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WHAT IS THE PROBLEM – SUSTAINABILITY BEYOND LIGHT GLOBES AND WATER BUCKETS?

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ABSTRACT
This paper presents a methodology in an attempt to address the lacuna between the scale of unsustainability described in the literature – and the initiatives employed by designers and the general public to reduce their ecological impact. For example, 'if every Australian household switched to renewable energy and stopped driving their cars tomorrow, total household emissions would decline by only about 18%' [1, p. 291] - How can design identify and engage in the remaining 82% of emissions?
The methodology was developed for an ongoing industry project to reduce the ecological impact of aged care delivery. The methodology makes connections between the objective approach of Life Cycle Assessment (LCA) in identifying the source of greatest impact, and creative problem solving by designers to reduce the impact within a service industry. The methodology is completed in three phases. I: holistic streamlined LCA to identify where the source of greatest impact is, II: participatory design ideation workshops to identify and develop potential solutions, and Finally III: sustainability action plan, to identify immediate solutions for implementation and a longer term strategy to significantly reduce resources and emissions. At the time of publication phase I has been completed –
This methodology addresses the conference's themes by connecting the disciplines of engineering (LCA) and product design. Aspects of the methodology are unique as they originated as tools for design education, and have developed into tools for industry applications.

Keywords: Life cycle assessment, participatory design, design for sustainability, environment

1 INTRODUCTION

The need for sustainability is great, and the timeframe for action is short. For designers to engage in the concept of sustainability, it would be worthwhile for the discipline to provide a process that enables designers to address areas that have the potential to offer the most significant environmental savings. This paper presents a methodology and preliminary findings of a project that attempts to achieve this, the paper is presented in three parts.
First, the paper illustrates a mismatch between the areas that designers have significantly engaged with in regards to Design for Sustainability (DfS), and the areas that are the largest source of impacts. As Dey *et al* articulates 'if every Australian household switched to renewable energy and stopped driving their cars tomorrow, total household emissions would decline by only about 18%' [1, p. 291] - How can design identify and engage in the remaining 82% of emissions?
The second part of the paper, outlines the methodology developed at the Centre for Design (CfD), RMIT University to enable designers to: first, identify the largest source of impact, and second creatively apply design thinking to significantly reduce the impact of the practice. The methodology is completed in three phases. Phase I: holistic streamlined LCA to identify the source of greatest impact. Phase II: participatory design ideation workshops to identify and develop potential solutions. Phase III: sustainability action plan, to identify immediate solutions for implementation and a longer term strategy to significantly reduce resources and emissions.
The third section provides the preliminary findings of the continuing project (Phase I), and reflects on how the identified approach has shifted the problem definition to date.

2 MISMATCH – WHAT IS THE PROBLEM

The title of the paper "beyond light globes and water buckets", represents two practices that some Australian's take part in, changing to energy efficient light globes and placing a bucket in the shower to catch water to re-use on plants in the garden. While the activities are positive in that the end user feels like they have made a contribution by 'doing their bit'; if you measure these individual actions against the significant change required they are totally inadequate. For example, the Club of Rome proposed reduction in resources by a Factor of 4 in 1972 [2]; the Wuppertal Institutes Factor 10 reduction [3] and the Netherlands Government Factor of 20 [4] reduction, while the Garnault report suggests a Factor of 5 reduction in Carbon [5]. To explain further, lighting, which has been the centre of many energy reduction strategies [6], is responsible for 1.35% of our embodied CO_2 consumption and 0.63% of our ecological footprint (extrapolated from Figure 1). In comparison, the practice of eating is responsible for 28.3% of our embodied CO_2 consumption, and 48% of our ecological footprint.

