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Ecological Sustainability in Australian Industrial Design Education

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Introduction

There is no more need to debate on the need for sustainable design. The consequences of our unsustainable patterns of production and consumption, which used to be heralded as uncertain fiction in decades past, are now part of our everyday experience: in the air we breathe, the waters around us, the climate change, and so on.

Industrial designers – by allowing themselves to play active roles in a culture of premature product obsolescence, product proliferation, and mass material consumption – are often blamed in the environmental crisis (Fletcher & Dewberry, 2002). In one of the world's most widely read book on design, *Design for the Real World*, Victor Papanek (1971) censured industrial design as being one of the most harmful of professions. The paradox is that: industrial designers are both the problem and the solution (Yang & Giard, 2001).

Industrial designers play a significant role in seeking out alternative solutions to the wasteful lifestyles of contemporary society, and in influencing positive change through the creation of more responsible goods and services. And yet, there can be no responsible design without a responsible designer (Findeli, 2001), so design education should be redirected to the development of an ethical designer, one who could rethink and radically design out design that delivers environmental problems (Fry, 1993). Indeed, design education for sustainability can help usher a promising future by transforming the industrial designers of tomorrow.

This conference is opportune for addressing the issue of integration of sustainability aspects in design education for several reasons. Next year will be the commencement of the United Nations Decade of Education for Sustainable Development, which is a chance and a challenge for educators of all stripes to reorient their teaching, research, and community outreach towards sustainability. Another motivation is the Talloires Declaration, the ten-point sustainability and environmental literacy action plan to which university leaders worldwide are committing their institutions (300 signatories in 40 countries so far), which includes “ensuring that all university graduates have the awareness and understanding to be ecologically responsible citizens” (ULSF, 1990). In Australia, the Adelaide Declaration mandated that all students should “have an understanding of, and concern for, stewardship of the natural environment, and the knowledge and skills to contribute to ecologically sustainable development” by the time they leave school (MCEETYA, 1999).

So how has the design education community responded to these challenges? Is ecological sustainability now sufficiently integrated within industrial design academic programs? Do studio projects engage students into long-term visioning into the environmental implications of their design outcomes? Does mainstream studio thinking include the minimization of ecological impacts of the products and systems that are created? Are academics and students adequately informed of strategies for ecological product development, and if they are, do they apply those in their design endeavours? Are students provided with opportunities for imagining solutions that foster sustainable behaviours of production and consumption? Are environmental aspects considered along with traditional design criteria in assessing student works? Do graduates exit university with a sense of responsibility towards promoting sustainable design?

Various design education surveys and studies done elsewhere in the disciplines of

architecture (Fowles et al, 2003), engineering (Nguyen & Pudlowski, 1997), interior design (Elliott, 2004; Metropolis, 2003) and mixed design disciplines (Metropolis, 2002) have generally shown that sustainability issues are hardly penetrating into core design programs. Among American industrial design educators, only 12% reported ecodesign to be integrated in some fashion in their curricula (IDSA, 2001).

In 2001 industrial designers from around the world declared that “industrial design will no longer regard the environment as a separate entity” and that “we, as global designers shall pursue the path of sustainable development by coordinating the different aspects influencing its attainment, such as politics, economy, culture, technology and environment” (ICSID, 2001). The model code of professional conduct of the International Council of Societies of Industrial Design also recognizes that a designer should “accept professional responsibility to act in the best interest of the ecology and of the natural environment” (ICSID, 1987).

To shed further light on these issues in the context of Australian industrial design education, a questionnaire using the Zoomerang® online survey software (www.zoomerang.com) was fielded to 89 fulltime academic staff in the 12 Australian universities that offered undergraduate degrees in industrial design or product design. Twenty-six academics (29%), including 10 program heads, replied, and all 12 universities have been represented by at least one respondent.

The relatively low level of response might suggest other design educators’ lack of interest on sustainability issues, but it could well be that some invited participants weren’t able to access the online questionnaires. In telephoned follow-ups to four program heads, non-receipt of the emailed invitations due to institutional security firewalls, not opening unsolicited messages, or other technical reasons have been cited.

