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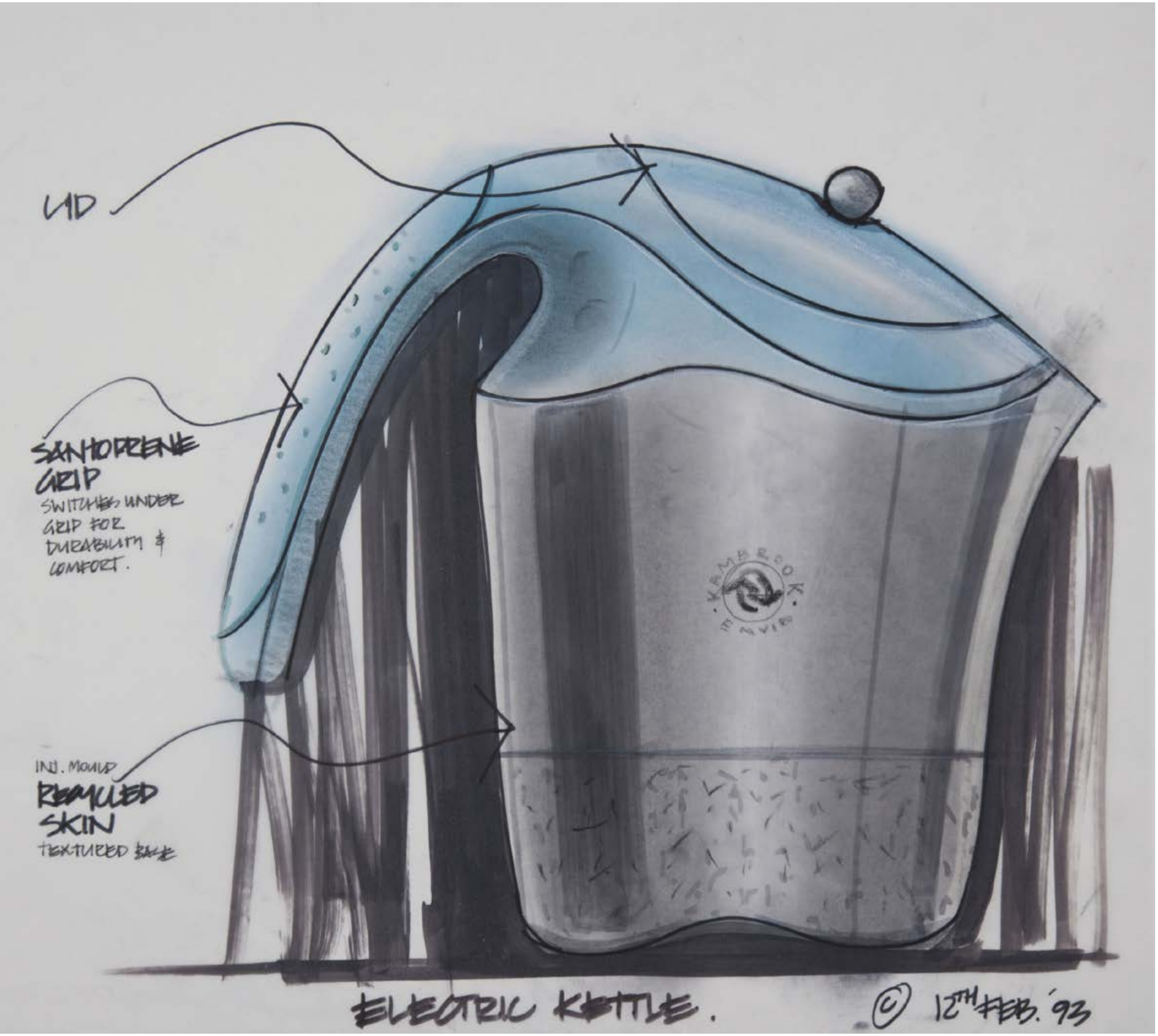
SPECIAL ISSUE

CENTRE FOR DESIGN AT RMIT 1989–2013



Cover and inside cover
Paul Taylor for Form Australia, Kambrook Axis kettle concept rendering, 1993, RMIT Design Archives collection

SPECIAL ISSUE
CENTRE FOR DESIGN AT RMIT 1989–2013

RMIT DESIGN ARCHIVES JOURNAL

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For more than two decades, the Centre for Design (CfD) at RMIT University created a significant and wide-ranging body of research that contributed new ideas about sustainable development that continues to make impacts to this day.

This ranged from hosting one of the first international conferences on EcoDesign in 1991, to ground-breaking outcomes of the federally funded EcoReDesign program, up until the closure of the Centre in 2013 when Australian Research Council and United Nations projects were completed. Throughout this journey the Centre was an evolving test-bed for novel approaches to environmentally sustainable futures. A cross-disciplinary team, who were global in their connections and leaders in the fields of social science, design, engineering, energy, environmental sustainability and building science, conducted research, consulting, and capacity building in addressing the environmental problems and opportunities that humanity faced. In doing so the Centre identified, reframed and discovered new possibilities for informed environmental decision making. Moreover, the Centre developed a strong research profile with this interdisciplinary approach and well-developed networks into industry and all levels of Government.

In this special issue of the *RMIT Design Archives Journal* we explore these issues, and uncover the impact that the Centre for Design at RMIT had on design and wider practices. In the first two articles in this issue of the *RMIT Design Archives Journal*, the broad context of the CfD is set, locally and internationally. Firstly, former directors Helen Lewis et al. reflect on some of the broader research contributions of the Centre, including eco-design methods in product development, packaging for sustainability, life cycle assessment (LCA), extended producer responsibility (EPR), green buildings and architecture.

The key attributes of the Centre are identified in; active engagement with industry, government and civil society groups to develop practical solutions based on rigorous research; inter-disciplinary approaches including life cycle thinking and a systems approach to sustainability challenges; the development of simple, easy-to-use 'tools' and training for practitioners based on academic and applied research; and, a deep understanding of the socio-economic and political processes within which design and its application takes place. The authors use these attributes to highlight some of the legacies of the Centre in research, policy and practice.

Brian Burns on the other hand provides an international perspective on the legacy of the Centre. He describes the global sustainability crisis that developed prior to the Centre's establishment, the Canadian context from which he writes, and problems that he observed throughout this journey. Burns articulates the way in which the Centre broke normal approaches to sustainability, for instance, by changing the focus from simple recycling to life cycle strategies in tackling environmental issues. Burns describes the pragmatism he experienced when on sabbatical at the Centre in 2003, where researchers dared to be 'ordinary' in solving real world environmental issues. He explains how this philosophy cut through and affected his own pedagogical practice in Canada. While Burns explores the value of LCA he also warns against a sole reliance on the technique, advocating a holistic systems approach as critical in addressing increasing environmental issues.

The following two articles focus on two key areas of CfD research, EcoReDesign and LCA. The first major Centre program of research, the federally funded EcoReDesign program, is discussed by current and former researchers, consultants and industry partners. They explain how the program came to be, and how it influenced subsequent Centre research, projects, and industry more widely. They use the cases of two ground-breaking projects facilitated by EcoReDesign - the Dishlex dishwasher and the Kambrook kettle - to demonstrate the innovation that developed through the conjunction of cross disciplinary teams, design techniques, and LCA. They illustrate how this context helped redefine the influence design could have on environmental sustainability problems at the time. The short-term successes and failures of these projects are reflected upon, as are the longer-term industry based impacts, so that both lessons learned and innovations realised become clear.

Life Cycle Assessment, the core environmental analysis technique used by the Centre, is explored by Karli Verghese et al. who examine the role that the researchers at the Centre had as LCA pioneers and ambassadors both locally and globally. Achievements include establishing the first LCA professional training courses and conferences in Australia; undertaking the first LCA of kerbside waste management in Australia; developing the first guides on green buildings; playing a leading role in the development of the first global commercial packaging-specific LCA decision support tool – PIQET; and consolidating their LCA expertise with its application in Antarctica. These novel approaches demonstrate the impact that the LCA work and advocacy has had on industry and government.

The articles in this special issue of the *RMIT Design Archives Journal* collectively demonstrate the lasting legacy of the Centre as one of Australasia's formative nodes of activity on environmental methods, management tools, and practice, particularly in the fields of EcoDesign and LCA. Through strong international links, the Centre contributed to global research and institutions that generated best of class products, services, systems and policies. Inherent in this was the accumulation and application of new knowledge in novel techniques, emerging trends, imminent policies, regulatory guidance, as well as new corporate directions in sustainability innovation.

More specifically, Centre research lives on in the groups that evolved throughout its operation. Sociologically based research about sustainable lifestyles, practices and communities continues to flourish under the auspice of Cecily Maller, Yolande Strengers, and Larissa Nichols at the RMIT Centre for Urban Research (CUR), led by Jago Dodson. For close to a decade Chris Ryan has led propositional and sustainability futures work at the Victorian Ecoinnovation Lab (VEIL) at the University of Melbourne. LCA, strategy, packaging/ food supply chain, and innovation research thrives with Karli Verghese and Simon Lockrey at the RMIT d___LAB in the School of Architecture and Design, the pair often teaming up with Enda Crossin in the School of Engineering. Usha Iyer-Raniga, Andrew Carre, James Wong, and Mary Myla Andamon continue to investigate sustainability in the built environment at RMIT Sustainable Building Innovation Laboratory (SBi Lab), as does Dominique Hes at Melbourne School of Design at the University of Melbourne. Ralph Horne leads research in the College of Design and Social Context at RMIT as Deputy Pro Vice-chancellor. As the Centre's work continues to live on in these guises, and be recognised internationally as leading the development of environmentally based design methodology, the impact created may indeed continue to affect the way we look to sustainable futures now, and for many years to come.

Simon Lockrey and Karli Verghese
Guest Editors

REFLECTING ON THE CENTRE FOR DESIGN'S CONTRIBUTION TO RESEARCH AND PRACTICE

Helen Lewis, John Gertsakis, Ralph Horne, Chris Ryan

Introduction

In the period 1989 to 2013 the Centre for Design (CfD) at RMIT University played a nationally and internationally significant role in leading innovative responses to environmental sustainability imperatives. Key contributions include the development of eco-design thinking, tools and practices across many disciplines; the development and application of decision support tools for life cycle assessment (LCA) and whole of life environmental sustainability outcomes; and innovative approaches to sustainable building design, construction, affordable housing, and carbon neutral communities. The legacy of this period is evident in the ongoing careers of those who have been involved in the Centre, and in the many policy and practice innovations that have emanated from it and that continue to influence sustainability outcomes today.

This paper reflects on some of CfD's research contributions—eco-design methods in product development ("EcoReDesign"), packaging for sustainability, life cycle assessment, extended producer responsibility (EPR) and green buildings and architecture. Each of these highlights the characteristics that have made the Centre so influential:

- active engagement with industry, government and civil society groups to develop practical solutions based on rigorous research;
- inter-disciplinary approaches including life cycle thinking and a systems approach to sustainability challenges;
- the development of simple, easy-to-use 'tools' and training for practitioners based on academic and applied research; and
- a deep understanding of the socio-economic and political processes within which design and its application takes place.

We begin with a brief introduction to the Centre's origins in the late 1980s and early 1990s under the leadership of its founding director, Chris Ryan. The CfD's research in the areas of product design, packaging, LCA, EPR and green buildings is then discussed to highlight some of the legacies in research, policy and practice.

Origins

The Centre for Design was established in May 1989 as a National Key Centre for teaching and research. Its mission was broad: "To encourage and develop the role and application of design and designers in industry, government, academia and the community to achieve beneficial economic, social and environmental outcomes for Australia". Its goals included constructing a program of applied research on the changing context of design and new design methods, and encouraging industry to achieve sustainable development through collaborative applied and analytical research.[1]

The Centre was established in response to a number of developments. Globally there was a recognition in academic and policy circles that design could add significant value to goods (and later services), and the Federal Government was keen to capitalise on this. Soon after the election of the Hawke Labor Government in 1983, Industry Minister, John Button, held a design summit in Canberra. Promoting design as essential to export competition, Minister Button announced that design and industry would be a priority research focus for Australian Research Council (ARC) centres of excellence in education and research.

RMIT created the Centre as a formal entity with only a director and one task, which was to seek ARC funding. While the ARC received numerous bids from other universities, RMIT's bid was the only one that included environment as a major driver of design along with other elements including materials, technology, computing etc. This proved to be advantageous at a time when the Greens were becoming influential at a political level. Whilst the applications were being assessed in 1989, five Green candidates were elected to Tasmania parliament, causing huge political ructions. Chris Ryan was later told privately by a senior public servant in Canberra that the RMIT bid (formally an ARC decision in consultation with the Minister and his department) seemed like a political gift.

Building a National Framework for Eco-design

During its first few years CfD was involved in several high profile initiatives that helped to raise awareness and build a national framework for eco-design activity in Australia. An internally-funded research project called "Design for Green" was an important first step. This aimed to identify and evaluate the opportunity for Australian goods and services to become more internationally competitive through attention to environmental design; develop a database of related information and case studies; develop a systematic approach to eco-design; and to use this information as the basis for further research and design projects at CfD.

This research resulted in the publication of a "market intelligence report", *The greening of the international market: challenges for design and industry*,[2] that was widely distributed to industry and government stakeholders. A shorter version of the paper was also published in *Design Studies*,[3] thus "introducing environmental imperatives to the academic design community".[4]

The greening of the international market helped to raise awareness amongst industry and government about the value of design for environment as "a sophisticated approach to how environmental impacts could be avoided and minimised within a context of innovative design, responsible business growth and exploiting competitive advantage".[5] From a practical perspective it included the first eco-design "decision tree", which reflected interviews with participants in a series of workshops. According to Ryan this was a global first, a systematic methodological approach to design for environment, introducing a life-cycle perspective (but not life cycle assessment). On the basis of the publication, Ryan was appointed as an international member of the board of a new European Eureka program (a Europe-wide Network for Industrial Research and Development) on eco-design that commenced in 1992.

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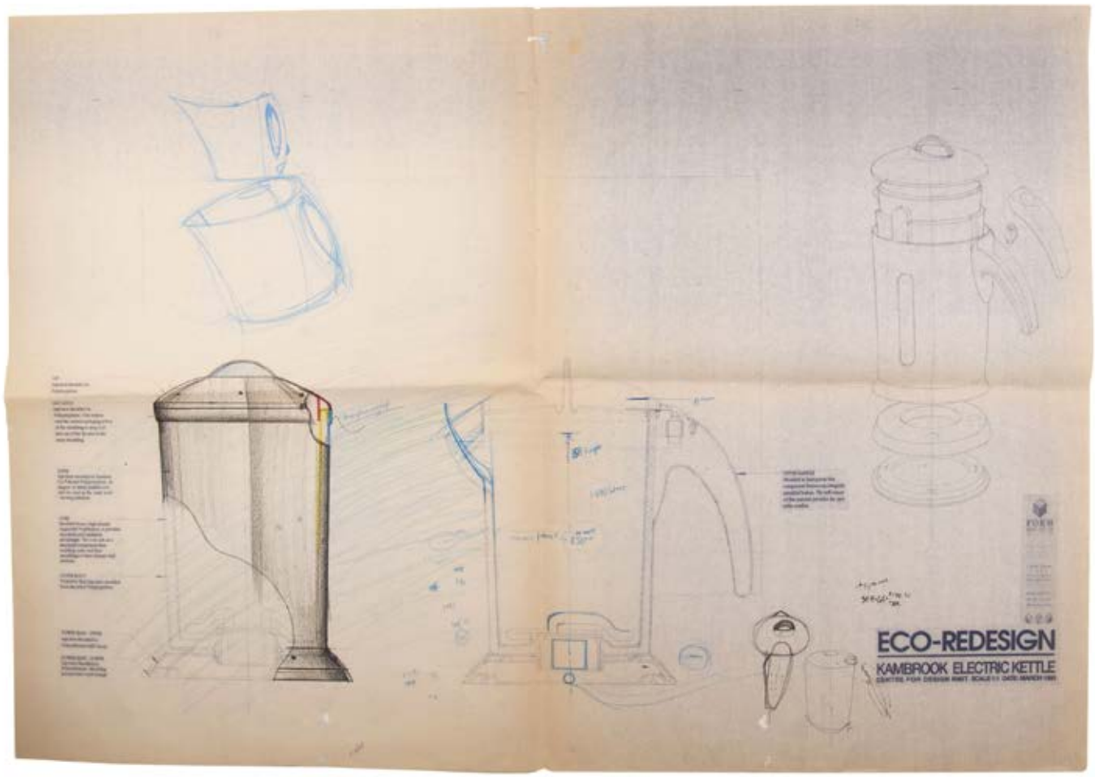
Domus Academy promotional posters, 1991-94, Chris Ryan collection

Opposite
Paul Taylor and Gerry Mussett for Form Australia, Kambrook Axis kettle exploded and section drawings, 1993, RMIT Design Archives collection



The first Australian conference on eco-design was jointly hosted by CfD and a government agency, the Australian Commission for the Future, in 1991. One of the conference aims was to set the agenda for a national eco-design strategy and it attracted high profile international speakers and over 300 participants. The distinguished US author, educator and responsible design advocate, Victor Papanek, delivered the keynote and set a proactive tone for ongoing eco-design action in Australia. In his introductory comments Ryan suggested that while the term "eco-design" was already well in use overseas, "as far as we know this is the first international eco-design conference in the world".[6]

The "Design for Green" research program and EcoDesign 1 conference expanded CfD's networks in government, industry and the community and helped to position it as the country's leading advocate and research group on eco-design. They also laid the foundations for future research projects, particularly the EcoReDesign demonstration program.