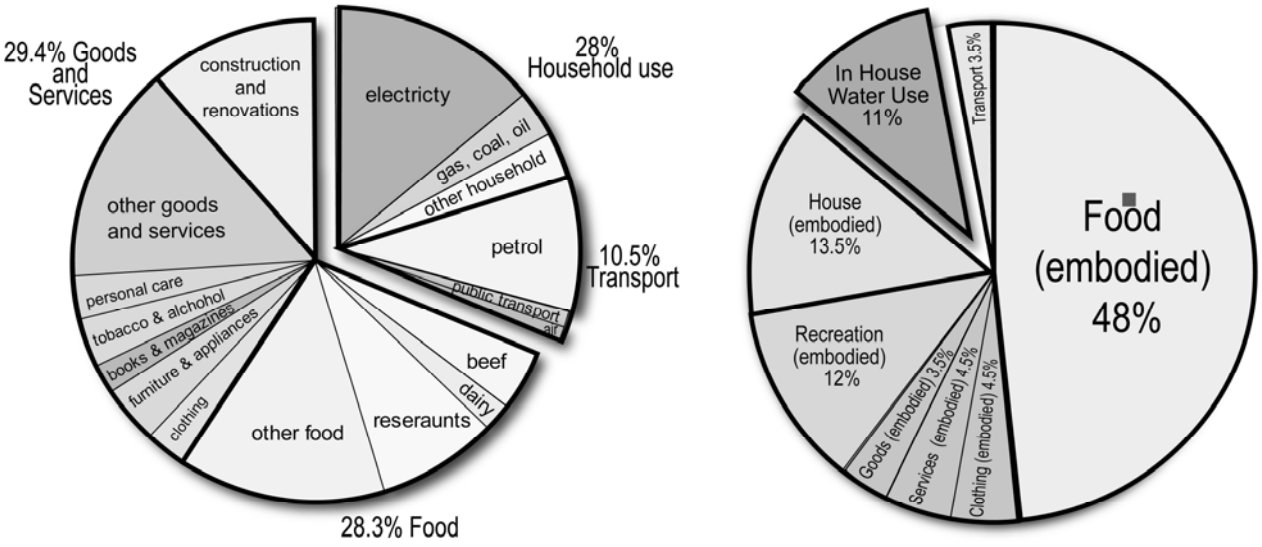

Figure 1. Breakdown of the embodied CO_2e for the average Australian [1] and total water budget within the average Sydney household Source: Lenzen and Foran [7, p.335]

Likewise, the shower is responsible for 1.8% of our embodied water consumption [extrapolated from 7, 8, 9], making the focus on water saving initiatives in the shower less relevant than holistically addressing the issue of embodied water consumption. Clune's [10] Action research study with student industrial designers found that almost all of the designs relating to water saving defined the problem as consumption of water within the house, and proposed a variety of solutions such as a 'water time delay switch' (a switch that automatically turns shower taps off). Such designs appear to be informed by the 'every drop counts' advertising and educational programs that had been running in Australia for many years [i.e. 11], which has given the act of turning off the tap iconic status as a key water-saving activity. Such designs are effective in reducing water use by 25% at the tap. However, in relation to the holistic consumption of water within Australia, the saving is small. A water time delay may result in 25% savings of water from the tap, yet water from the tap accounts for 1.4% water use nationally [8]. This equates to total water savings of 0.35% if adopted by the entire population.

The above numbers illustrate the limited capacity of designers to foster significant reductions unless they think relationally and broaden the scope of their work. The presentation of such statistics to Industrial Design students reframes the design problem, forcing designers to think relationally about their engagement with sustainable design initiatives in order to achieve the greatest impact. A key argument of Clune's [12, 13] is that problematic definitions of sustainability contribute to problematic DfS. Our understanding of 'unsustainability' are embodied in realised design outcomes, or *'how you define is how you design'*.

Recently the authors have been commissioned to reduce the ecological footprint of a major aged care facility provider, Uniting Aged Care Victoria and Tasmania [UACVT]. UACVT operates 24 residential facilities, providing 1,821 beds, and 6,954 days of respite care with buildings valued at approximately AUD$100 million. In the scoping work for the project, it became apparent that the

areas most likely to hold significant ecological impact are not traditional areas that designers have engaged with (i.e., it is assumed the results may be similar to the national averages in figure 1 above). In such a scenario, two things become apparent. First, design has to move from focusing on the artifact, to understanding the broader system of provision, and the practices that are associated with the area of impact. This does not suggest that you can escape the designed artefact; merely that it is not the starting point. Second, in order to implement change (particularly if it involves a shift in behaviour) cannot occur in isolation of the stakeholders – it is often not for the lack of appropriate sustainable solutions, but for the lack of adoption of the solution where the problem is occurring. A participatory approach to design assists to engage the stakeholder to manage and improve the facilities over time.

As such, the project has developed a unique methodology to enable designers to address the areas of greatest impact, focus on the associated practices and draw on the knowledge of the relevant stakeholders to significantly reduce the environmental impact of their facilities.