This study recognizes that some respondent bias could be present, since ecologically passionate academics are more likely to answer than those with less interest in these issues. These survey results could thus depict a more affirmative view than what is actually the case.

Sustainability in Curricula

It appears that sustainability aspects are at least considered in most Australian industrial design curricular offerings. Only 3 respondents (11%) felt that sustainability was only marginally addressed in their program (Figure 1).

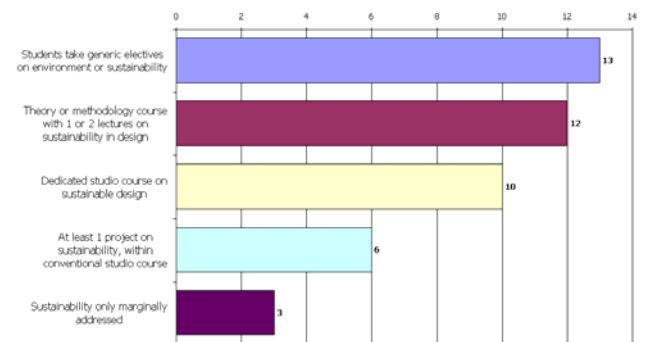


Figure 1. Extent of sustainability inclusion in Australian industrial design curricula.

Survey respondents were requested to identify which of their studio-type and lecture-type subjects covered sustainability aspects. A text analysis of course descriptions appearing on the undergraduate course handbooks of all universities was also conducted, using such search terms as “green design”, “ecodesign”, “sustainable”, “ecological” and “environmental”. There are distinctions between these terms discussed in the later part of this paper, but for the purposes of this survey, the above keywords were considered synonymous.

Details of the course identification results are found in Appendix A. In general, it was found that some of the handbook descriptions were too vague or generic, and in practice academics do deviate from the published course content.

Using the table in Appendix A, a calculation was made of the proportion of the credit points of courses which cover design for sustainability, in relation with the rest of the required program units. Courses which had the entire syllabus dedicated to learning sustainability – either as a studio subject or a lecture subject – were given the full value of the credit points. Those which cover sustainability as a portion of the syllabus were given a half value. On average, 11 out of every 100 credit points earned in an Australian industrial design program has sustainability content (Figure 2).

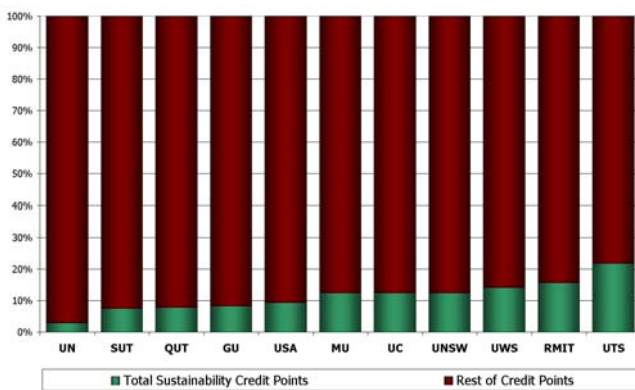


Figure 2. Proportion of credit points of courses with design sustainability content.

Half of the respondents noted that their ID students took generic electives on ecology, environment, or sustainable development somewhere in their university. These electives, often pursued within faculties of environmental, biological, chemical or social sciences, systemically examine broad ecological issues or interdependencies between nature and human society, but the course content is often not directly linked to informing design students on schemes for planning more sustainable products or services. Students’ environmental awareness and literacy are heightened by being bombarded with studies and images of a threatened future, but as designers they often have to decipher how to make sense of this mass of information and how they could in fact contribute towards providing a remedy.

An almost equal number replied that their program has built in a design theory or methodology course which includes one or two lectures discussing sustainability

aspects in industrial design, but with no design activity. These include materials and manufacturing technology subjects, as well as courses that foster debate on contemporary issues and trends in design practice.