Design Education and the Design Industry

Although it is the CfD's reputation within the broad "design for sustainability" field that has underpinned its international standing, this success can be seen in retrospect to have been built from a fundamental core of more general research and professional programs aimed at extending and deepening the design sector in Australia. At its core, this work focused on professional training of designers in industry and practice, undergraduate and post-graduate education and research in universities and at TAFE level. This was the stated purpose of the ARC funding of the Centre.[7]

In the first year of the CfD, an international search for global collaboration identified a Milan research and post-graduate institution, the Domus Academy (DA), a private education and research institute founded from the magazine of the same name, and a network of programs in the Netherlands linking their national organisation for applied science (TNO) and the faculty of industrial design engineering at the Technical University of Delft (TUD).

Agreements made in 1989 by the CfD director saw the evolution of cooperative programs between RMIT and DA and TUD/TNO. The latter became central to the CfD EcoReDesign program. The Domus collaboration led to a suite of conferences and an annual professional design event known as the Australian Domus Winter School presented by the CfD for five years from 1991.

The Domus Winter Schools

These were two week-long (later reduced to one-week) events that paralleled a Milan international summer school that was part of the DA program. Each Winter School was attended by 30–40 professional designers and design academics from Australia and Asia; each school explored a disruptive trend in design innovation that was identified by DA and the CfD as significant to the global development of design as a profession and in its contribution to the economy. Participants worked with internationally known designers, architects and academics associated with the DA. Amongst those were: Michelle di Lucchi (1991), Clino Trini Castelli (1991); Ezio Manzini (1991;1993), Anna Castelli Ferrieri (1992), Mario Trimarchi (1992; 1995), James Wines (1993), Mario Bellini (1994), and John Thakara (1995).

Attendees and sponsors of the Winter Schools included design practices that later were central to the EcoReDesign program and also companies such as Schiavello, Email (later acquired by Electrolux) and Caroma and others that participated in the program. Important industry bodies (such as the Plastics Institute of Australia) and state and federal government agencies, including the City of Melbourne, the Australia Council, the National Industry Extension Scheme, industry departments of the States of New South Wales, Victoria, Tasmania and Western Australia, became sponsors of the Winter Schools.

From 1991 to1996 the Winter School program was co-ordinated by Gini Lee, now professor of landscape architecture at the University of Melbourne. This huge financial undertaking was under-written by the Australian and Victorian Governments' commitment to an industry training levy (in place from 1990 to1996), through the Victorian Education Foundation.

Design Education in Australia and the Academy of Design

During the years of the DA/CfD Winter Schools a national strategy for design was emerging, with a National Design Summit held in the old Australian Parliament House, Canberra, in 1989, the creation of the Australian Academy of Design (as an elected peak council to advise government policy, 1992-1998), the reframing of the Design Board of the Australia Council and a design export program (Design Australia) to build the business of Australian design in Southeast Asia. The CfD was represented in all those developments, particularly with a focus on shaping appropriate design education and research. CfD input included framing of the education and research section of the annual Singapore Design Conference from 1992 to 1994 (organised with a new government body, Design Australia) and the first national review of design education in Australia for the Australian Government, commissioned through the Academy of Design[8]. In the first half of 1990s, RMIT and the CfD became a de-facto national hub of the debate about university design education focused strongly on some of the recommendations from the national review. Unsurprisingly, with that context the participation of Australian TAFE and university design programs in the Winter School grew.

Other programs initiated by the CfD, related to the broad education and research agenda, included: A "Designers in Schools" program (funded by the Australia Council and supported by both the Design Institute of Australia, the Australian Graphic Design Association and the Royal Australian Institute of Architects); a new professional Masters in Design program at RMIT; and, an international review of National Design Centres in the UK, Europe, the USA and Singapore, conducted by the Director for the Victorian Government (unpublished Report 1992). Work on appropriate curricula for design education and research at universities also continued with some collaboration with the UK Open University and in 1996 the CfD director was commissioned to review the design research program of the UK Design Council.

EcoReDesign

The EcoReDesign (ERD 1) demonstration program (1993 to 1997) was based on similar programs in Europe and adapted to suit Australian design a nd manufacturing. It was supported by grants from Environment Australia (now Department of Environment) and ARC, with contributions from participating companies. Seven companies were involved: Southcorp Whitegoods, Kambrook, Email Major Appliances, Caroma Industries, NIDA Technology Group, Schiavello Commercial Interiors, Blackmores and Zoom Systems (formerly Imaging Technologies).

The research team at CfD, supported by industrial design consultants including Form Australia and Blue Sky Design, provided companies with the know-how required to design environmentally improved products with reduced life cycle impacts. The highly collaborative teams also included environmental specialists with extensive knowledge in energy efficiency, water conservation, plastics recycling and waste avoidance. Experts such as the late Deni Greene, the late John Millar, Alan Pears and Edward Kosior, played an important role in critically assessing eco-design concepts, as well as developing product ideas and environmentally sound features. The role of inter-industry-academic collaboration and knowledge transfer, was at the core of every demonstration project and the Centre's ERD methodology. The research outcomes were publicly disseminated through A Guide to EcoReDesign.[9] This was followed by the ERD 2 program (1998 to 1999), a company assistance program targeting small to medium-sized firms. A typical company assistance project involved a scan of the life cycle impacts of their products, a workshop with company staff and external specialists, and follow-up research.[10]

The ERD program had a number of important legacies. Some of the people involved in the individual projects assumed a champion role within their company and continued to promote environmentally sensitive design. Through positive media coverage and conference presentations, it also raised general consumer and industry awareness of greener products. From CfD's perspective, it laid the

foundations for future work on life cycle assessment (LCA), packaging sustainability and eco-design methods. Several of the researchers involved in the ERD project later published a book, *Design + Environment: a global guide to greener goods*, [11] which was used as a textbook for eco-design courses in Australia and elsewhere, was translated into Italian, and remains in print.

Life Cycle Assessment

In the mid-1990s researchers at CfD were amongst the first LCA practitioners in Australia.[12] Marjolein Demmers brought her practical LCA experience and knowledge from Europe to the program. Tim Grant, now one of Australia's most recognised LCA consultants, and Karli Verghese built on this work to establish the Centre's LCA research program.

Through the first decade of the new millennium the LCA capability and breadth of research grew and CfD became the hub of LCA expertise in Australia. In 2005, the incoming Director, Ralph Horne, came to Australia from the Resources Research Unit at Sheffield Hallam University, a key life cycle energy analysis research group in Europe. At Sheffield, Horne and his colleagues had conducted life cycle energy studies on biomass energy technologies for the UK Government and the EU Framework programs 5 and 6. In the years 2005 to 2009, the Centre for Design's LCA program researchers demonstrated pioneering leadership in LCA research in Australia, by:

> leading the integration, development and sharing of inventory initiatives both nationally and internationally, with key LCA clearing houses in Europe such as Pré Consultants;

> conducting a range of reference LCA and material analysis studies for the Commonwealth Government, State agencies, and for private sector firms and peak bodies, across a wide range of sectors including; built environment; packaging and logistics; food, water and agriculture; biofuels and biomass energy technologies; appliances; and waste and recycling;

> developing a range of 'quick LCA' tools and approaches to bring LCA decision-making closer to the beginning of design and decision-making processes;

> sharing developments, knowledge and learning through regular conferences, workshops and dissemination fora, including Australia's first book on LCA[13] and networking that ultimately culminated in the establishment of a new professional body, the Australian LCA Society (ALCAS).

CfD LCA staff including Karli Verghese, Enda Crossin, Simon Lockrey, Andrew Carre, James Wong, Mary Myla Andamon and Ralph Horne and others remain at RMIT in new roles, and continue to utilise LCA methods in various ways: Verghese and Lockrey use LCA in on-going packaging, food, product and waste studies in the School of Architecture and Design; there is also a group in the Sustainable Buildings Lab in the School of Property, Construction and Project Management, and Crossin in the School of Engineering. More broadly, the legacy of LCA research in the Centre for Design continues through initiatives such as ALCAS, and the staff and researchers who worked there, many of whom continue to conduct LCA studies in Australia and beyond. Others have taken LCA to new audiences through their ongoing teaching and research.

Extended Producer Responsibility and Product Stewardship

As a result of the Centre's work on eco-design and LCA, it was acknowledged that new policies and regulatory instruments were also required to eliminate or minimise product-related environmental impacts. The policy principles emerging from Europe in the early 1990s were being transformed into EU directives for end-of-life vehicles, electronics and batteries, and their relevance to Australia was obvious.

The Centre's work on EPR and product stewardship rapidly transformed into stakeholder research, guidance documents and pilot projects, all of which collectively aimed to highlight the environmental and commercial benefit of manufacturers taking greater responsibility for their products at the post-consumer stage. Indeed, the genesis of Australia's journey towards EPR for electronics can be directly traced to a landmark report authored by John Gertsakis and Chris Ryan titled "Short circuiting waste from electrical and electronic products", which investigated the status of electrical and electronic waste and the implications of extending producer responsibility in the Australian context.[14] This was followed by a number of other key EPR and stewardship-related projects initiated and executed by the Centre.[15]

These research and pilot project outcomes contributed directly and indirectly to the ongoing development of product stewardship solutions for electronics in Australia, especially in collaboration with individual manufacturers, e-waste recyclers and key associations like the Consumer Electronics Suppliers Association (CESA). In collaboration with CESA, Gertsakis – a former acting director of the Centre – established Product Stewardship Australia (PSA), which became the primary industry advocate for the creation of the Product Stewardship Act (2011). At the time, PSA represented major global brands such as Sony, Sharp, Samsung, LG, NEC, Sanyo, HiSense and many other television manufacturers. Through this regulatory instrument, Australia now has the National Television and Computer Recycling Scheme, which requires television and computer brands to provide a national take-back and recycling scheme for unwanted equipment. Following the introduction of the legislation, Gertsakis was appointed to the Federal Environment Minister's Product Stewardship Advisory Group. Another former Director of CfD, Helen Lewis, collaborated with manufacturers, retailers, recyclers and government agencies on take-back and recycling solutions for batteries through the Australian Battery Recycling Initiative (ABRI).

Packaging Sustainability

CfD researchers have helped to drive a new approach to packaging design in Australia. This has been achieved through a combination of industry engagement, applied research, training and a LCA-based assessment tool (PIQET).

Packaging research began with the ERD program, when CfD worked with Blackmores to develop a more environmentally sensitive packaging alternative for its beauty products (skin and hair care). Having already redesigned their plastic bottles to be more recyclable – they were now manufactured from PET, a material included in kerbside collection programs – the company wanted to look at the redesign of their polyethylene and polypropylene tubes so that these could be recycled as well. The resulting packaging concept involved a reusable outer pack and a recyclable inner.

This packaging concept was significant because it shifted the design focus away from recycling and towards a more holistic view of life cycle impacts, which identified alternative strategies to reduce packaging waste (a combination of lightweighting and reuse). In the early 1990s, the emphasis of packaging debates in Australia and elsewhere, was still on the need to recover as much packaging as possible through kerbside collection programs rather than to redesign packaging to minimise waste using a total life cycle approach. The Centre played an important role in promoting life cycle thinking and ecodesign, and as part of the ERD 2 program published guidelines for specific product groups including packaging.[16]

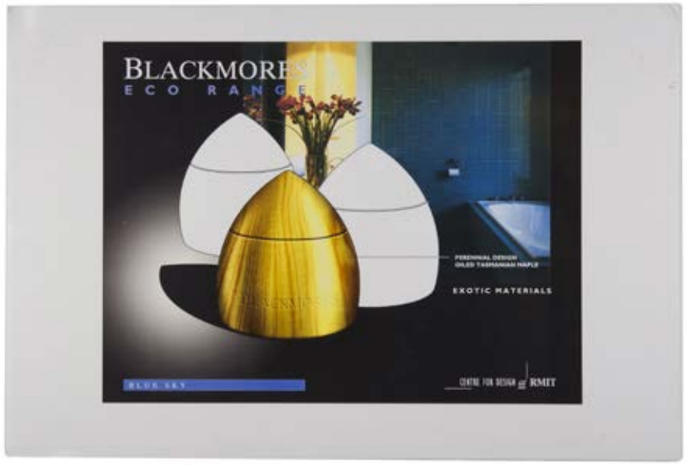
In 2001 CfD helped to establish the Sustainable Packaging Alliance (SPA) in partnership with Victoria University and Birubi Innovation Pty Ltd. Its aim was to build skills and knowledge in packaging sustainability through an integrated approach to research, education and training. There were four key areas of activity:[17]

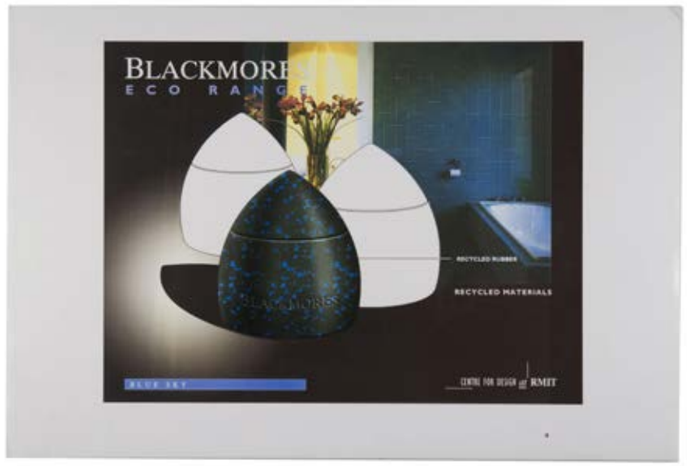
> underpinning research to create a vision and benchmarks for packaging sustainability;

