and are colored differently and labelled to illustrate their function for example. It was envisioned that in a similar way, it would be useful to study the buildings' GHG emissions to understand the impact that the built environment has on climate.

4.1 GHG Emissions Reduction Project

As Glyphis (2001) points out, it is crucial to understand that architectural education needs to go beyond just an understanding of buildings. If knowledge is too specialised without an understanding of the larger context or system, then people may fail to recognise that different aspects of the climate change challenge are fundamentally related (Wahl & Baxter, 2008). This can result in solutions which solve one problem but make another worse in a different time or place (Cortese, 2003). The design of individual buildings is often the focus for architectural education, yet it is the behavior of people using buildings that determines a large part of the environmental impact of the built environment.

With this in mind a project aiming to give students in the Sustainable Architecture course an understanding of how to encourage positive behavior change was devised. The central aim of the project was to provide students with an opportunity to put knowledge about the causes of climate change into practice and to become familiar with relationships between the built environment (how it is designed and used), emissions of GHGs, and global climate change. At the end of the project students were expected to be able to: assess and approximate the size of a building's basic GHG emission sources; employ various techniques to reduce in-use building related GHG emissions; respond to behavior based challenges in the development of emissions reduction planning; and to reflect critically on project processes, outcomes and effectiveness.

4.1.1 Setting a real context

In a similar way to 'live projects', described as projects that engage real users in real-time contexts, and encourage students to become active citizens of a given community (Morrow, 2008), the project asked students to focus on the existing campus buildings and take a leadership role by devising strategies for reducing the Faculty's GHG emissions. The existing built environment will need to be part of a long term solution to climate change because of the relatively long life of buildings and slow rate of renewal (relative to consumer items such as clothing or electronic equipment). Most buildings that will make up the built environment in the coming decades, as climate change impacts become more intense and the need to mitigate the causes of climate change becomes more urgent, have already been built (Pedersen Zari 2008a).

Students were tasked with putting their ideas into place while engaging directly with their peers to initiate behavior change. While there are a number of national and international initiatives aimed at mitigating of the

causes of climate change, in order for people to meaningfully participate in such a large and global issue, action must begin locally and at a personal level. Putting knowledge gained in academia into action can be a positive and motivational way to learn more about environmental issues and is a critical feature of developing leadership skills (Cortese, 2003).

4.1.2 Understanding behavior change

The project drew upon both voluntary behavior change and social marketing concepts to understand how to encourage people to change their behavior. In brief, social marketing is based on the concept that similar marketing tactics that encourage people to buy services or products can be used to influence behavior. The tools to instigate change include: encouraging people to make public or visible commitments to change; providing prompts so people remember new behaviors; reinforcing new behaviors as the norm; providing incentives; and removing barriers. Voluntary behavior change involves working with a community to devise ways to adopt new behaviors that become more convenient or desirable for individuals. These new behaviors also incidentally have better sustainability outcomes. Changes are often encouraged by tapping into existing social networks and utilising: peer influence; influence from respected or well-known people; the creation of new fashions or trends; and engagement with people at critical 'change moments' in their lives such as moving house, or beginning university for example (McKenzie-Mohr & Smith, 1999; Amlt, 2003; Monroe, 2003).

4.1.3 A multidisciplinary approach

The cohort of students undertaking the course were a mix of architecture, building science, interior architecture, and landscape architecture students as well as a small number of science and arts students from other faculties. They ranged from second year through to fifth year. Students were divided into working groups of four for the project, made up of different disciplines and year groups. Several authors discuss the importance of a multi-disciplinary approach to design because it leads to greater sustainability outcomes but also has wider social benefits due to a more participatory and socially inclusive design methodology (Storey & Pedersen Zari, 2006; Wahl & Baxter, 2008). Much of architectural education emphasises individual and competitive learning (Cortese, 2003). It is important therefore that students have a chance to practice working with other disciplines on complex problems in group situations.

4.1.4 The project process

The first step of the project saw students employ research and interview skills to find out the nature and size of the Faculty's emissions. Online carbon calculators were used alongside the supplied Faculty Emissions Inventory. The findings of this research, and importantly the rationale for targeting chosen emissions were recorded in a research summary. The next part of the project was the planning and execution of an intervention to both call attention to, as well as reduce this source of emissions.