A slightly lesser proportion (39%) stated that their programs had a dedicated “green design” studio course, where students actually generated design solutions within the context of traditional industrial design education. Ecodesign coverage may not be evident in the titles of these subjects, as most of them are titled according to the ordinal names of the studio courses. In some programs taking a string of sustainability electives earns the student a degree sub-major or minor (UTS, 2004; UWS, 2004; UniSA, 2004). The problem with elective courses is that certain groups of industrial design graduates may not have enough exposure to sustainability.

About a quarter of the respondents said that environmental issues were covered by engaging students in at least one design project focused on sustainability, within their conventional studio courses.

Sustainability in Studio Teaching

Without looking at individual briefs and outcomes it was difficult to determine the range of “green design” projects that students explored in the various university programs. The most frequently mentioned student projects were on packaging (Table 1). There was mention of final-year major projects that addressed sustainability concerns. A search of the university websites for these student projects has not been fruitful; the only one found was an online exhibition on Immaterialism (Ramirez, 2003).

Table 1. Some Student Projects with Sustainable Design Focus

- automotive • digital product replacement • domestic appliances • furniture pieces • human powered hand dryer • immaterialism & dematerialization • energy & water saving devices • kettles • lighting • packaging • physical, minicar and electric assist vehicles for Currumbin eco village • product service systems • transportation products • final year projects

Of the many strategies for designing for the environment, the one most academics used as a focus for student briefs were those addressing end-of-life concerns (design for reuse, recycling and disposal) and those addressing the distribution phase (Figure 3). These were closely followed by design using low-impact materials. The least used strategy was design for dematerialization, but only slightly lesser than the others. There is not much difference on the employment of these ecodesign strategies in studio projects.

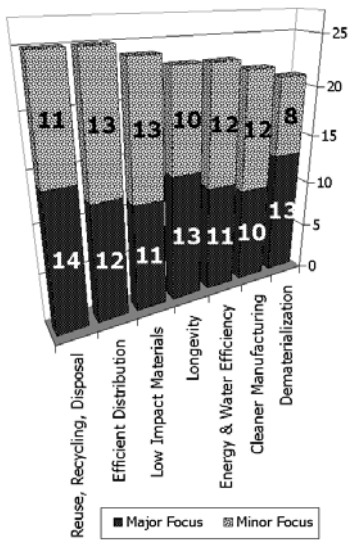


Figure 3. Focus on EcoDesign strategies in studio teaching.

In terms of the different ecodesign tools which students were required to use in their studio projects, the most frequently used were environmental impact scenarios, ecodesign checklists or rules of thumb, and simplified lifecycle analysis methods (Figure 4). It appears that ecological impact assessment software such as Simapro or EcoScan were not widely used. The MIPS, or material-intensity per service unit, was also not popular.

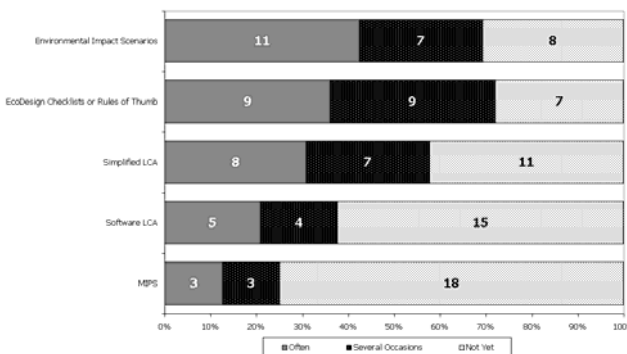


Figure 4. Requirement to use EcoDesign tools in studio projects.

Sustainability in Teacher Education

The most common mode by which Australian ID academics educate themselves on sustainable design is by attending seminars, symposia, conferences or other modes of continuing education (Figure 5).