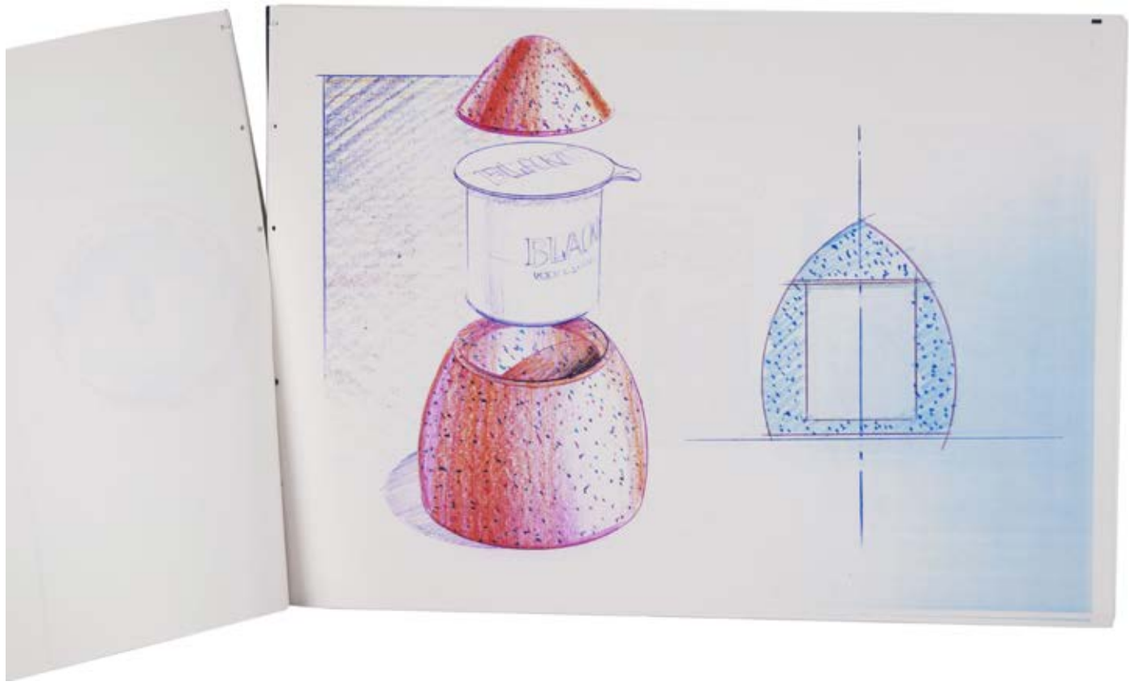
> stakeholder engagement to identify research and training needs and build business understanding of sustainable packaging solutions;

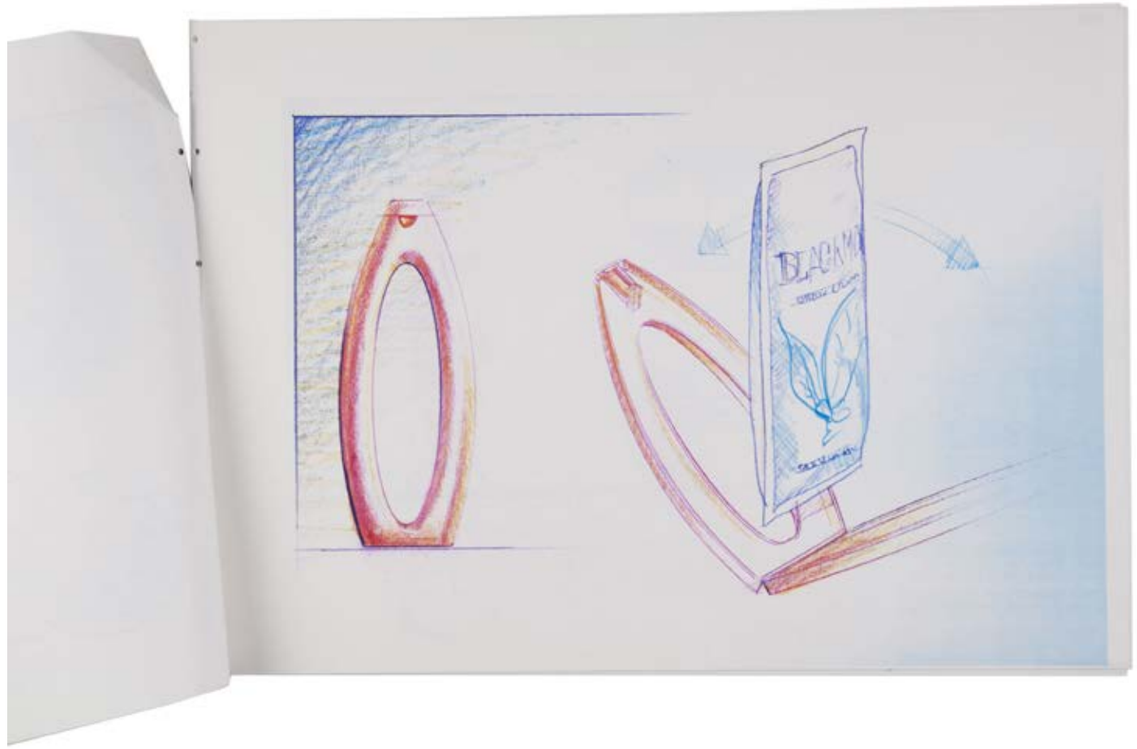
> industry training courses to build the capacity of practitioners in industry to design more sustainable packaging solutions;

> development of tools and methodologies to facilitate design and assessment of packaging sustainability.









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Mark Armstrong for Blue Sky Design, Blackmores packaging concept renderings, 1993, RMIT Design Archives collection

Opposite page
Mark Armstrong for Blue Sky Design, Blackmores packaging concept hand sketches, 1993, RMIT Design Archives collection

Underpinning research included analysis of the packaging sustainability discourse[18] and development of four principles for packaging sustainability - effective, efficient, cyclic and safe.[19] These principles informed the development of sustainable packaging guidelines for a national industry stewardship initiative, the Australian Packaging Covenant, in 2005. Stakeholder engagement was undertaken through quarterly round tables that combined presentations, panel discussions and workshops on particular topics. These were well attended by representatives from the packaging supply chain, government, consultants and academia. Two-day training courses in Australia and New Zealand also proved to be popular, because they combined theory and practical strategies for design.

One of SPA's most successful outcomes was the Packaging Impact Quick Evaluation Tool (PIQET). Participants in SPA round tables identified the need for an easy-to-use LCA tool for packaging developers who needed a fast way of evaluating or comparing packaging concepts. The project, led by Verghese at CfD, received seed funding from five manufacturers (Nestlé, Cadbury Schweppes, Lion Nathan, Simplot and Master Foods), Sustainability Victoria and the Federal Government. It was co-designed with packaging technologists and sustainability managers from the industry partners to ensure that it would meet their needs. The first prototype was released to the partners in 2007, and the online version was commercialised in 2008.

PIQET[20] was the first commercialised packaging-specific streamlined LCA tool on the global market, although others have been released since that time. In 2009 SPA became a not-for-profit company and took over the management of PIQET under a licensing agreement with RMIT, Victoria University and Birubi Innovation. The research outcomes for RMIT have included over ten journal articles and book chapters, numerous conference presentations in Australia and internationally, as well as an ongoing income stream from royalties.

Green Buildings and Architecture

Early attempts by the CfD to extend its eco-design product success to the built environment and architecture had only sporadic success. In 1995 the federal department of Industry Science and Tourism commissioned the CfD to conduct a national study of building waste in the housing construction industry.[21] In 1996 a CfD conference, Architecture + Green, was held at RMIT that tried to highlight the greening of architecture as a new and important field for creative innovation. In spite of presentations from local and international architects and engineers already making a name from work in that domain, take up within the Australian architecture profession remained weak.

By 2001, climate change and the attendant urgency for carbon mitigation was coupled in the growing policy discourse with recognition around the poor energy efficiency of Australia's building stock. Some blamed the architects, others the regulators, yet others the builders – and the rest blamed the market and consumers. Across this blame game, there were three camps: the first arguing for the private sector to step up; the second arguing for regulation; and, the third arguing for both. In the event, the most significant move that was to transform the high end office buildings of Australia emerged in 2002, with the formation of the Green Building Council of Australia (GBCA).

The GBCA was a voluntary private sector-led initiative that also recognised the critical role of regulation. It deliberately involved a founding coalition of designers, builders, developers, peak bodies, regulators – and a University: RMIT Centre for Design. Richard Sebo of CfD was Chair of the GBCA education committee – an influential and highly innovative arm of GBCA recognising that there was a whole range of professions to coax along a building revolution. Other CfD staff were quickly brought in to provide technical research on Green Star tools development, a core mechanism for rating proposed new buildings. CfD began designing and delivering 'Green Build' conferences and training events that were packed with practitioners as CfD staff struggled to keep up with demand. In parallel, tools were developed to specify green materials (e.g. Ecospecifier) and assess the relative stringency of building codes. Later, CfD Director, Ralph Horne, was to serve on the GBCA Board of Directors providing the independent academic voice into this vibrant and innovative organisation.

In 2005, CfD led a national study for the Federal Government to compare housing energy efficiency codes in the USA, UK and Australia, as new "5 star" building code provision were being debated. The study roundly dispelled the myths being propagated by laissez-faire opposition to regulation (e.g. Demographia and the HIA). Instead of piling costs onto buildings, the study showed that even with improved regulation Australia would still be behind the western world. The regulations were introduced, the world survived, and the implementation costs were close to zero; and once again CfD research was influential in a major step-change in improving environmental performance of Australia's buildings.

From environmental and energy efficiency in new housing, research expanded into various typologies, tenure, scale, age and locations; and into both production and consumption of housing. "Re-imagining the Australian Suburb" heralded a suite of projects examining the social, economic and environmental consequences of current urban development in existing cities, in the middle ring, and on the outer edges of cities. A series of Australian Research Council funded projects, followed:

> "Carbon Neutral Communities – Making the Transition". (LP0775120) - mapping energy demand, renewable energy resource potential, and action research with households on behaviour change; this led to setting up the 'Beyond Behaviour Change' research group centred on social practices and sustainable consumption;

> "Lifetime Affordable Housing in Australia: Integrating environmental performance and affordability" (LP0776834) - integrated life cycle costing and environmental performance assessment of housing options; redefining housing affordability for policy and regulation of sustainable housing; and

> "More than a Roof Overhead - meeting the need for a sustainable housing system in remote indigenous communities" (LP0883615) - development of design, consultation, building and evaluating socio-economic benefits of housing provision in Indigenous communities.

The legacy continued following the reformation of the CfD in 2011 with two further ARC grants on housing (LATCH: "Lifetime Affordable and Tenable City Housing", LP130100008 and "Project HOME: Housing Outcomes Metrics and Evaluation", LP150100089). The quest for sustainable housing also led to two Australian Housing and Urban Research Institute (AHURI) projects on housing production; *Understanding the patterns, characteristics and trends in the housing sector labour force in Australia, and Current labour processes and management of subcontractors: impacts on productivity in the housing construction industry.* Both investigated the capacities of the housing construction industry to build sustainable housing.

Two other strands of work were significant nationally and internationally. The first was housing retrofitting for sustainability, and CfD provided a range of research, advice, tools and guidance for governments and householders on the environmental and cost benefits, including both sustainable renovations and environmental upgrades such as PV domestic systems which subsequently mushroomed nationally in associated with various initiatives. The second was community scale research including social capacity and responses to climate change. Both NCARF and VCCCAR funded projects on design-led solutions for regional climate adaptation; a socio-technical study of resilient urban systems; and climate adaptive practices. VicHealth also funded a 5-year fellowship on *Community Development and Residential Planning: Studying Life at Selandra Rise*, which highlights both the difficulties facing new communities on the urban fringe in accessing services and jobs, and the challenges facing timely provision of amenities and services in these master planned estate developments.

Reflecting on CfD's Contributions to Research and Practice

In numerous ways, CfD was at the forefront of innovative practice in responding to the environmental challenges across Australia between 1989 and 2013, when it morphed into three new research Centres at RMIT (the legacy continues). From eco-design thinking and tools, EPR and product stewardship strategy; to research and analysis on the built environment, packaging, products and systems; to social change, behavioural change and low carbon socio-technical transitions, CfD has provided an independent, trusted and rigorous yet practical and accessible stream of expertise to the many environment stakeholders across the Australian community.

One of the Centre's most important contributions over the past 25 years has been to demonstrate, in very real and practical ways, the role of design in helping to shape more sustainable systems for production, consumption and the built environment. The importance of CfD can be recognised in its contribution to the establishment of another research and education centre at Melbourne University. After the end of the ARC-funded phase of the CfD, there were various initiatives to reframe its objectives for the coming years. Various drafts for the possible evolution of the Centre circulated during 1996-1999 following a series of strategic planning processes. In 2004, this thinking was revived by Chris Ryan who had returned to RMIT from his post as Director of a Swedish research institute. One of the past proposals, for a new Australian Centre for Environmental Design and Innovation (ACEDI), alternatively called the Australian Centre for Eco-Design and Eco-Innovation, was submitted to an RMIT process to establish new domains of research headed by 'Innovation Professors'. This was not successful, but the ACEDI idea came to the attention of a team conducting an 'innovation review' for the Victorian state government. Melbourne University responded to that review with a proposal for a centre that was announced in the 2005-2006 environmental action statement of the government. That centre became known as the Victorian Eco-Innovation Lab (VEIL: www.ecoinnovationlab.com).

Ryan (now the Director of VEIL) based the vision for VEIL on the concept presented in the prospectus for ACEDI. ACEDI was to be a Centre spanning teaching, multi-disciplinary research and community engagement, directed to "the overriding challenge of the 21C": How to end global deterioration of ecosystems and still expand economic opportunities for billions of people who lack an acceptable standard of living.[22] ACEDI was to focus on eco-innovation for "new products, new systems, new urban infrastructures and new businesses". Post-graduate education linked to design research would target the core environmental issues of water, energy, greenhouse gas production, waste, land, food and urban systems. That still describes the objectives of VEIL's work today.

From 2006 to 2009, State Government funding to VEIL explicitly provided resources to enable a collaboration between the design schools and design-research centres of RMIT, Monash, Melbourne and Swinburne Universities. For that short period there were joint multi-university design studios that brought final year and post-graduate students and academic staff from the four universities to collaborate on design and eco-innovation research. The spirit of the Domus Winter Schools lived on. VEIL's current focus on cities and urban resilience developed from that period of collaborative activity.

The policy and cultural context in 2016 is very different from other periods of CfD's operation. While there are climate-change sceptics and naysayers in Australia, debates about climate and environmental concerns have nevertheless matured and design for sustainability in all its forms is becoming more mainstream. This raises questions about future research priorities and what a CfD equivalent research centre might look like in 2020. Notions about sustainability have broadened beyond environmental concerns to include social and cultural ideals such as living local, stronger communities and ethical cities. The idea of a circular economy is transforming environmental strategies such as resource efficiency and recycling into economic priorities for government policy makers and industry alike. All of these trends provide an exciting framework for future research at RMIT.

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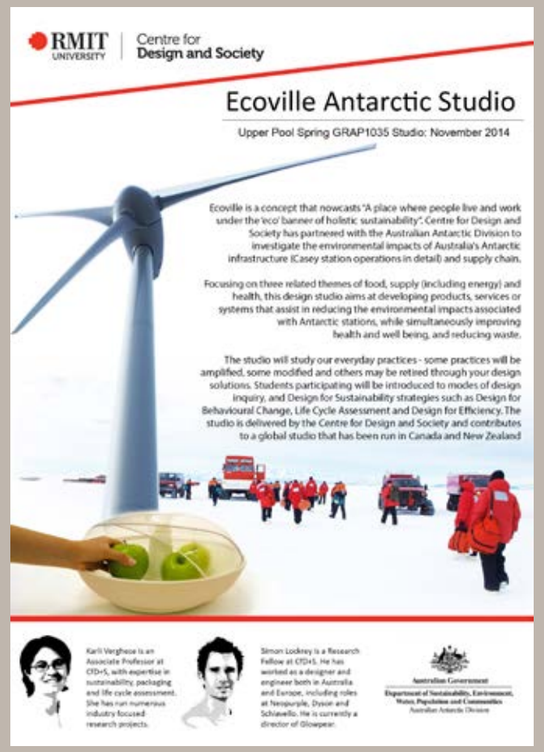


DARING TO BE ORDINARY ON A FINITE PLANET AND HOW THE CENTRE FOR DESIGN IS HELPING

Brian Burns

Our knowledge of science and the technology that accompanies it continues to grow at an extraordinary rate. The average person is today surrounded by technology that enables them to live more comfortably than ever before yet carries with it increasing complexity that continues to separate the user from any fundamental understanding of the environmental implications of their lifestyle.

With such an increase in technological growth, it is not surprising that we are growing increasingly concerned about our potential to prosper and survive in the long term, along with a growing desire to promote connection; to restore an understanding of the way the world works; to help make our extraordinary achievements more understandable. This article will briefly review some of the key events that have influenced our understanding of potentials of our finite planet and that "daring to be ordinary" might well be one of the less heralded, yet more significant, contributions of the Centre for Design.