3 PROPOSED METHODOLOGY

The methodology developed has three phases. I: a holistic streamlined LCA to identify where the source of greatest impact is, II: a participatory design ideation workshop to identify and develop potential solutions, and Finally III: the development of a sustainability action plan, to identify immediate solutions for implementation and a long-term strategy to significantly reduce resource and emissions. The methodology attempts to find a balance of scientific research in LCA to identify the area of greatest impact, and designs creative potential in offering solutions – Phase I of the project is complete and the remaining phases are ongoing. The functional unit for the study was identified as one bed day of care delivered to a certified standard.

3.1 Streamlined Life Cycle Assessment – Phase I

LCA is the process of evaluating the potential effects that a product, process or service has on the environment over the entire period of its life cycle. The International Standards Organisation (ISO) has defined LCA as: *'Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its lifecycle'* [14, p. 2] The study revolved around a 'Streamlined' Life Cycle Assessment (LCA) of the UACVT's operations, as described above). A streamlined LCA is differentiated from a full LCA by the degree to which data is collected and the complexity of the underlying life cycle model. Streamlined LCA's typically abbreviate modelling and data collection in order to achieve quick indications rather than detailed quantifications. The LCA was modelled using SimaPro input output databases for one representative aged care facility in Melbourne. Data was collected from electricity, water and gas bills; inventory on the items consumed in the provision of care, and waste quantities and types generated. A site visit was conducted prior to and after the streamlined assessment.

A streamlined LCA was used for this project, as the final results are to be utilised in the identification of key areas for sustainable improvement and not on comparing services of aged care providers. The majority of LCA studies are used to verify market position, as opposed to drawing on the life cycle thinking, relational thinking and improvement opportunity which is most beneficial [15].

Following the streamlined LCA, the Centre for Design will facilitate two full-day workshops to develop initiatives to reduce environmental impacts. The emphasis of the first workshop is the problem definition of unsustainability in aged care, and the emphasis of the second workshop is solutions to these problems.

3.2 Initiatives to reduce environmental impacts – Phase II

The first workshop will disseminate the results of the LCA to key personnel, as well as introduce key sustainability indicators and terminology to participants (setting targets reflective of the sustainability literature [2-5]). The objective of the first workshop is to identify aspects of aged care operations with a high ecological footprint which would benefit from revision. The first workshop includes two exercises: first, transferring the areas of impacts in the LCA into daily practices, to make meaningful for stakeholder discussion. Rather than discuss kilowatt hours used – the focus may move to heating and cooling - to comfort (Shove's [16] comfort cleanliness and convenience provides terminology to make humane the scientific data). Secondly, stakeholders attempt to unpick how the identified practices came into being, and understand the current trajectory that aged care is moving towards.

Prior to suggesting any alternative for aged care provision, it is critical that a sound problem definition is refined on where UACVT is unsustainable – and what it would like to achieve in moving towards more sustainable aged care practice.
The second workshop will focus on problem resolution; CfD will facilitate creativity sessions with personnel from UACVT, designers and strategic thinkers, to identify initiatives to reduce the environmental footprint of aged care provision. Results of the workshop will be presented in the form of 'conceptual design scenarios'. The scenarios are future orientated scenarios of how aged care provision could be; they are not presented as fait-accomplis. Instead, they follow Manzini and Jegou's [17] philosophy in that they are scenarios that UACVT could make happen if they chose to. What will become evident through the process of the workshops is that there is a range of strategies that UACVT may engage in to reduce the environmental footprint of aged care. These range from very practical initiatives that can be implemented immediately to more long-term initiatives that require a more fundamental shift in practice from UACVT and relevant stakeholders. This shift will need to be managed over time.
The format for the workshops and the process of separating the solution phase from the problem definition phase has been used successfully in design education. Design students have been held back on the concept generation phase until a sound problem definition had been established, thus improving their ability to DfS [13]. This process is now being applied to an Industry related project. Creative problem solving requires a clear problem definition. As Dewey stated, 'a problem well put is half-solved' [18, p.173]. Without a comprehensive understanding of the problem that needs to be turned around by design, it will be difficult to offer effective creative solutions.

3.3 Sustainability action plan – Phase III

The third phase involves trialling initiatives available to immediately reduce environmental footprint by prototyping scenarios identified in phase II. Accompanying this trial is the development of a roadmap to sustainability (long-term strategic plan) with UACVT to achieve the long-term initiatives identified. The long-term initiatives involve a broad feasibility assessment of initiatives and a ranking process completed cooperatively between UACVT and CfD. The long-term strategic plan and engagement of key personal is seen as critical to the projects success. As it acknowledges, the transition towards sustainability cannot be a fit and forget solution, it requires continual learning and improvement over time.