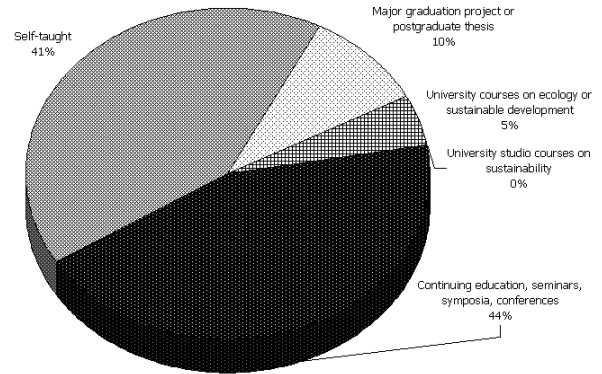


Figure 5. Modes of teacher education on sustainable design.

An almost equal number considered themselves as “self-taught” on aspects of sustainable design, citing books and magazines as their most widely used resource for self-education (Table 2).

Table 2. References used by respondents for self-education on sustainable design.

Fuad-Luke, EcoDesign Handbook • Mackenzie, Green Design • Datschewski, Total Beauty of Sustainable Products • Manzini, Material of Invention • Brezet, Ecodesign, a Promising Approach • Charter, Sustainable Solutions • RMIT, Introduction to EcoReDesign • Fry, Green Desires • Tischner, How to do ecodesign? • Papanek, Green Imperative • Lomborg, The Skeptical Environmentalist • Centre for Sustainable Design Conference Proceedings • Suzuki • Denison • Erlich • Journal of Sustainable Product Design • Mollison, Permaculture Designers Manual • Ehrig, Plastics Recycling • Keoleian, Product Life Cycle Assessment • Stahel • “Lots of Dutch books”

About 10% of respondents had the opportunity to learn by working on a final-year project or doing a postgraduate thesis on sustainable design, and an even smaller number said they were exposed through their university courses on ecology or sustainable development (but not sustainable design).

In studies elsewhere, lack of academic staff training, as well as lack of time for education, have frequently been acknowledged as the most common obstacles to integrating sustainability themes into design education (Yang &

Giard, 2001; GSDEP & FFTF, 1999; Metropolis, 2002). The Australian Academy of Design, in identifying ecodesign as one of the main issues in design education, also recognized that there is a shortage of expertise, curriculum content and training resources (Ryan et al, 1991).

It seems that design educators fall into a loose categorization of ecodesign passions. A UK study found that 1/3 of design teachers dedicated over 15% of their time teaching sustainability concepts; 1/3 said such issues occupy less than 10% of their teaching time; and the other 1/3 didn't spend any time at all. (GSDEP & FFTF, 1998)

It was thus reassuring to find that 92% of our survey respondents agreed to the statement that they were "passionate about getting students to advocate sustainability in their design endeavours" (Figure 6). Moreover, 77% considered themselves to be adequately informed about sustainability in design.

Sustainability Integration

Almost 9 out of 10 respondents agreed that sustainability should be integrated in all industrial design curricula in Australia within the next 5 years. Three-quarters disagreed when asked if sustainability issues should be discussed in detail in a separate course instead of consuming time in the regular design studios.

Respondents were equally divided when asked if evidence of ecodesign work in a student's portfolio can be a key factor in getting a job. This is not surprising, as ecodesign knowledge or understanding doesn't seem to be in the current hiring criteria of employers. A survey of leading Australian design consultancies (UC, 1998) showed that 9 out of the "top 10 skills for emerging ID graduates" were on various visual and verbal communication abilities; understanding of sustainable design principles was nowhere in the list.

Interestingly, a special report by the Industrial Designers Society of America (Siegel, 1994) listed "environmental impact" among the spectrum of 44 technical skills that the graduate needs to master to get the industrial design job that they really want. Another US survey showed that 41% of design professionals would prefer to hire a student from a school that incorporates green design (Metropolis, 2002). Thus sustainable design abilities can give a candidate an employment edge.

More respondents believed that the typical student would elect to work on a graduate project that has explicit ecological benefits, and that their ID graduates exhibit reasonable understanding of sustainable design issues.