In the late 1960s the first photographs of the planet we call Earth were taken from space. The NASA astronauts who took those early photographs, and the many more that soon followed, commented that the sight of the Earthrise over the Moon was almost a religious experience. Our little blue planet appeared perfect and clean and quite distinct from so many of the other spheres in our sky.

While there had been rumblings of environmental concerns prior to the late 1960s, from the work of Rachel Carson[1] for example, our planet was to that point our oyster; perceived to be almost infinite while we relentlessly pursued our thirst for growth and resource use. The peoples of the so-called developed parts of the world found it relatively easy to throw energy and resources at every need or problem; in order to remove drudgery and to move our lives from concerns for survival and safety to those of convenience and comfort, and on to luxury, decadence, and beyond.

It is somewhat ironic that the most successful civilisations have ultimately faded to glorious memories. The ancient Egyptians, Greeks, and Romans all met their demise predominantly because they couldn't contain themselves in a sustainable manner.[2] In the late 1960s the industrial society of the 20th century was showing no signs of slowing down, in fact it was accelerating at a remarkable rate. Population growth, resource use, and the search for oil and energy were all at the heart of our desire to improve the quality of our lives. This period could perhaps be identified as a time in which tasks were mechanised for convenience, after all isn't a car just a more stable, protected, self-powered bicycle? And all while 95% of total output pollutants were attributable to the production related to new technologies.[3]

In *Small is Beautiful: Economics as if People Mattered*, E.F. Schumacher[4] wrote of the importance of primary technology, for example, the basic hammer and the ordinary wood clad pencil, while society ambitiously exploited more and more advanced technologies. Few were listening while he stressed the importance of finding appropriate technology; a concept not yet contemplated in the chase for bigger, better and easier.

So at the start of the 1970s, industrial society had built up a great deal of momentum. Even the global GNP and GDP economic systems, so important to measure growth, were geared to reflect activity rather than efficiency. "Getting people to make something to earn money to buy something that someone else had made" seemed to be the dominant way to create wealth, and, for the people who made the things, to share in the creation of that wealth; a simple but entrenched example of how our infinite-world-thinking habits were not appropriate for our finite planet.

All this is likely very familiar to the reader, and today, these same issues have escalated leading to the realities of climate change and global warming, with carbon trading strangely seen as part of the solution[5]. Perhaps the best analogy to our progress since the 1970s is that of a large oil tanker: uniquely designed with basic functionality to slowly go with its precious cargo, not to lubricate, but to power our energy consumptive lifestyles. As with our current ways of life, oil tankers are very hard to slow down and not easy to turn around. So, with so much momentum, it has proven very difficult to make drastic changes to our global ways of life in the 40 or so years that have followed, especially since most people's lifestyles rely on the oil tanker holding its slow steady course, and the basic question must be asked: Is the development of cheap clean energy a possibility, and if it is, would it slow down or accelerate our current concerns?

Opposite page
Simon Lockrey and Stephen Clune, posters for RMIT Industrial Design Program 'Towards Ecoville' design studios, 2012-2014, Simon Lockrey collection

While our progress to date in generating appropriate environmental awareness and activity has been broad, it has achieved limited success. Today there are many doom and gloom scenarios, for example, James Lovelock.[6] Our best hope is that we soon learn to live sustainably on our planet with the current myriad adverse influences under resilient control without suffering the effects of regional, national or global panic.

In its early days the Centre for Design at RMIT University was just one small important voice searching for ways of understanding manufacture, design and the environment, with Life Cycle Analysis (LCA) slowly emerging as an appropriate weapon of choice. But here lies the dilemma. How can such a small group make an important difference?

First we have to go back a little further. In the mid 1950s the term "man-made" [7], coined at the beginning of that century, was starting to be called into question. Could mankind really be smarter than nature? Perhaps. Even Buckminster Fuller envisaged a large glass dome over New York City[8] while the early 1960s US cartoon series 'The Jetsons' played with the notion of life in the space age.The last thirty years of the 20th century proved that we clearly are not smarter than nature. Perhaps this realisation started with the OPEC oil crisis of 1973, when a buyer's market suddenly became a seller's market. There was still a great deal of momentum, but shortages in supply due to industrial growth in Southeast Asia were becoming common, and we are continually being reminded of just how powerless we are against increasing numbers of natural disasters.

Drought is one such global concern, and in Australia much has been learned in the past 20 years or so. Out of all the efforts to facilitate adequate water supplies came an interesting concept, the four-minute shower, the maximum time it should take to cleanse your body. Not simply reliant on low-flow shower heads and instant water heaters, but a simple means to communicate a sense of social control over behaviour. After all it is human behaviour that has helped modify this beautiful planet in ways that today question our survival; so this ordinary way to help us modify our behaviour was a significant start and the products we choose to use will always have the potential to reflect our behaviour and influence it in good and bad ways.

The oil crisis hastened the development of improved fuel efficiency, and lengthy droughts brought significant measures of reduced water use, grey water, and the storage of rainwater. However, the dominant ways that global societies have risen to the challenge of the need to become eco-sustainable have been predominantly from the back end, from the symptom. Faced with a problem of pollution and toxic waste, we have usually tried simply to clean up the mess. While the impacts on the environment due to leachate from our landfills meant that landfills were capped and lined, therefore made a little more efficient, more and more waste was still being created. As part of this process we popularised the term "recycling" to divert waste from the landfills, all so that we could carry on doing what we were doing before. Knee-jerk reactions; much needed, but largely symbolic.

Against this backdrop Life Cycle Analysis was still slowly emerging, primarily from the energy industry, but a long way from being a useful tool, and who knew how to use it effectively anyway? How could the concerns we faced be quantified without stagnating the growth and industrial development essential to our economic prosperity?

When the first desk top computers were introduced towards the end of the 20th century they were largely successful in replacing typewriters, but they also offered the promise of organised memory, and two new terms were introduced: "hardware" and "software". It is hard to believe that the comprehension of the new world of personal computing was focused initially on just two new words, a far cry from the fast changing proliferation of the hi-tech jargon we hear today, but an interesting parallel. The term "recycling" also represents a particular time in history, but, like "hardware" and "software", we are beginning to evolve more subtle and specific terms. Words like "reduce" and "re-use" are commonly adopted, but are largely inadequate in changing the habits and lifestyles that many of us enjoy. As a consequence we now need more useful language alongside holistic thinking, and the term "recycling" is at best not a very useful umbrella term.

On the one hand the environmental movement can perhaps be thought of as an extension of the ways of life originating in the 1960s, which promoted more primary technological alternatives heralded later by Schumacher. The lessons offered have not proven to be easily adoptable by mainstream society. However, they were perhaps an early indicator that we needed a more ubiquitous and useful vision, and in the last decades of the 20th century there were many renowned voices whose slides and images illustrated danger and despair; offering the first images of far off scarred landscapes and toxic pollution. Unfortunately these strong messages usually failed to inspire, and commonly provoked responses of paralysis. The challenges were just too big. What can anyone do?

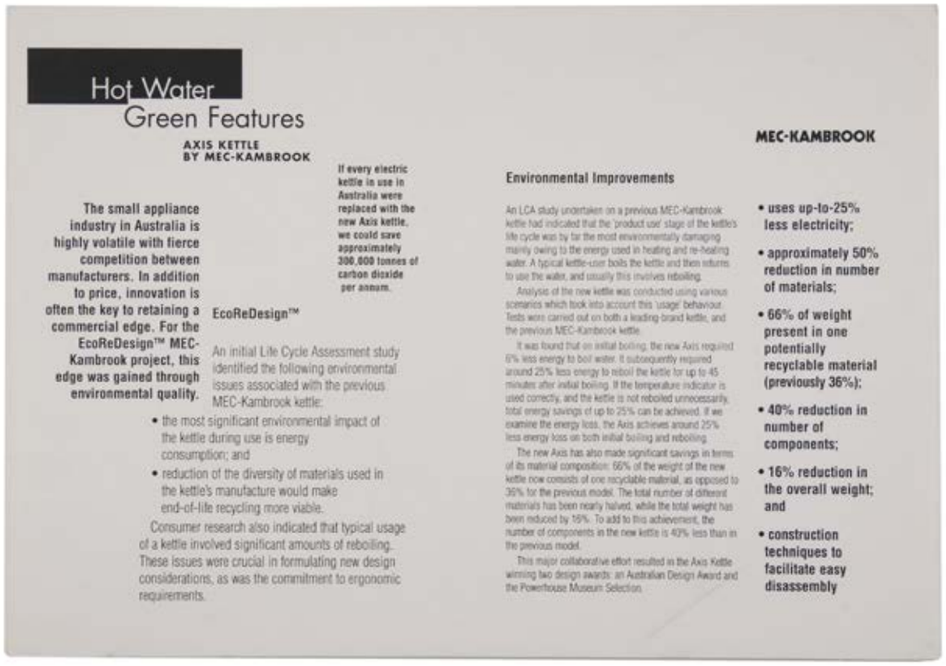
Joseph Coates once wrote: "What do I do Monday morning differently from what I have done in the past? . . .the moralist offers no moral guidance other than "be good. Only the saints can get by on that advice".[9] Society, it appears, needs simpler messages, and the messages coming from "the messiahs of doom" were somewhat unsuccessful. The challenge of spreading the word became a little competitive as to who exactly had the truth; preaching the bible of eco-sustainability became quite a competitive business.

The seeds of the Centre for Design were still being sown. The United Nations, the Club of Rome, Friends of the Earth, the newly formed Green parties were all emerging, and the public were starting to listen, keen to find something good that they could do, next Monday, as long as it did not cost too much. Organic foodstuffs were quick to emerge, offering healthier nutrition, and many were prepared to pay a little more for the benefits, but there were also less positive developments.

Greenwashing is today understood to indicate a product that purportedly is "eco-friendly", but either is not or perhaps offers only a small environmental benefit. However, the invention of the term 'greenwashing' is also an ironic indicator of our progress. It is almost inevitable that many manufacturers would try to take advantage of the environmental movement. As a consequence, the success of greenwashing is an unlikely positive indicator of the large number of people who want to do better; who want to contribute to the need for environmental sensitivity; who want to do something different next Monday. Greenwashing could not have been as successful if it were not for a growing public desire to do better, to be better connected. At the time of writing, Canadian television carries advertisements for a new recycled battery containing 4% recycled material.[10] How is the average consumer supposed to understand the pros and cons of such an offer? At face value the new battery uses more recycled material than other batteries. Perhaps it is at least a place to start, assuming it is cost competitive.

Such is the dilemma facing consumers today, and while many want to know more about the production and contents of the products they buy, it is not easy. Buying groceries could take all day if we had to check every fact and figure, bypass any greenwash potential, and get the stuff home before the "best-before-dates" have passed. In essence, buying "green" is somewhat of a further symptomatic response to a major concern.

As our realisation of the importance of environmental issues has grown, more and more people, groups, industries, and countries have begun to try to change their attitudes to climate change, resource use and the concept of growth. Many kinds of organisations are trying to play their part: energy industries are planning for alternative and renewable sources; international agreements are being made and sometimes kept; international standards are making progress against a world of guidelines; we have resource managers, increasingly effective consumer groups, and far more widespread "green" politics alongside an array of ways of considering carbon. At the highest of levels, plans and policies are slowly being formed. But there is a vast chasm



Hot Water Green Features

AXIS KETTLE BY MEC-KAMBROOK

The small appliance industry in Australia is highly volatile with fierce competition between manufacturers. In addition to price, innovation is often the key to retaining a commercial edge. For the EcoReDesign™ MEC-Kambrook project, this edge was gained through environmental quality.

If every electric kettle in use in Australia were replaced with the new Axis kettle, we could save approximately 300,000 tonnes of carbon dioxide per annum.

EcoReDesign™

An initial Life Cycle Assessment study identified the following environmental issues associated with the previous MEC-Kambrook kettle:

- the most significant environmental impact of the kettle during use is energy consumption; and
- reduction of the diversity of materials used in the kettle's manufacture would make end-of-life recycling more viable.

Consumer research also indicated that typical usage of a kettle involved significant amounts of reboiling. These issues were crucial in formulating new design considerations, as was the commitment to ergonomic requirements.

Environmental Improvements

An LCA study undertaken on a previous MEC-Kambrook kettle had indicated that the 'product use' stage of the kettle's life cycle was by far the most environmentally damaging mainly owing to the energy used in heating and re-heating water. A typical kettle-user boils the kettle and then returns to use the water, and usually this involves reboiling.

Analysis of the new kettle was conducted using various scenarios which took into account this 'usage' behaviour. Tests were carried out on both a leading-brand kettle, and the previous MEC-Kambrook kettle.

It was found that on initial boiling, the new Axis required 6% less energy to boil water. It subsequently required around 25% less energy to reboil the kettle for up to 45 minutes after initial boiling. If the temperature indicator is used correctly, and the kettle is not reboiled unnecessarily, total energy savings of up to 25% can be achieved. If we examine the energy loss, the Axis achieves around 25% less energy loss on both initial boiling and reboiling.

The new Axis has also made significant savings in terms of its material composition: 66% of the weight of the new kettle now consists of one recyclable material, as opposed to 36% for the previous model. The total number of different materials has been nearly halved, while the total weight has been reduced by 16%. To add to this achievement, the number of components in the new kettle is 40% less than in the previous model.

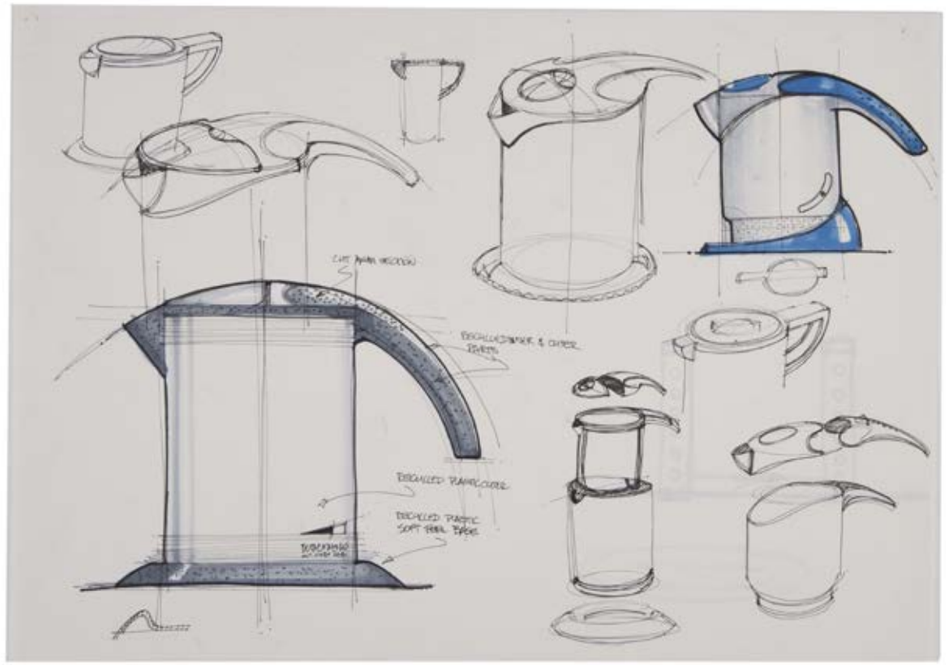
This major collaborative effort resulted in the Axis Kettle winning two design awards: an Australian Design Award and the Powerhouse Museum Selection.