Interventions took many forms. For example: behavior change initiatives to remind or encourage students to do something differently; surveys and consultative processes; proposals made to faculty management for changes; petitions initiated and presented; public commitments made and gathered from students; the setting up of interactive educational displays; demonstrations of new technologies on campus; organisation of sponsorship by local businesses for recycling initiatives; and setting up of model material sharing stations.

An important aspect of this part of the project was that students actually put the interventions in place where possible. Unlike many typical design projects where students use drawings, models and other representations to propose an imagined solution, this project asked students to actually create change on campus. This provided an opportunity for students to practise initialising, or positive activism which puts tangible change into place, rather than protest activism which is typically based on fighting against something (Morrow, 2008). In the weeks when the interventions began, the profile of climate change was substantially raised on campus. This occurred through the diverse array of installations, banners, activities and new initiatives set up for students to participate in.

In the next part of the project students were asked to document their interventions and finally to make these interventions visible to a wider audience. The negative environmental impact of the built environment and particularly its contribution to climate change is largely invisible. An aspect of taking positive action to improve the environmental performance of a building therefore is make positive changes noticeable (Cortese, 2003). This enables interventions to be doubly effective by acting firstly as a GHG reduction mechanism in this case, and secondly as an educational or awareness raising tool for students, staff and potentially a wider audience. This draws upon aspects of eco-revelatory theory where it is assumed that by revealing ecological processes in landscape architecture or urban design, people will become more aware of them and value them more (Eisenstein, 2001). Students used many different methods to record and document their interventions such as: photography; video; animation; sketches; photocopies; and sound recordings. The outreach part of the project where interventions were publicized also took many forms such as: distribution of posters; radio interviews; banner drops; exhibitions; articles in the student news paper; you tube postings; and use of social networking sites online.

An example of a resolution of this project was the work of one of the groups that examined the high proportion of paper coffee cups in the campus's waste stream. These go to landfill and emit methane gas as they decompose which contributes to the green house effect. The students approached local cafes and organised a discount on coffee for those bringing their own specially marked cups. They analyzed the life cycle impact of paper coffee cups and ceramic coffee cups and found that after 40 uses, a ceramic cup had less impact than a paper one. In light of this they sourced an eclectic mix of second hand cups and

stamped their own permanent logo onto the bottom. This stamp was easily identifiable and to try to start a trend, cups were given away to well known and respected staff and students on campus. The rest of the cups were sold for a small fee to cover costs in a festive event in the main atrium of the campus, drawing attention to the initiative. Students documented the process through photography and drawings and for the final part of the project, transformed their collected images and designed logo into posters. These were put up around the campus and at the cafes. Figures 3-5 illustrate some of the interventions that other groups of students devised.



Figure 3: Collection of student opinions at student initiated solar tube exhibition designed to encourage faculty management to install solar tubes to reduce lighting energy consumption while improving the quality of some interior spaces.



Figure 4: Material reuse station designed to reduce laser machine off cuts and save students money. This was combined with banners and information posted on computers for how to cut materials efficiently when using the laser cutting machine.

The last and perhaps crucial part of the project was the requirement that students produce individual evaluations of how effective the intervention was in terms of reducing GHG emissions and also as a way to educate others about reducing GHG emissions in a built environment context. This enabled students to reflect upon the meaning of their design interventions and the role of designers as not just creators of structures or objects, but also as instigators or changers of behavior patterns. They were also able to examine the limitations of purely technological solutions to complex climate change issues. Wahl and Baxter (2008) suggest that design education that encourages people to examine their world view and engage in dialogue, leads to more effective problem solving skills than simply learning about how to create more artefacts.



Figure 5: Posters targeting waste producing behavior using popular students as the subjects and setting up inter-campus competition.

4.1.5 Forming wider partnerships

The importance of forming partnerships with local communities as a way to expand architectural education opportunities and also benefit the community through civic involvement by students is discussed by Morrow (2008). In this project, a local non-governmental organisation and city council were active in providing critique and prizes. This seemed to motivate the students and demonstrated the real-life nature of the project.

While only a three week assignment, the success of the project was apparent in the enthusiasm showed by the students who took part and also in the positive responses from the general student population. While some interventions did not continue because they were short term in nature or were not tended to by students after the conclusion of the project, others did and have become ongoing aspects of campus life. An example is the increasing use of electronic rather than paper

based handouts for students. This occurred after students organised staff training sessions to enable wider use of the appropriate computer programs in an effort to reduce paper waste.