There were slightly more teachers who sensed that environmental impacts of design proposals are assessed in studio projects, and that they give sustainability a similar value to what is normally given to form, function and other criteria. On this point it is worth noting that the prestigious international Industrial Design Excellence Awards (IDEA) weigh ecological issues on equal footing with other design qualities (White et al, 2000).

The group was equally divided on the question whether, when given an open brief, the typical student would include ecodesign criteria in evaluating his/her own concepts, such as by reflecting that "the disadvantage of my second concept is that it cannot be upgraded."

The overwhelming majority of respondents (85%) agreed that sustainability is relevant and important in most studio projects.

Respondents from only 5 universities identified an academic in their faculty who specializes in green design. Those from the 7 other institutions who didn't identify in-house specialists might not know which of their colleagues are engaged on sustainable design, or there might actually be none.

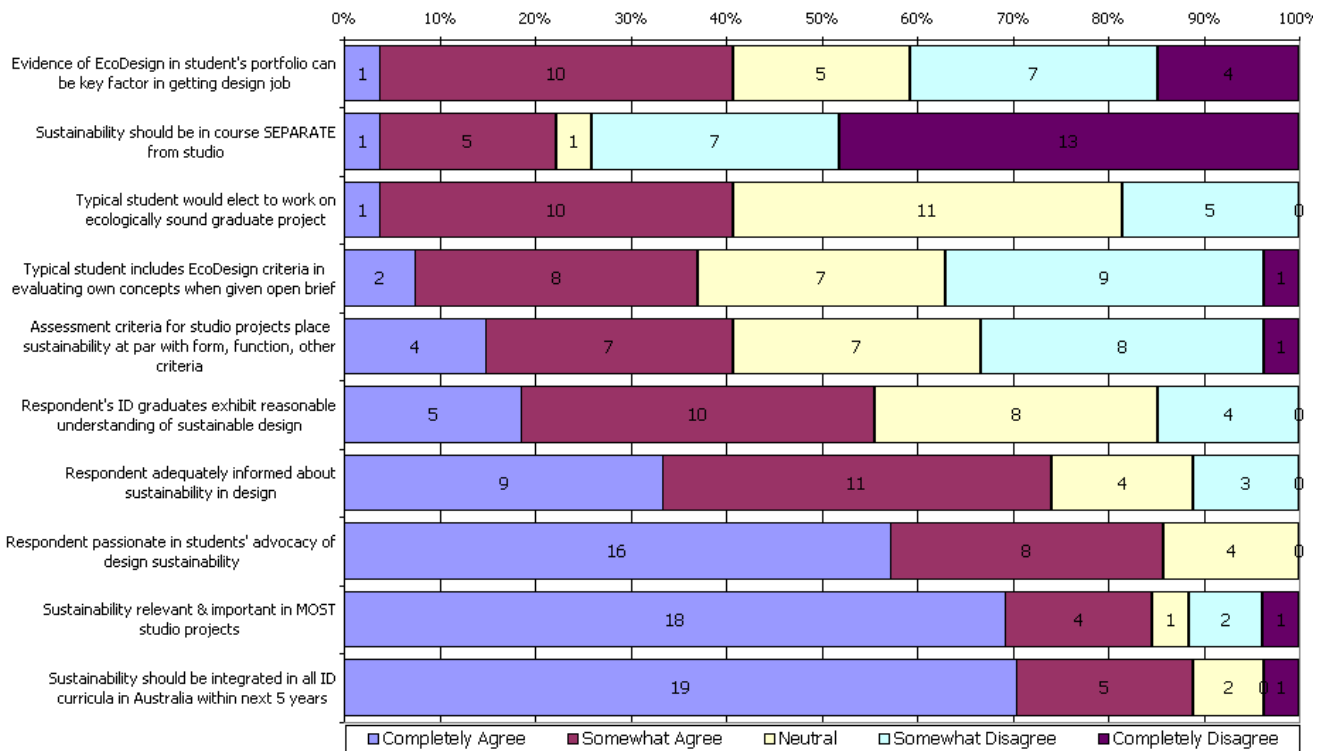


Figure 6. Academic opinions on sustainable industrial design education.