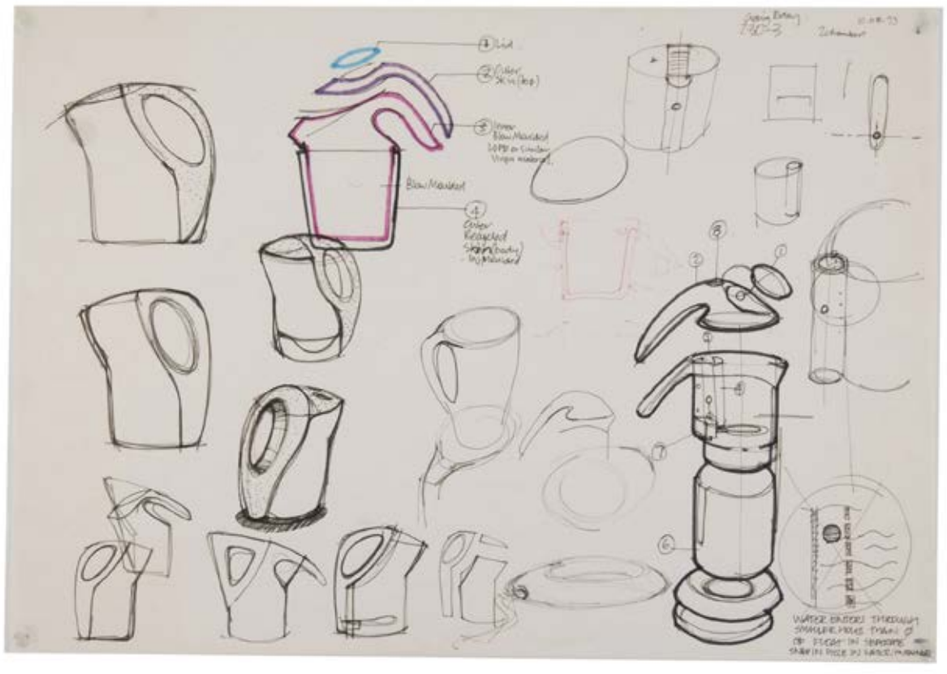
MEC-KAMBROOK

- **uses up-to-25% less electricity;**
- **approximately 50% reduction in number of materials;**
- **66% of weight present in one potentially recyclable material (previously 36%);**
- **40% reduction in number of components;**
- **16% reduction in the overall weight; and**
- **construction techniques to facilitate easy disassembly**

Top
EcoReDesign Newsletter, Volume 2, Number 2, 2003, RMIT Design Archives collection

Below
Paul Taylor and Gerry Mussett for Form Australia, Kambrook Axis kettle concept computer generated and hand renderings, 1993, RMIT Design Archives collection





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Paul Taylor for Form Australia, Kambrook Axis kettle concept sketches, 1993, RMIT Design Archives collection

Below
Paul Taylor for Form Australia, Kambrook Axis kettle concept thumbnail sketches, 1993, RMIT Design Archives collection

between international policy and its concepts of wealth creation and the day to day activities of the ordinary consumer.

Long ago, the members of the Centre for Design realised that we can hardly recycle ourselves to eco-sustainable prosperity; the term "recycle" is too limited. Terms like "recover", "down-cycle", "up-cycle", "cradle-to-cradle thinking" were emerging, but were not easy to make sense of, and, around the turn of the last century, from across the continents, including some interested people in Canada, there came an important awareness of the work going on in Melbourne.

Life Cycle Analysis was now maturing as the first holistic tool to be able to look at the overall impacts of any product throughout its life. However, in its very short lifetime LCA had been heavily abused. Incomplete analyses offered numbers based on dubious data, and were being used by all manner of companies to justify all manner of products. Practitioners were competing to create data bases accompanied by unique forms of software. LCA was by and large seen as expensive, inaccurate, and too susceptible to manipulation. LCA was off to a bumpy start. While there were stories from Germany related to successes in automotive production, and the Green Dot program initiated in 1995 was making headway, real tangible benefits were hard to find.

At that time I was teaching a course called "Product Life Cycle Analysis" in the Department of Technology Society and Environmental Studies at Carleton University in Canada. It was a non-mathematical course trying to influence the environmental perceptions of 4th year undergraduate students from a range of disciplines. At the same time a colleague was working for a large telephony company trying to evolve the concept of an environmentally friendly telephone. It was an uphill battle, but word had come of the design of an environmentally appropriate domestic kettle coming from the Centre for Design in, of all places, Melbourne, Australia.[11] That little project was, in many ways, world changing.

The project was the design and analysis of a simple domestic kettle. I assume readers are familiar with the project, if not, look it up in the accompanying articles in this special issue of the *RMIT Design Archives Journal*. For now I would like to explain why it was significant.

Water and hot water are primary needs for today's society. The first scientific exercise that I undertook, as a young student, was to watch and monitor the boiling of water in a glass beaker. For many people water is sometimes thought of as the next gold, and for good reason. It would be an understatement to say that water is a very important resource to all of Australia. *What do I do next Monday different to what I did last Monday*? What better product could there be to consider than the domestic kettle?

Kettles used to boil water continuously on fires and cast iron stoves. Many still whistle on gas rings and more modern electric stoves. Early electric kettles, perhaps the first countertop appliances, were large and solid. Traditionally the only part to fail would be the heating element, which could easily be unscrewed and replaced. A domestic electric kettle could potentially last generations. In the year 2000 the average life of domestic appliances was reducing globally[12]. The period after the Second World War had seen that everyone in the advanced countries could now aspire to have all the appliances they needed. Domestic drudgery was planned to soon become a thing of the past. Every product was thought of as trusted and mature; simply plug them in, straight out of the box and push the button. Kettles no longer whistled using the natural steam created by the boiling water, but turned off automatically, which was good as long as you were there to notice. For most of the world, kettles, like every other small appliance, were getting cheaper and cheaper, usually un-repairable, designed to match the aesthetics of the kitchen and, as a consequence, disposable at their end of life. But energy costs were starting to rise as plastics made the moulding of alternative shaped kettles possible. Large elements need to be covered with a lot of water, and suddenly the concept of just boiling a small amount of water was possible and desirable.

The most ordinary of products, part of every kitchen, easy to understand, and with the potential to deal with all aspects of Life Cycle Analysis and its assessment, the choice of the domestic kettle made perfect sense. In this one exercise LCA became a perceivably viable tool, and many people around the world struggling to make sense of the potential of LCA as part of eco-sensibility, took notice.

At that time I had been teaching industrial design with a strong concern for its environmental implications for over 20 years. My early research was focused on the factors affecting the life of consumer durables, and I was realising that every object or product that I was trying to help be designed, is full of information about values, lifestyle, materials, use, energy, culture and more: information that could connect with everyone. I have often challenged students to consider how they would explain an everyday product to an intergalactic alien, even a simple Australian Rules football would take a great deal of time to explain.

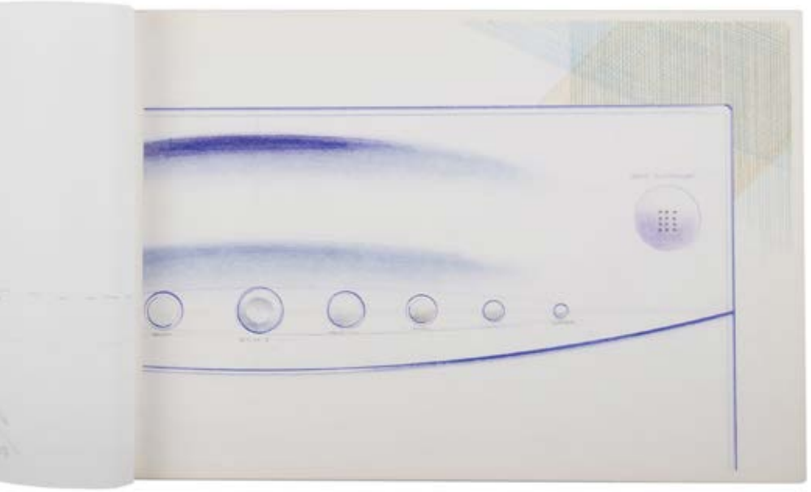
In 2003 I was lucky enough to spend a six month sabbatical at RMIT University with the opportunity to engage with the Centre for Design and the Industrial Design Program in the School of Architecture and Design. I taught a little, was involved with projects, ran a couple of courses, and observed what was going on. At that time members of the Centre were branching out, moving elsewhere in Melbourne and Australia. Visitors like me were welcomed, and I was struck that, in contrast to many North American and European counterparts, the Centre for Design was open, honest and unassuming. Just as with that electric kettle, the Centre was daring to be ordinary; tackling a range of real problems in a real and somewhat unglamorous way.[13] Unfortunately that approach doesn't attract much outside glory and attention. During that time I attended an LCA conference and was impressed by how the practitioners were sharing their growing knowledge in undertaking complex LCAs. Many years previously I had the pleasure of listening to Barrington Nevitt speak at a conference in Ottawa.[14] He impressed me with his explanation of why he liked to attend such conferences; for him it was a chance for everyone to share their ignorance. That LCA conference in Melbourne displayed that same approach.

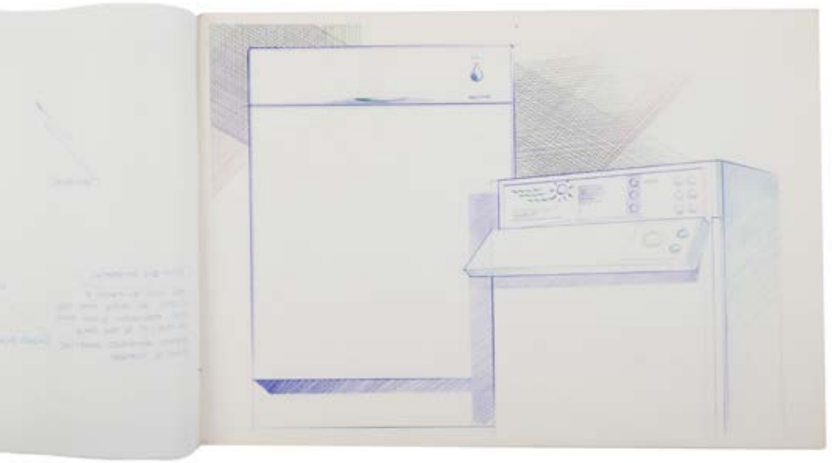
A few years later I was back in Canada planning a project for final year industrial design students. Instrumental in the concept was probably that kettle study. The project was called "Towards Ecoville", and challenged the students to design for a place where everything we did was understandable and environmentally responsible – trying to do "healthy things in healthy ways". The project lasted eight months and students were asked to use "now-casting", a notion that I had quickly invented to challenge them to design only using what is known to be possible, since too many such projects have commonly failed to be very useful due to inaccurate or barely supportable predictions for the future. The project produced products representing a range of everyday activities from cooking to cycling and from packaging to furniture. The project was certainly challenging for the students who were used to designing futuristic concepts or more commonly trying to satisfy the wishes of industry. It was also a challenge for many of the faculty in my department. However, not surprisingly, the concept was embraced by members of the Centre for Design. The project has since been undertaken at RMIT, in New Zealand, Sweden, and, apparently, the Antarctic.

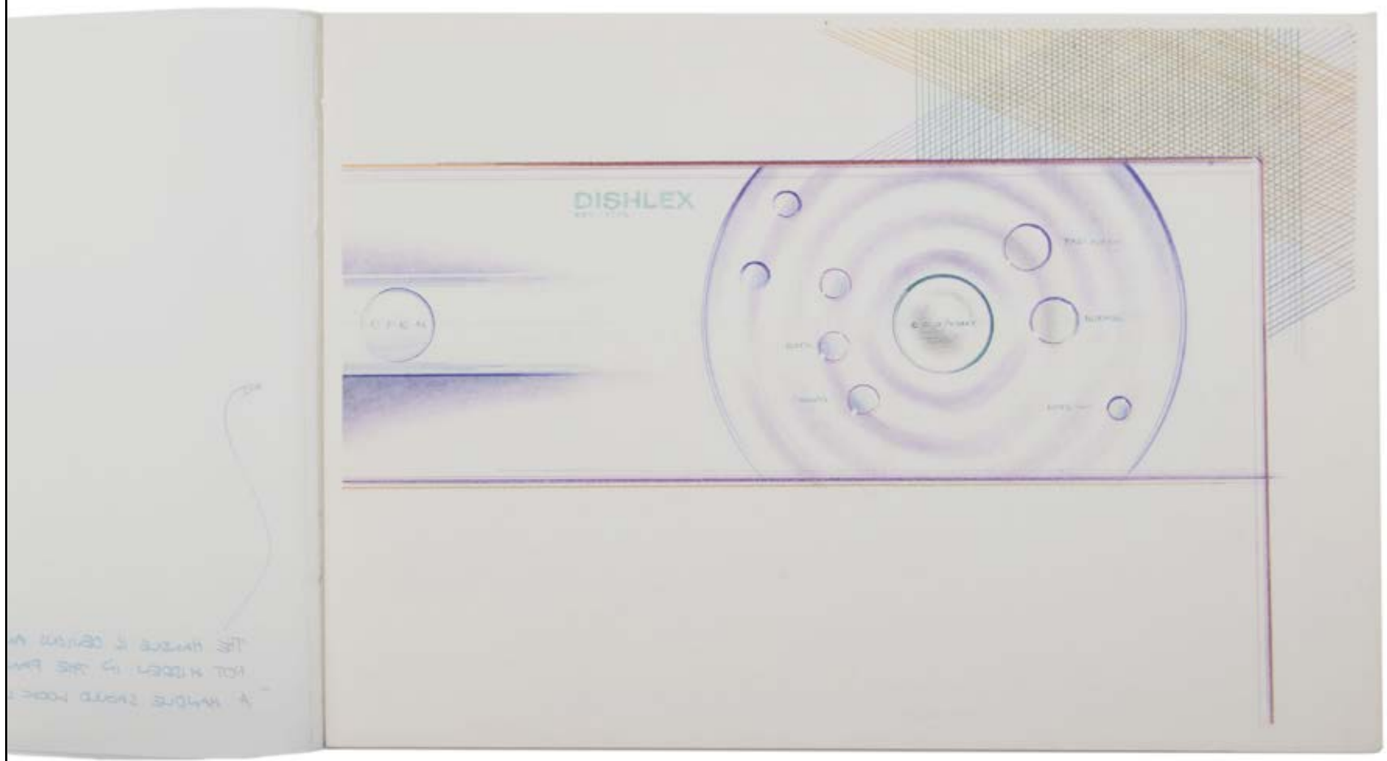
The world today is troubled by many major issues. Climate change, global warming, oil dependency, carbon, wealth creation, water and resource use, and even the battle with corruption. Such issues are hard to fathom and it is difficult for anyone to know what to do differently *next Monday*. There is evidence that in dealing with any dilemma, society passes through many attitudinal tipping points: cigarette smoking, drink driving, Aboriginal respect, to name a few, and no doubt we will need to pass through a few more if we are to make sense of living on our finite planet. The role of the Centre for Design need not change. Its openness is laudable. Its desire to take on a broad range of real challenges is important. Its courage in taking ordinary steps with ordinary issues and sharing the lessons learned along the way, essential.