This project also served to engage the student population in the process of the Faculty becoming carboNZero. The students, particularly those who took part in the project felt that they had made more contribution to the process and therefore perhaps had an ongoing responsibility to examine their own behavior in relation to sustainability issues. Cortese (2003) suggests that students engaging in understanding and positively changing the ecological footprint of their own campuses is an effective way to build a sense of collaboration and community within the institution. While evidence of this is difficult to gauge at the faculty in question, a feeling of community among the students partaking in the course was apparent. Another success of the project was evident when some students took up a voluntary leadership role in the Faculty when they requested time to speak to the larger group of students not involved in the course about the carboNZero status of the Faculty and climate change in general.

5. Benefits of a carboNZero Status

The primary benefit and justification of the Faculty participating in the carboNZero program was the reduction of GHG emissions in an effort to mitigate the causes of climate change. Initial results indicate that reductions of 16% of waste generated and 4% of electricity used (on 2007 figures) have already occurred. Along with environmental benefits, it is clear that engaging in GHG emissions reduction and offset will have significant additional benefits for the Faculty in terms of educational, research and marketing potentials. It is expected that unique research opportunities will arise from the carboNZero status. With increased monitoring and more accurate records it is anticipated that students and academic staff alike will be able to analyze results and carry out related research projects. The Memorandum of Understanding between the Faculty and Right House is also expected to herald research opportunities for both parties.

The reduction of gas use, paper use, international flights, and waste in accordance with the GHG Emissions Reduction Plan may have economic benefits over the longer term. Preparing for managing GHG emissions while it is still voluntary will also likely be less costly than waiting until institutions such as universities are regulated to take account of their GHG emissions. Improving and cementing the Faculty's reputation as a leader in sustainable design and architectural education and research may also bring additional economic benefits by attracting high achieving students and staff.

6. Recommendations and Findings

The commitment of senior management to the process was important in the Faculty obtaining carboNZero certification. The need for the team

working on the initiative to be diverse and well resourced also became apparent. Although a number of parties were involved in the process the Faculty undertook, making the coordination of the project complex, several beneficial relationships have been formed and a success of the process has been using participation in the carboNZero program as both an educational and research opportunity for students and staff.

In inviting staff in particular to participate in the GHG Emissions Reduction Planning, greater 'buy in' was thought to have occurred. Earlier discussions with staff and opportunities for involvement may have been beneficial however. People tended to be somewhat cynical of carboNZero certification if they did not understand that a plan with the aim of reducing actual emissions was in place alongside the offsetting of emissions. Many of the initiatives to reduce GHG emissions as set out in the Reduction Plan, such as adjusting boilers and improving systems for recycling were not immediately visible to staff and students, so it was found that providing progress reports is important to demonstrate that positive changes are actually occurring.

An example of the potential of 'carbon neutrality' to contribute to the curriculum has been given, however the full potential has not yet been tapped in the case of the Faculty of Architecture and Design. As the Faculty learns how to best reduce and manage its emissions, it is anticipated that students will continue to play a critical role in that, thus providing leadership and active citizenship opportunities for them. Students that participated in designing and implementing initiatives to reduce GHG emissions in the Faculty commented on the positive experience of practical engagement in reducing the causes of climate change.

It remains to be seen if the significant efforts that the Faculty have and will go to in reducing GHG emissions will result in a net reduction of GHG emissions. Initial results look promising however and illustrate that working to reduce GHG emissions is a long term and ongoing process. The carboNZero status lasts only for one year and can only be extended if a reduction in emissions is demonstrated and if the Faculty purchases more carbon credits to offset emissions for 2008. If offsetting does not continue, emissions reduction planning can simply go on alone.

The opportunity taken to become leaders in addressing climate change in the built environment sends a clear signal to students, staff and the public alike that working towards mitigating the causes of climate change is considered to be important by Victoria University's Faculty of Architecture and Design. It suggests that tertiary institutions can play a significant role in addressing climate change both immediately in terms of reducing negative operational impact, but also over the longer term through the thoughtful education of the next generation of building and design professionals.

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End Notes:

- 1 In 2007, 68% of all electricity available for purchase by consumers in New Zealand was generated from renewable sources including hydro, wind, geothermal, and biomass. (Statistics New Zealand, 2008).
- 2 GHG Emissions Inventory Report and GHG Emissions Reduction Plan are available from the author or from: www.victoria.ac.nz/home/about/CarbonNeutralFaculty.aspx