Moreover, respondents from 4 universities didn't name a research centre for sustainable design in their institution. Interestingly, a search within university web pages revealed that all 12 universities have centres for various aspects of sustainability research (Appendix B), whose activities could include design for sustainability. The lack of response might mean that no teaching, research or other working relationship exists between the industrial design program and those institutions. The works of these centres mainly benefit the external clients that fund their work, and the knowledge that they create hardly trickles down into the design schools' academic programs.

The path ahead

Having shown that ecodesign is incorporated to a minor extent in most Australian industrial design degree programs, the challenge now is to go beyond "ecodesign" into the bigger sphere of "sustainable design", of which it is a subset (Figure 7). A vision for sustainable society would be incomplete if we only look at the environmental picture (Figure 8) and ignore the social and ethical issues.



Figure 7. The relationship between ecodesign and sustainable design (Adapted from (Tischner, Dietz, Masselter, & Hirschl, 2000))



Figure 8. Building blocks for a sustainable society (Source: www.conservativeconomy.net)

Papanek (1995) observed that industrial designers tend to myopically focus on the

needs of the 20% of the wealthiest in the population, and thus neglect their social responsibilities. He calls this condition a “vacuum of conscience”, and noted that most designers don’t seem to feel comfortable with a term like “social responsibility”, considering it “somewhat of an embarrassment”.

For most of the history of industrial design education and practice, programs around the world have focused on the growth of economic capital. In the last decade we saw many designer attempts at nurturing the natural capital. In the new millenium, education should explore the enhancement of social capital in addition to the natural and the economic, thus addressing all the “triple bottomline” factors.

In the end we will all reap the fruits of our efforts: a legion of 21st-century industrial designers who acknowledge their responsibility for providing holistic and pragmatic solutions for a sustainable world. If we are able to achieve this in our lifetime as design educators, what else could we ask for?

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Appendix A. Sustainability courses in Australian Industrial Design curricula.