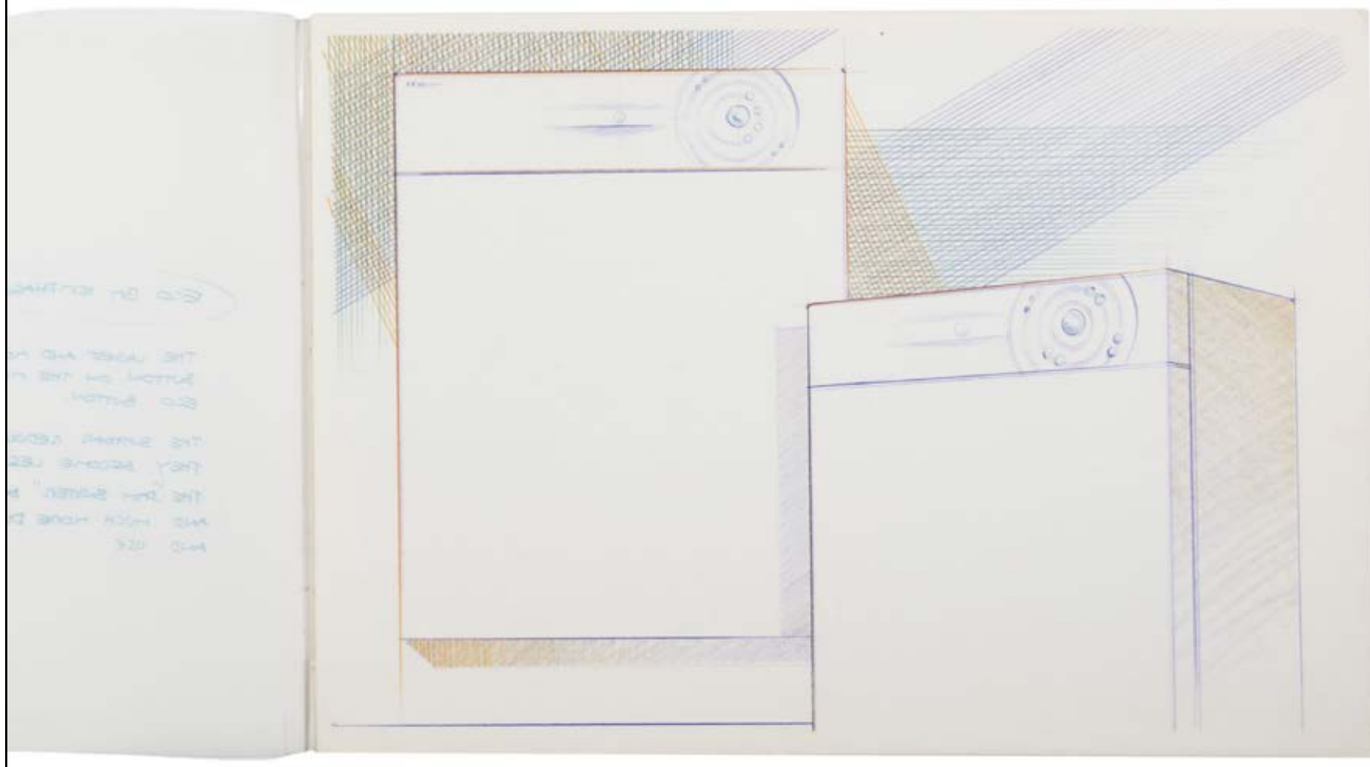
I believe that the resilience of communication and interconnection should help drive the next few years. In his renowned work published in 1971, *The Closing Circle*, Barry Commoner articulated what he

This spread
Mark Armstrong for Blue Sky Design, Southcorp Dishlex dishwasher concept hand sketches, 1993, RMIT Design Archives collection









thought would be the most important hurdle if we are to achieve a balanced approach to living on our planet.[15] He wrote of the need for a clear "ecological impact inventory" for every productive activity to have attached a pollution price tag. We are getting closer to this goal, but it needs to be easily communicable, and it has only taken us 40 plus years to date. Today policies are being drawn up and laws and standards are following, but good sense will need to be understandable; daring to be ordinary.

The reliance on Life Cycle Analysis to create a magic number is still a dangerous myth. The data that LCA depends on is variable and dependant on our ability to extend the boundaries of impact to the length, breadth and depth of our planet. The computational technology responsible for organising large amounts of data mentioned earlier is now more available. However, the answer will not be a number but a clear indicator of important communicable hot-spots in products, processes, and planning, building awareness of significant issues to be addressed and likely ranked in importance. The policies and best-practices that result will be everybody's business and most importantly understandable to all; the domestic kettle in another guise and in a much bigger context. Initially this might seem too enormous a challenge, but we have many useful examples in nature and Janine Benyus has sparked our awareness of this potential in her work on biomimicry.[16]

Nature, as we should all be aware, has no labels, but has been extraordinarily learnable by all its users. We are surrounded by amazingly complex organisms and life-forms most of which offer an understandable model; the tree is perhaps the first product of nature to be well understood for its impact on climate: in large groups, to the soil, to animals, to our gardens, as furniture, and as a building material. We have learned of many past mistakes through the study of trees and forest management, and, more significantly, we are developing knowledge of the paths we must take to preserve their role on the planet. And significantly, they are still just trees.

We need a similar understanding of all things. The journey to the supermarket should not be one of anguished reading and comparison. An apple should be an apple in several varieties, but all of them healthy. Thanks to the work of the Centre for Design and others, we are learning basic lessons that we should create less non-recyclable packaging.[17] We are also learning that it should contain less complex information for the consumer who should simply be able to trust the infrastructure that brought the goods to the store. In a way we need to understand what an eco-logical world looks like – Ecoville if you will. Just as with nature, we should have simple means to know what to avoid, where to go and where not to go, what should be protected, how to create resilience, and always to remain in healthy harmony.

Perhaps the next exercise could extend that kettle study towards an understandable total review of water from its atmospheric prosperity to its aquifers and our taps; what we add to it, and how we maintain its fundamental cycle. As an example the word "use" needs extensive exploration. When I "use" oil to lubricate, it is very different to when I "use" oil to power my vehicle. When I "use" water it is very dependent on my location and whether I am "using" millions of litres to swim or just a cupful to drink.

As was mentioned previously, the latest developments in computational technology offer incredible potential to assist all those responsible to make smart decisions at all levels. While we are not smarter than nature we know that nature will survive even if we do not. No doubt we will continue to push near the limits of our finite planet, but all the while we will need to create an understanding that is communicable, with examples as poignant as the ordinary domestic kettle, whether it is a billy or electric, or a tree: a Coolibah or even a Maple. Many will be involved at high and low levels but I expect the (extra)ordinary work of the Centre for Design to continue to be a major contributor.

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SPREADING THE LIFE CYCLE WORD: THE ROLE OF RMIT CENTRE FOR DESIGN

Karli Verghese, Dominique Hes, Andrew Carre, Enda Crossin and Tim Grant

Who would have thought that when the Centre for Design (CfD) was established in 1989, employing the overarching methodology of Life Cycle thinking would cement it as a leading force for years to come? The Centre for Design was a very successful research organisation that was known locally, but more so globally, for its independent, innovative, and applied research.

This work was driven by practical approaches and engagement with key industry and government bodies, to inform government policy and provide industry solutions. When the Federal Government announced its new "National Innovation and Science Agenda" on 7 December 2015, with a strong focus on university-industry engagement, striking parallels could be drawn to the successful formula of the Centre for Design, twenty years earlier.[1]

Life Cycle Assessment (LCA) is an internationally recognised scientific approach that quantifies the potential environmental impacts of a product, service or system. Material, energy, water, waste and emission flows that occur through the life cycle of the product, service or system are quantified and assigned to environmental impacts such as global warming potential, water pollution, embodied energy and toxicity.

Australian LCA Pioneers

The Centre pioneered LCA in Australia and established itself as the leading voice, the "go to research group" that combined a multi-disciplinary team with a sharp eye for identifying early-on the needs of industry and Government. Some of its major achievements included:

- the development of the first national life cycle inventory dataset;[2]
- establishing the first LCA professional training courses and conferences in Australia;[3]
- playing a significant role in the establishment of the Australian Life Cycle Assessment Society (ALCAS);[4]
- undertaking the first LCA of kerbside waste management in Australia;[5] [6]
- running the first courses for local Government, the first conference and guides on green buildings;[7] and,
- playing a leading role in the development of the first global commercial packaging specific LCA decision support tool – PIQET.[8]

LCA researchers from the Centre also published *Life Cycle Assessment. Principles, Practice and Prospects* in 2009, a book that provided critical insights into the LCA technique and how it can be used as a problem-solving tool, with an emphasis on practice in Australia.[9]

Life cycle approaches were first employed at the Centre under the umbrella of the EcoReDesign program.[10] They were used by design teams and industry partners to map and understand the complex and dynamic nature of the products under investigation. This was combined with a series of industry engagement programs that aimed to raise awareness of eco-design principles and practices. More detailed discussion on the success of the EcoReDesign program can be found in the articles by Lewis et al. and Lockrey et al. in this special issue. Life cycle mapping and streamlined LCAs were used and highlighted the "hot spots" of each product such as the use phase for kettles and dishwashers. This experience provided the LCA bedrock, which enabled the Centre to set the agenda for the LCA industry in Australia. It enabled the group to employ an active, collaborative, engaged and multi-disciplinary approach into such fields as waste, recycling, water, wastewater management, packaging, building materials, the built environment and energy systems. The Centre saw the important value that partnering with industry gave. It did this by looking at sustainability from a rational perspective, which was unusual at the time. While addressing sustainability is now a more normal decision-making process, the Centre was good at finding ways of taking the emotion out of things and looking at the facts.

The Centre took on projects commissioned by industry to improve it, with a constructive view about sustainability. It used LCA to challenge pre-conceived ideas about what it meant to be environmental. The rigour of the LCA process also helped uncover counterintuitive practices. For example, Dominique Hes recalls that "the railway sleeper LCA was memorable for this reason; concrete came out ahead of timber. It was the rigour of the LCA that helped with providing explanations and insights when the outcomes were not what the industry wanted to hear".[11]

The team would have regular discussions around the importance of life cycle thinking early in the design phase. Our collective understanding of life cycle impacts was used to inform potential clients, upfront, that where applicable, the LCA would most likely reveal that their product/system/service did not have a superior environmental performance and we would point out precisely where in the life cycle those environmental impacts occurred.

What this meant for the Centre's LCA work was that it helped Government and industry work with the real problems of a system rather than assumed problems. For example, in the biofuels work, there was an assumption amongst the sector that biofuels would be better across the whole of life cycle as they were not based on the extraction of fossil fuels .[12] Yet the LCA showed that it was just as bad, because it is the system of providing energy that has the impact, *you just cannot get energy for nothing*!

Those who had the privilege of working at the Centre often reflect upon a place that was special; that encouraged innovation, that was thought-provoking; and, that provided a collaborative environment with a strong practical focus. It was a place that supported people from different backgrounds, some from academia, some from industry, and some students at pre-PhD level. It was a mix of disciplines that included engineering, science, architecture, finance, design, and social science. A non-territorial structure thrived, and silos did not exist. It was more than the sum of the people.

An open-planned office design enabled ideas to be shared among those working there. The space also created a sense of sharing, supporting and teaching each other, enabling you to ask questions, be challenged, enabling you to learn and grow as researchers. As Crossin reflects:

> Personally, I loved working in a multi-disciplinary centre as this exposed me to different ideas and ways of thinking, as well as allowing me to apply my ideas and knowledge to other fields. In terms of my career, my experience at the Centre for Design was a fantastic basis for my current lecturing role, as it allows me to draw upon real life sustainability related projects.

This sense of sharing our knowledge about life cycles was extended out into the research projects, training courses and conferences. Tim Grant was instrumental in ensuring the LCA word got out into the wider world:

> What I remember most about LCA at the Centre was that the courses changed everything. The first course we ran had four people, and two of them were free, but that didn't matter because people just knew we had run a course. Then we got a few more people and a few more people and at the height of it we were running half a dozen a year of ten to fifteen people; and that enabled us to set the agenda for LCA in Australia for that period of time. Because we taught most people coming into the industry and set a common goal, those people still keep coming back to me now. It created a collegiate feeling of sharing, a common purpose, rather than a competitive environment in the LCA area.

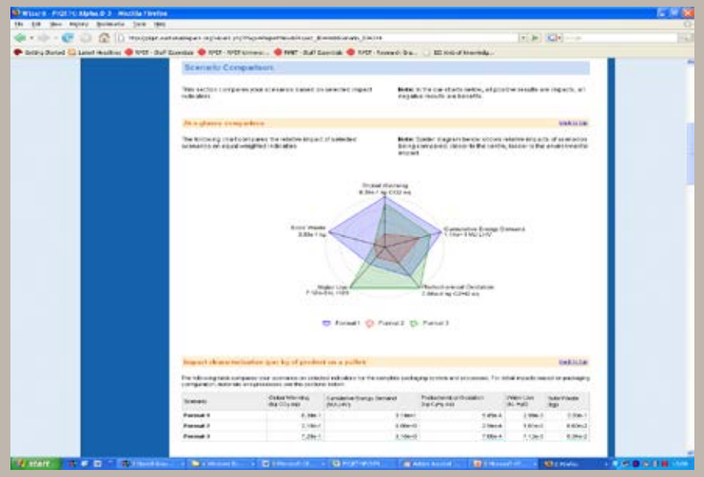
Decision Support Tools

The Centre's history of working collaboratively with clients helped it to expand its reach and impact as the need to address the sustainability agenda within government and industry grew through the late 1990s and early 2000s. The Centre employed a range of life cycle approaches to its research. These included life cycle mapping, matrices, streamlined LCA, full peer review LCA; and, in consultation with research partners, we identified the most appropriate and practical approach.[13] For example, we worked with the Forest and Wood Products Association (FWPA) and Lend Lease to understand the life cycle impacts and benefits of the Forte construct using cross-laminated timber, lighting and HVAC systems.[14] We also combined other techniques with LCA including life cycle costing (LCC) and triple bottom line (TBL) assessments. Examples of such projects are described below.

The Centre also developed a number of calculators that utilised life cycle thinking and data to communicate life cycle principals. Interest in communicating clearly the consequences of decisions was becoming a priority for the Government. For instance, the Victorian Environment Protection Authority (EPA) was

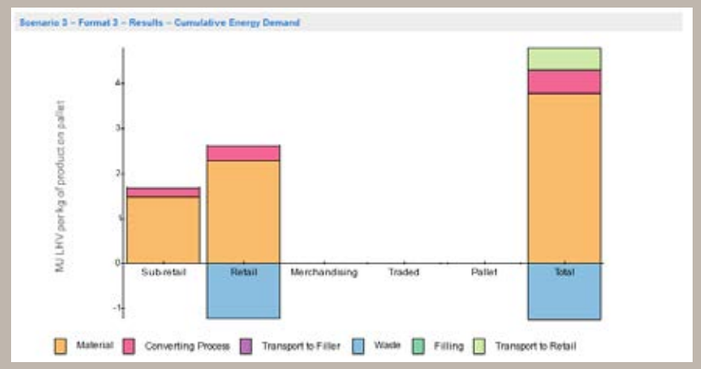
Comparison of packaging system formats in spider graph output of PIQET

Source: Verghese, K., R. Horne and A. Carre, *PIQET: the design and development of an online 'streamlined'* LCA tool for sustainable packaging design decision support", *International Journal of Life Cycle Assessment*, 15(6) (2010): 608-620;



Comparison of packaging system formats in bar graph output of PIQET

Source: Verghese, K., R. Horne and A. Carre, "PIQET: the design and development of an online 'streamlined' LCA tool for sustainable packaging design decision support", International Journal of Life Cycle Assessment, 15(6) (2010): 608-620;



Greenfly home page www.greenflyonline.org 2016, RMIT University

Photos from Casey Station Antarctic expedition, taken by Karli Verghese and Enda Crossin, 2014, Karli Verghese collection

working on ecological footprint assessments and commissioned the Centre to develop a user-friendly communication tool so that ordinary consumers could calculate their footprint. *The Australian Greenhouse Calculator*, released in 2011, is still being used to introduce people to an understanding of their ecological footprint.[15] The team would test and progress its ideas for LCA-based decision support tools using MS Excel spread sheets. Developed in consultation with stakeholders and co-designed with end users, these developed into web-based LCA decision support tools. Two pivotal projects using this approach were PIQET and Greenfly.[16]

In 1999 the National Packaging Covenant (NPC) came into effect in Australia .[17] It was a voluntary agreement between all levels of government and companies in the packaging supply chain to improve the management and environmental performance of packaging in an effective manner.[18] In subsequent years, companies operating in the packaging supply chain recognised the need for consistent and readily available LCA data to assist them in understanding, calculating, monitoring and better managing the life cycle impacts of their packaging designs and material selections. In 2004, this was the setting for the beginning of the multi-stakeholder project that developed the first streamlined packaging LCA tool – Packaging Impact Quick Evaluation Tool (PIQET).

Designed in conjunction with packaging technologists, designers, environmental managers and marketers of fast moving consumer goods companies (FMGG), PIQET is a great demonstration of how to collaborate with industry for a common goal. There were five multi-national FMGG companies (Nestlé Australia, Master Foods Australia, Cadbury Schweppes, Lion Nathan and Simplot Australia) working collaboratively with the research team over many years. The group identified the need for the sector to have access to an easy and quick LCA-based decision support tool that could be used in packaging design. PIQET was initially developed as an MS Excel spreadsheet that was pilot tested within the participating companies. The research consortium then secured nationally competitive funding to develop it as a web-based tool.[19] PIQET was commercialised in 2009. It was the first globally released packaging-specific LCA tool that influenced and changed the way packaging was designed within these participating companies and more broadly. It facilitated training and knowledge sharing around life cycle principles between actors in the packaging supply chain. Some companies mandated the use of PIQET within their new product development (NPD) processes (e.g. Nestlé); suppliers were requested to provide life cycle data on their materials; while some subscribers used PIQET to scan poorly performing packaging within their portfolios. The project also received funding from the State and Federal Governments.[20]

In the 2000s, designers were increasingly in search for information and tools that could assist them in understanding the environmental impacts of their designs. While there were many good resources on eco-design available, including the earlier work of the Centre such as the landmark publication *Design + Environment*, times were changing and technology was driving the need to adapt. Performing LCAs through dedicated software platforms were expensive and time consuming. In response to these needs the Centre developed Greenfly, securing funding through the Sustainability Fund managed by Sustainability Victoria in 2006. Utilising experience gained through the PIQET project, which had been in progress for two years at that stage, the research team this time worked with industrial designers and the Design Institute of Australia. The result was a web-delivered streamlined LCA decision support tool combined with design guidelines and strategies, another world first for that context.[21] Greenfly has continued to attract local and global interest, with more than 5,000 subscribers to the current version, and over 400 students subscribing from a number of Australian universities (Swinburne, RMIT, UNSW, ANU, Monash and UTAS) and a suite of international universities, including Stanford and Lehigh.[22] Industry subscribers include professionals from Dyson, Apple, Converse, and Samsung.

The Centre closed in 2013 and its programs were absorbed into the School of Architecture and Design. Under this new regime the LCA work has continued, most recently in Antarctica. RMIT University is partnering with the Australian Antarctic Division (AAD) on *LCA in the last frontier*, a five-year funded project to develop strategies to reduce the environmental impacts of operating Casey Station (66° 16′ 55″ S).[23] An environmental impact reduction strategy is being developed with AAD through a participatory design thinking process, to quantify and direct future research and operational planning. This includes understanding the dynamics and flow of energy, resources, water, food and waste on station in conjunction with the logistics and supply chain between Hobart and Antarctica, building design and operations on station and behaviours and practices of expeditioners on station. The project is informing current decision-making within the AAD and is linked to Stream 2.3[3] Human impacts prevention, mitigation and remediation of the Australian Antarctic Strategic Plan 2011–12 to 2020–21.[24]

Impact within Industry Practice and Government Policy

The LCA research has had, and continues to have, high impact on Government policy, industry partners' business and operations, or sectors more broadly. Upon reflection, the industry partners and Government departments who commissioned the research were also somewhat pioneering and once they got into using LCA, for some it became the methodology of choice to drive business innovation. Four examples are provided below to illustrate these different impacts.

One such business was Orica Consumer Products (OCP) whose executives were participating in The Natural Step training courses to look at the broader strategic context of sustainable development across the business.[25] In 2000, Rod Vockler then OCP's Research and Development Product Steward attended a two-hour LCA course, with the organisation's expectation that he would return an LCA expert. He returned with more questions than answers and thereby undertook an internet search of LCA research centres in Australia. He came across the Centre for Design, met Tim Grant, LCA Program Manager, and this was the beginning of four LCA studies that the Centre would undertake for OCP. These studies compared solvent-based and water-based paints; powder coating; No More Gaps; and Tinplate and plastic paint can packaging. The impact of these studies across the organisation included:

> "a significant increase in the understanding of environmental impacts of key products, packaging and processes.

> able to leverage and educate their suppliers through the acquisition of data and dissemination of findings from the reports, resulting in Millennium Chemicals (one of OCP suppliers) initiating their own LCA.

> supply information to customers in tender submissions (e.g., green office fit out questionnaires), providing a competitive edge over their competition.

> The LCA work has also helped get two OCP paint products, Berger Breatheasy and Dulux Aquanamel, listed on Eco-Buy".[26]

Another organisation that embraced LCA and the Centre for Design was Yarra Valley Water. Francis Pamminger played a critical role within the organisation as one of the key LCA champions. The first LCA was completed in 2003 investigating if rainwater tanks in an urban environment with reticulated water pipes delivered an environmental benefit. [27] This was followed in 2005 by a study of the sustainability of alternative water and sewerage servicing options at a greenfield site at Kalkallo and at Box Hill.[28] In 2006 the Centre partnered with CSIRO to undertake a study of the sustainability of alternative sewerage and water servicing options in Kinglake.[29] Yarra Valley Water has used LCA "for all key business decisions since 2002, enabling us to effectively quantify (rather than simply estimate) environmental impacts and therefore determine the most environmentally sustainable outcome".[30]

Even through multiple restructures and changes in Government, LCA has stood the test of time within one particular state Government department – Sustainability Victoria (formally EcoRecycle Victoria). The Centre for Design LCA team

undertook the first domestic waste management for EcoRecycle in 1999.[31] It was to be the catalyst for several other studies, in each of which the system boundary was expanded to investigate more waste fractions and a wider array of waste treatment technologies.[32] The second study in 2001 for the EcoRecycle Victoria "Stage 2" Report also known at the Centre as "pack waste" was the cornerstone report modelling kerbside collection of paper and packaging materials including newsprint by comparing landfill with recycling.[33] It also inspired the NSW Government to commission their own studies.[34] [35] EcoRecycle Victoria further engaged the Centre who worked with Nolan ITU in 2002, to investigate other kerbside waste streams (i.e. green waste; food waste) and different waste treatment technologies (landfill, recycling, aerobic stabilisation, anaerobic digestion, gasification/pyrolysis and incineration).[36] The findings from this study assisted in the development of Victoria's solid waste strategy: Towards Zero Waste.

The fourth study for sustainability Victoria expanded to investigate commercial and industrial (C&I) and construction and demolition (C&D) waste fractions and waste management, in 2005.[37] In 2015, Sustainability Victoria commissioned the Centre to update the 2001 study and also to produce a waste calculator.[38] All of these recycling and waste studies have been used by the Victorian Government to quantify environmental impacts of the waste sector and inform waste policy (e.g. Towards Zero Waste). They have also provided the mechanism to communicate and educate various stakeholders including Government employees, local councils, the waste sector and even consumers. Each iteration of the investigations has expanded the coverage of waste fractions and technologies providing Sustainability Victoria with more detail on the intricacies of the waste sector.

The Centre's life cycle assessment work also fed into the green buildings program. Projects informed by LCA were the Council House 2 building (CH2) developed for the City of Melbourne which led the green building industry; [39] the materials selection and specifications tool EcoSpecifier; the EcoHome research project [40] and materials guide [41] which worked with 11 local builders and the state run land corporation; and, Re-Imagining the Australian Suburb research program that continued the work in large outer Melbourne developments and brought in aspects of biodiversity, planning, community and health. [42] Each of these used both life cycle thinking and where appropriate, a full life cycle assessment. The main aim was to work with industry on real projects to overcome barriers to the use of more environmentally responsible materials.

LCA Ambassadors

Through the years, those who interacted with the Centre through research projects, conference presentations, training courses and events all become ambassadors for LCA. As Andrew Carre notes: "What people touched on in the process, changed their lives and perspective and how they thought about sustainability, they then took that knowledge and changed something in their sphere of influence". By osmosis the LCA team was spreading the life cycle word and opening eyes to the complex nature of products, systems and services. This expanded to teaching at the undergraduate level in engineering and design at RMIT in the later years of the Centre. As Crossin notes, having those who had worked on real LCA projects teach into under-graduate programs "enables students to respond to sustainability challenges in a meaningful way. I remember one student saying 'the LCA course was the best - it broke things down and enabled me to understand how things are made'".

The work undertaken by members of the LCA team over the years continues both within RMIT and externally. While Tim Grant left the Centre in 2007, to set up his own consulting business, he has continued to play an active role in the compilation of inventories and databases, professional training, and consulting projects across Australia. Dominique Hes moved to the University of Melbourne's Faculty of Architecture, Building and Planning in 2005 where she has expanded her interest in buildings and LCA into undergraduate and post-graduate teaching. In addition she continues research in identifying and filling the knowledge gaps in sustainability practice and application in the built environment.
While the restructure of the Centre for Design in 2013 saw the end of what it had been known for over the preceding 24 years, the research and approaches used, continue. While working in different schools, Enda Crossin, Andrew Carre and Karli Verghese continue to work together at RMIT. Crossin teaches a number of courses relating to design, sustainability and LCA in the School of Engineering; Carre teaches building performance and sustainability and undertakes research in the School of Property Construction and Project Management, while Verghese continues cross disciplinary research in packaging, sustainability, LCA and food waste through the Industrial Design Program of the School of Architecture and Design, alongside Simon Lockrey.

Those years at the Centre were not only formative for those of us involved but also the industries with which we worked. It was the agility of the Centre and its ability to follow both staff research interests and the demands of the market that assured its legacy into the future.

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ECOREDESIGN: METHODS AND PRODUCTS FOR ENVIRONMENTAL CHANGE

Simon Lockrey, Karli Verghese, Alan Pears, Paul Taylor and Liam Fennessy

At the time of the inception of the Centre for Design in 1989, the world was changing when it came to approaching sustainability.

Global sustainable development: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" was gaining momentum off the back of the Brundtland Report, "Our Common Future".[1] The formative musings of Papanek[2] about the role of designers in environmental sustainability started to shape the propositions of influential thinkers such as Whiteley[3] and later Hawken, Lovins, and Lovins.[4] Academia began to incorporate programs that addressed the sustainability issues relevant to design. Universities and research institutions in Europe, such as TU Delft, Danmarks Tekniske Højskole, Technische Universität, and Netherlands Organisation for Applied Scientific Research, led the way with integrated tools, methods and resources in combating environmental issues through design.[5] However there was much to be done in practice, with a lack of industry based projects aimed at redefining the influence of design on sustainability problems.

One of the cornerstones of the research that was undertaken by the Centre for Design concerned a hands-on approach to product design, underpinned by life cycle approaches. Original projects facilitated through the EcoReDesign program from 1994 to 1997 were heavily focused upon the redesign of existing consumer products, whereby material and/or energy efficient outcomes were delivered to the market place.[6] More recent research at the Centre adapted the life cycle modelling and thinking developed during EcoReDesign to strategic and service decision-making, marketing, and tool-based outcomes that informed or complemented product development.[7]

A multi-disciplinary team formed the backbone of expertise required for EcoReDesign projects, working in partnership with manufacturers, to reduce the environmental intensity of their products, processes and/or services. Approaches were developed, insights gained and lessons were learnt from these projects. This paper presents personal reflections by those who have all played critical roles over the 24 years of research undertaken by the Centre. It details how the EcoReDesign program went on to inform subsequent projects and research, influence Government policy, and affect product design and manufacturing more widely, both in the short and longer term.

EcoReDesign – The Fundamentals

Funded through the Australian Commonwealth Government, the EcoReDesign program brought together interdisciplinary 'EcoDesign' teams comprising designers, environmental researchers, engineers, social scientists, marketing experts and other related professionals. Teams worked together to research, develop and design products with leading manufacturers that improved environmental design and economic performance.[8] Industry partners included Australian household names such as Blackmores, Schiavello, Caroma, Southcorp (Dishlex), and Kambrook.[9] Teams produced prototypes through to commercialised products such as vending machines, office workstations, packaging, printer cartridge recycling kiosks, shower heads, dishwashers and kettles. The main objectives of these designs were to improve energy efficiency; minimise waste and conserve resources; use recycled material; design for recyclability; educate and engage consumers; reduce greenhouse gases; and, produce commercial outcomes.[10] Importantly, the key method of analysis used to verify environmental benefits of EcoReDesign designs was life cycle assessment (LCA). LCA, an objective scientific method to identify environmental impacts of products, services and systems, is now a widely accepted methodology adopted within the corporate sector.[11] However, at the time, LCA was only just being considered by organisations. The method originated in analysing product systems retrospectively; once a product had come into being LCA was used to make claims about its environmental credibility.[12] The problem here was that a product had already been manufactured or procured, with environmental impacts designed in. The design stage is often considered the best time to consider environmental aspects, designers "locking in" up to 70% of the environmental impacts of a product.[13] EcoReDesign was one of the first programs where LCA shifted to the design stage, to make informed decisions about the environmental performance of the products proposed, rather than already procured.[14]

All of the products developed through EcoReDesign were informed by LCA, to identify the key impacts associated with a product life, and to determine how to optimise the system. For instance, when a detergent expert was brought into the discussions on the re-design of the Dishlex dishwasher, he was able to provide the design team with information around detergent formulations that operate at lower temperatures thereby requiring less energy to operate the dishwasher. This informed the design of the dishwasher to enable it to operate at different temperatures, reinforcing the connection between different life cycle elements of a product and its operational use. To summarise the program, consultant Alan Pears remembers:

> *The processes we developed would bring up technical issues that may not have been discussed previously. Cross-disciplinary perspectives were considered. Fundamental were models reflecting the physics and chemistry of a context, and the use of benchmarking. There was a great deal of respect for each other, and a process by which you drew out the fundamentals of what was happening environmentally. This meant that teams didn't jump to conclusions too early. There is a rigour in this process, and an ability to take on the challenge. It is the embracing of these processes that drove the innovation.*

This demonstrates how EcoReDesign combined LCA with a multitude of other design techniques, including the exploration and application of fundamental physics, product design, laboratory testing and field measurements, alongside multi-disciplinary workshops and market analysis. Fundamentally, LCA helped develop an understanding of the life cycle of products and how to reduce their environmental impact. At the same time teams created commercially viable outcomes. Mathematical analysis allowed participants to understand the fundamentals prior to prototyping, laboratory analysis allowed the products to be benchmarked, and field work allowed for measurements and testing of the prototype product, to see what happened in reality. Moreover, this suite of techniques ensured that the program's main objectives could be met. We will later discuss elements of these other techniques as they relate to the products that were included in the EcoReDesign program.

The cross-disciplinary nature of the EcoReDesign process provided a very powerful environment, either during workshops, or dialogue around documented evidence, where researchers and industry partners were able to engage in a constructive and collaborative manner. There was respect among the team members for the contribution that each party brought to the table, illustrating the different and complementary skills involved. This respect allowed members to be challenged, and to explore ways of thinking about the products from very different disciplinary perspectives.

Commercial Wins

In the late 1980s, the Dishlex dishwasher manufactured by Southcorp sold at a low price and also had a poor reputation for performance. Dishlex faced a challenge: should they design a new product, or just rebadge an imported product? The organisation chose to work with Centre for Design through the EcoReDesign program to design a new product, along with Mark Armstrong and the team at Blue Sky Design. The result, according to Pears, "was a very exciting and challenging project that delivered Australia's first 6 Star energy, AAA water efficiency rated dishwasher".

This result was achieved through a variety of mechanisms and approaches that took into consideration acoustic, energy and water performance. As Pears recalls:

> *I was asked to look at the energy and water performance. I measured and calculated the volumes of reservoirs, pipes and fittings, looked at flow restrictions, then developed a computer model to simulate its performance minute by minute. I was very pleased when the model closely matched the actual performance of a reference machine.*

The computer models that Pears developed were based in excel spreadsheets, covering the energy use of products, minute by minute. Dishlex used these

excel models to help optimise their appliance. This streamlined the previous practice of making prototypes of the product and testing performance, without the prior input of systemic performance modelling. The team also created an understanding of the design specifications of the dishwasher (e.g. size of pipes, connections, spray arm, etc). By using the specification and fundamental physics to measure where water flowed, they were able to identify flow resistance, length and sizing of pipes that could be changed to increase water efficiency.

Noise was also an issue for the dishwasher. Pears' energy modelling combined nicely with an acoustic analysis. Noise in a dishwasher is generally generated through connections (e.g. thermal bridges), the location where most heat loss also occurs. Working together the team investigated different soundproofing materials and how they could reduce noise and energy simultaneously.