University	Degrees	Studio courses on sustainable design	Lecture courses on design & sustainability
Curtin University of Technology	BA Des (PD) 3yrs 600 cp		
Griffith University	B Des (PD) 3yrs 240 cp B Des Stds (PD) 3yrs 240 cp	<ul style="list-style-type: none"> ▪ Product Design 1 (10) ▪ Product Design 2 (10) ▪ 3D Design Studies 2 (10) ▪ Design Project 3 (10) 	
Monash University	B ID 3yrs 192 cp	<ul style="list-style-type: none"> ▪ Industrial Design Studio 7 (12) ▪ Industrial Design Studio 8 (18) 	<ul style="list-style-type: none"> ▪ Critical issues in design (6) ▪ Contemporary discourse in design (6)
Queensland University of Technology	B Built Env (ID) 3yrs 288 cp GradDip (ID) +1yr 96 cp	<ul style="list-style-type: none"> ▪ Industrial Design 5 (12) 	<ul style="list-style-type: none"> ▪ Design, Technology & Society (12) ▪ Human Environment 1 (12) ▪ Technology & Science Foundation (12)
Royal Melbourne Institute of Technology	B Des (ID) 384 cp	<ul style="list-style-type: none"> ▪ Design Studio 5 (24) ▪ Design Studio 6 (12) 	<ul style="list-style-type: none"> ▪ Design Studies 3 (12) ▪ Design Studies 4 (12)
Swinburne University of Technology	B Des (ID) 3yrs 300 cp B Des (ID) Hons +1yr 100 cp		
	B PD Engg 4yrs 500 cp	<ul style="list-style-type: none"> ▪ Product Design 3 25) ▪ Product Design 5 (12.5) ▪ Product Design 7 (12.5) 	<ul style="list-style-type: none"> ▪ Materials & Processes (12.5) ▪ Manufacturing Technology 1 (12.5)
University of Canberra	B ID 4yrs 96 cp	<ul style="list-style-type: none"> ▪ Industrial Design 2.2 (4) ▪ Industrial Design 3.2 (4) 	<ul style="list-style-type: none"> ▪ Design Environment (4)
University of New South Wales	B ID 4yrs 192 cp	<ul style="list-style-type: none"> ▪ ID Studio 2A (6) ▪ ID Studio 3A (6) ▪ ID Studio 3B (6) 	<ul style="list-style-type: none"> ▪ Design History (3) ▪ Materials & Tech A (6) ▪ Materials & Tech B (6) ▪ Materials & Tech C (6) ▪ ID Theory & Process (6) ▪ Industrial Design Management & Practice (6)
University of Newcastle	B Des (ID) 4yrs 340 cp	<ul style="list-style-type: none"> ▪ Environmental Design (10) 	
University of South Australia	B ID 4yrs 144 cp		<ul style="list-style-type: none"> ▪ Sustainable Design Strategies (4.5) ▪ Sustainable Futures (4.5) ▪ Design, Culture & Environment (4.5) ▪ Design Engineering B (4.5)
University of Technology, Sydney	B Des (ID) 4yrs 192 cp	<ul style="list-style-type: none"> ▪ Sustainability & Design (6) ▪ Industrial Design & Society (6) 	<ul style="list-style-type: none"> ▪ Design Ecology (6) ▪ Design & Sustainable Human Futures 1/2/3/4 (24)
University of Western Sydney	B Des & Tech 3yrs 240 cp B ID 4yrs 320 cp B ID Engg 5yrs 400 cp	<ul style="list-style-type: none"> ▪ Design Studio 2 (10) ▪ Design Studio 3 (10) ▪ Sustainable Design 3: Life Cycle Analysis (10) 	<ul style="list-style-type: none"> ▪ Sustainable Design 2: Sustainable Futures (10) ▪ Sustainable Design 1: Materials Technology (10)

Note: Figures in brackets refer to the credit points for the course. Courses in underline have been identified through the published course descriptions as having major sustainable design content.

Appendix B. Sustainability Research Units within Australian Universities

University	Sustainability Research Units
Curtin University of Technology	<ul style="list-style-type: none"> ▪ Centre for Renewable Energy Systems Technology, Australia
Griffith University	<ul style="list-style-type: none"> ▪ Centre for Environmental & Population Health ▪ Griffith EcoCentre ▪ International Centre for Ecotourism Research
Monash University	<ul style="list-style-type: none"> ▪ Monash Environment Institute
Queensland University of Technology	<ul style="list-style-type: none"> ▪ Centre for Sustainable Design (planned)
Royal Melbourne Institute of Technology	<ul style="list-style-type: none"> ▪ Centre for Design @RMIT
Swinburne University of Technology	<ul style="list-style-type: none"> ▪ National Centre for Sustainability ▪ Environment & Biotechnology Centre
University of Canberra	<ul style="list-style-type: none"> ▪ Cooperative Research Centre for Sustainable Tourism (see bottom)
University of New South Wales	<ul style="list-style-type: none"> ▪ Australian Research Council Centre of Excellence in Photovoltaics and Photonics ▪ Centre for a Sustainable Built Environment
University of Newcastle	<ul style="list-style-type: none"> ▪ Centre for Sustainable Technology (Centre for Sustainable Architecture, Building and Design)
University of South Australia	<ul style="list-style-type: none"> ▪ Sustainable Energy Centre
University of Technology, Sydney	<ul style="list-style-type: none"> ▪ Institute for Sustainable Futures ▪ Institute for Water & Environmental Resource Management
University of Western Sydney	<ul style="list-style-type: none"> ▪ Social Justice & Social Change Research Centre
Inter-university	<ul style="list-style-type: none"> ▪ Cooperative Research Centre for Sustainable Tourism ▪ Cooperative Research Centre for Water Quality and Treatment ▪ Cooperative Research Centre for Waste Management and Pollution Control