With this design approach, supported by comprehensive marketing, the Dishlex dishwasher went from being a very basic, low cost option, to enjoying long-lasting commercial success at a price premium. Dishlex became an example of the "Samsung effect" in local terms, being a capitalisation of the combination of superior technology and sophisticated marketing.[15] Many will remember the now famous "Disssssshlex" television commercial tag line, reflecting the quietness of the product to families around the dinner table at prime time television advertising slots. With massive market share increase and various acquisitions, Dishlex has enjoyed longevity. The brand is now owned by Electrolux as one of their high volume performers in a successful stable of dishwasher brands. Moreover, the Dishlex dishwasher should be considered the crown jewel of the EcoReDesign program from a commercial, environmental, and design perspective.

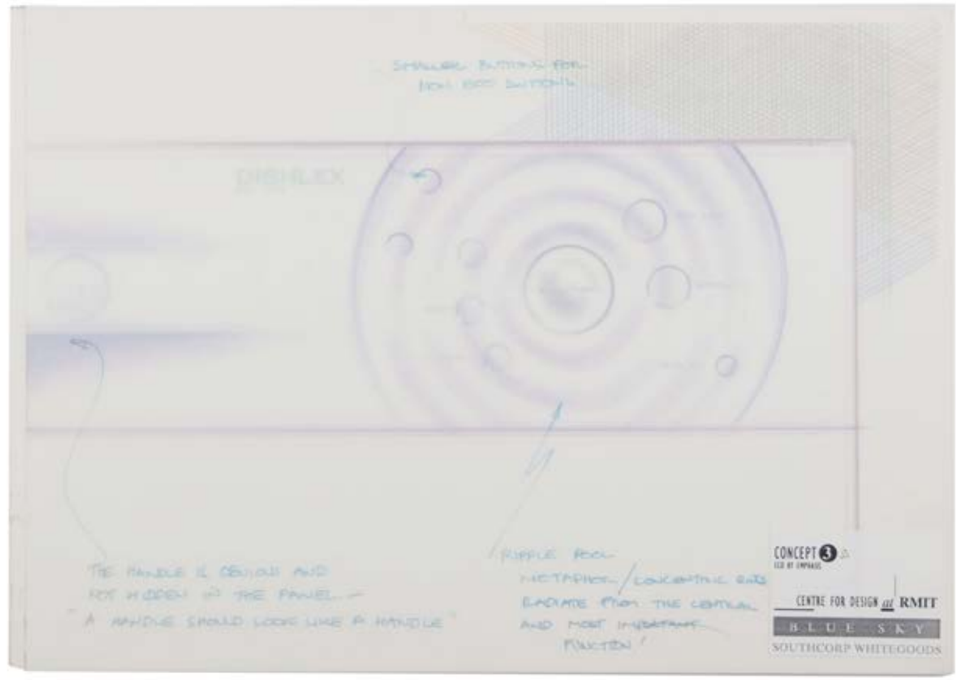
Success or Failure?

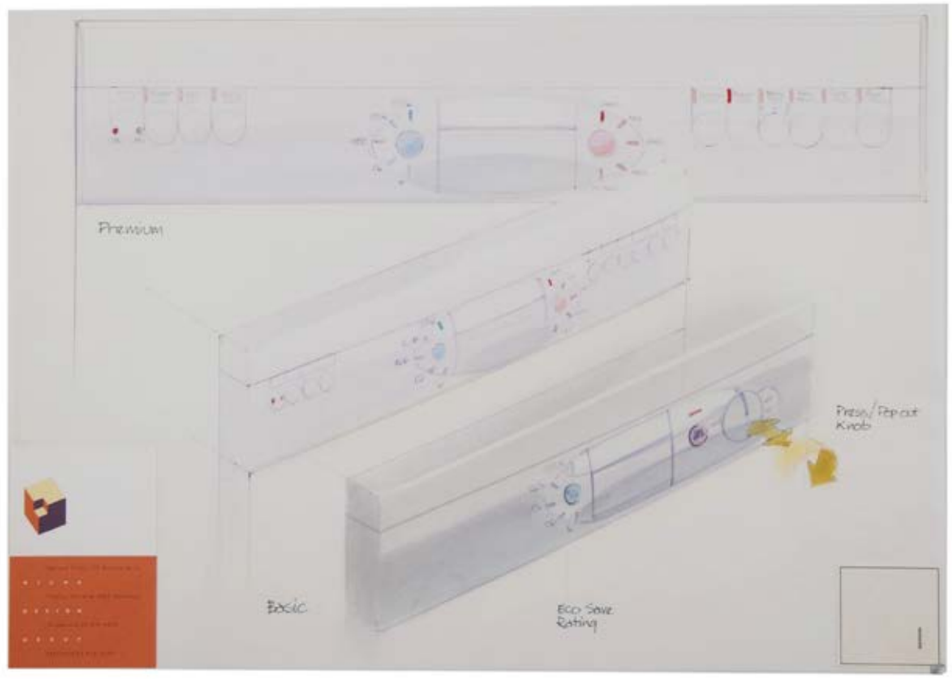
Clearly the Dishlex case demonstrates the commercial impact of federal funding for innovation and environmental design; something quite poignant on which to reflect in the current political climate.[16] However, not all projects enjoyed such commercial success, and as such, may provide lessons for future programs. For instance, some projects only reached a concept or prototype stage, with very few of the industry partners following through to a mass-produced commercially beneficial outcome.

Of the projects that are considered a success globally, the Kambrook Axis kettle is certainly held in high regard for its contribution to design, to sustainability, behavioural change; in practice, and, regarding collaboration.[17] It was the first kettle to include a petrol gauge-like indicator to communicate water level and reduce double boiling; a corded hub to render the kettle cordless; double walls to reduce heat loss; smart control systems; more elegant aesthetics; design for disassembly; and better grade of polymers.[18] These innovations derived from market research, thermal modelling, LCA, and clever design, with Kambrook teaming up with Centre for Design, Millard for production computer-aided design, and the design team at Form consisting of Gerry Mussett, Paul Taylor and Scott Ballis. The Axis kettle thus provided a platform for both technical efficiency and prompts for consumer behavioural change and it was lauded as an exemplary EcoDesign outcome for years afterwards.

However, these innovations translated to extra cost for the Axis kettle, which created a problematic commercial context. Complications derived from Kambrook requiring a "boat" style petrol gauge to indicate water level. This added a costly metal component, along with additional polymer mouldings, and increased assembly time. The design team had some smarter options, but they were rejected. To the manufacturer's credit, the ease of reading the water level via this system was a big step forward over all mainstream kettles at the time. Other issues that affected the Axis included the use of component choices outside of the design specification, leading to high return rates and compromises in manufacturing forcing design changes at the cost of ergonomics and aesthetics.

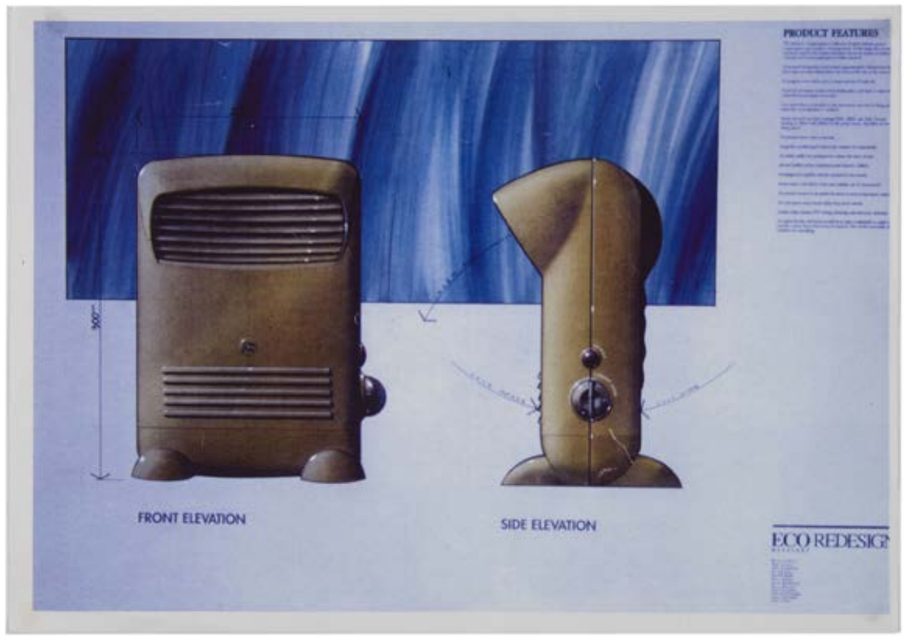
At the time, Kambrook was competing at the bottom end of the market in the highly competitive category of staple household appliances - low cost kettles and toasters. Price is a key consideration in these markets, and cost is often stripped out of products to remain





Opposite Top
Mark Armstrong for Blue Sky Design, Southcorp Dishlex dishwasher concept hand sketch, 1993, RMIT Design Archives collection

Opposite Below
David Flynn for Niche Design Group, Southcorp Dishlex dishwasher concept hand renderings, 1993, RMIT Design Archives collection



Top
Paul Taylor for Form Australia, Green Heating Quest Workshop hand rendering, 1995, RMIT Design Archives collection

Bottom Left
Paul Taylor for Form Australia, Caroma shower head concept hand renderings, 1995, RMIT Design Archives collection

Bottom Right
Paul Taylor for Form Australia, Kambrook toaster concept hand rendering, 1995, RMIT Design Archives collection

competitive. Although the Axis innovations were revolutionary for performance, the final product was more suited to sales channels Kambrook was not familiar with. As Paul Taylor recalls:

Big box stores of K-Mart and Target didn't stock the Axis kettle. To Kambrook's credit, they found a new avenue for Axis through David Jones, a first for them. The problem though was that David Jones didn't have the volume of sales Kambrook were used to, and Kambrook didn't have the reputation for high-end retailers.

Kambrook was asking its customer base to pay nearly double that of their successful budget kettle, the K300, in exchange for Axis' innovative features and a saving on electricity. To complicate matters, at the time, competitor Sunbeam had a long-standing reputation as the "go to" quality brand at an acceptable price. Breville fitted somewhere in-between. Taylor reflects:

> *Sunbeam had always delivered more progressive designs with better components and quality of usability, therefore it was a big leap of faith for a budget consumer to purchase a more premium product in a budget store, and even bigger for a traditional, wealthier David Jones customer to accept what they had always considered an inferior brand to Sunbeam.*

This leads to another aspect of disruptive product commercialisation. Education through marketing can be the key to success when pushing against the status quo but there was no substantial supporting marketing for Axis to counteract the ingrained reputations of its market competitors. Taylor recalls there was a distinct lack of in-store point-of-sale material, or television advertising for the kettle. This was is in contrast to the work done by Dishlex for their dishwasher.

Ultimately, the cost of the kettle was revised and it was discontinued in its original form. Kambrook continues to sell the modified version of Axis into contexts where consumers are price-sensitive, which somewhat continues the legacy and success of the project. In short, the kettle reverted to budget retailers with which Kambrook was familiar. Things may well have been different with marketing support and a different consumer context as Taylor notes:

> *As a nation we're more savvy shoppers these days and our brands are less ignorant of their customers, realising they can't just put products on a shelf without a supporting deeper value story and communicating meaning through various channels.*

Kambrook lost momentum during the later development of Axis mostly due to the hidden financial pressures, a "fish out of water" product, and the fact that much of the development was done outside their organisation. While their design team embraced the sustainability angle internally, there did not appear to be company-wide commitment. Kambrook needed a top-down belief in sustainability to change culture, together with a proactive management.[19] Instead, the organisation looked externally for these things, and used the project for publicity and investment in exploratory research and development. Another issue here was that multiple organisational changes of management, corporate takeover and restructuring occurred as the incarnations of Axis were sold. For all this, the design of Axis exceeded expectations for environmental improvements and affected kettle design for many years.

Lasting Industry Benefits and Dissonance

Centre for Design changed over time with different funding sources, industry partners, research projects, and researchers, which meant a range of diverse initiatives and trends developed from the EcoReDesign program. But was design the right focus? As Liam Fennessy puts it:

> *The Centre for Design produced some excellent thinking, tools and projects, yet much of it may have been misdirected by targeting industrial design education and practice as a way of getting traction. This was a misreading of the situation in that in mass manufacturing and the concurrent implementation of environmental management systems, total quality management, and life cycle management, the responsibility for lean production and environmental standards became an engineering domain. This meant that industrial designers could suggest or press for*

particular approaches, but the hard audit/ implementation was already being done by others.

Moreover, the EcoReDesign program did not make industry-wide change to the culture of environmental responsibility across the Australian manufacturing sector. This may have been a combination of Australian manufacturing at that time being cost and product driven (rather than human-centred and brand oriented) and locally focussed (apart from the automotive sector and a handful of other brands in different sectors). Policy failure to continue the momentum of the program, and the lost knowledge at various organisations when Centre for Design staff and industry personnel moved on, did not help. Industry wide change may well have been an ambitious objective.

As Fennessy posited, maybe LCA was not aimed at the right disciplines. Indeed, power could have played a key role here. The most powerful departments in new product development are often not design disciplines,[20] and as such, other organisational stakeholders may be better situated to drive environmentally based decisions. In a more recent study of multinational Unilever, power relations were identified as critical to EcoDesign failures.[21] Even with a top- down mandate from management to implement environmental strategies, people in disciplines other than design, delegate environmental actions to design teams, without those design teams adequately empowered to act.[22] Palmer et al take this further, and question the value of LCA to business at all, suggesting we should not "expect them [organisations] to know what to eventually do with a completed LCA study (experience has shown this to be rarely the case)".[23] This may also been the case for organisations involved with EcoReDesign, lacking the adequate resources or expertise to use LCA effectively after taking part in the program. At the very least, industry needed to be given a chance to innovate, and should be applauded for doing so. More than this, pockets of lasting change did occur.

Some organisations implemented processes in environmental measurement and reporting that remain today. For instance, Schiavello may not have widely commercialised designs from the program, yet they benefitted from the implementation of life cycle and environmental reporting through the support of Director, Peter Schiavello, and the leadership of environmental manager, Michael Pitcher.[24] As the local green building movement grew in the 2000s, compliance activities shifted to environmental credentials becoming a market differentiator, a phenomenon on which Schiavello capitalised. Some organisations benefited and carried through, whether with process implementation like Schiavello, or through commercial product success like the Dishlex dishwasher.

Many of the personnel who worked on EcoReDesign projects continued to apply the learning from EcoReDesign in their careers. For example, the insights gained and the methods employed from EcoReDesign were adapted by Pears in a series of energy efficiency projects. Pears continued to operate with these methods for a long time, for projects in industrial contexts (i.e. production facilities, factories and corporate buildings), residential developments, product design, policy development, and regulated information programs. Of the last, Pears pioneered product energy efficiency labelling nationally, prior to EcoReDesign commencing. That work underpinned some of the EcoReDesign approaches, and continued on well after the projects concluded with water also included in the labelling mix. This could have been too late for the Axis kettle, where commercial success may well have been achieved if energy and water labelling were more recognisable and widespread.

Labelling opened opportunities for organisations to promote the environmental attributes of products more overtly, so that efficiency features that were previously difficult to convince manufacturers to include (for cost reasons), started to proliferate. Suddenly highly efficient products across whole categories had an advantage in a highly visible, legislated system.

Pears innovated for the environment, from product through to policy, receiving an AM in 2009. However he laments: "Regulators and policy makers don't create policies that are open ended enough to reward more innovation. Policy ends up blocking progress and undermining the opportunities for people to be recognised for the innovations they bring". Design innovation still gets stifled by the very mechanism that enabled EcoReDesign: Government bureaucracy.

For all that, in terms of design, EcoReDesign projects did enable designers to use many of their existing technical skills and develop new ones. As Taylor notes: "we could co-create, collaborate with best in field specialists and to work from ground up first principles rather than deal with legacy and re-style flawed ideas or just a different version of the same old thing".

EcoReDesign allowed designers to do what they were trained for, to question, explore, research, make, reimagine, validate, and educate, to deliver real value. Although it may not have created broad change for industry, EcoReDesign represents a period of time when design disciplines were given purpose and meaning in the environmental context where they had not had such agency previously. Many aspects of the program have continued to this day, and as such the EcoReDesign legacy continues to contribute to society's quest for environmental sustainability.

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