3 PRELIMINARY FINDINGS

The project is ongoing, phase I has been completed – the ecological impacts in the provision of aged care to a certified standard were measured against global warming impact (CO_2e) and water. The findings are presented and reflected upon in comparison to a traditional auditing approach.
Two areas stood out within the study as having the most significant ecological impact: these are food and energy (see fig 2). Food accounted for 54% of the budget and for 46.6% of the global warming impact, and 89% of the embodied water used. The majority of food related global warming impact (26.1%) comes through the production of meat, particularly beef. Recent work surrounding the carbon impact of food has been conducted by catering [19] and health care [20, 21] organisations providing a precedence that could be followed to reduce the carbon impacts associated with food.
The second most significant single area of impact is electricity generation, which accounts for 15% of the budget, is responsible for 39.9% of the global warming impact of the facility. This is primarily due to the location of the facility in Victoria, where the electricity grid is predominately fed by brown coal. Site visits to the aged care facility indicated that significant savings could be made in the area of energy. Particularly in relation to the area of thermal comfort – this could be achieved by both improvements in capital infrastructure, as well as behaviour change initiatives within the facility.
To validate the results of the study - the provision of aged care was compared against Dey *et al's* [1] impacts of the average Australian. The average aged care residents total greenhouse gas emissions are estimated to be 16.71t/year CO_2e – compared to 18.9t for an average Australian. Average embodied water per person is 827kl in the aged care facility in comparison to 720kl used by the average Australian[1]. It could be expected that the industrial-like practice of aged care facilities (such as

[1] Please note that the figures are not conclusive that aged care is better or worse that the average Australians. It indicated that there is validity within our streamlined assessment.

communal cooking and laundering) could provide quantities of scale superior to those of individual living. The results to date indicate that such quantities of scale have not reached their potential and would benefit of design interventions.

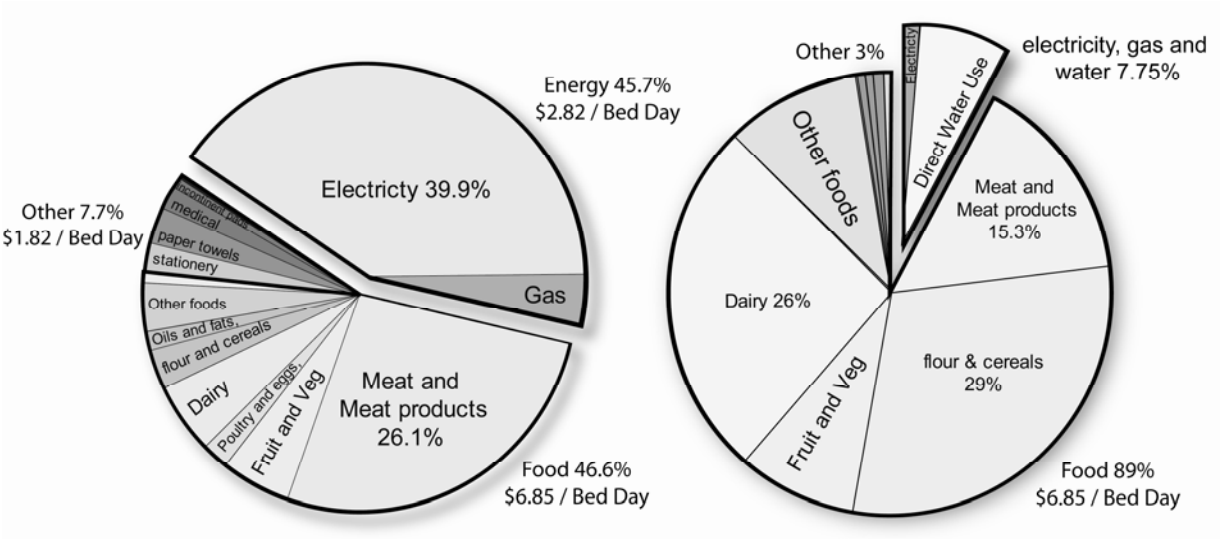

Figure 2. Breakdown of the total global warming impact (left) for the average Strathdon resident (16.3 t CO2e / year) and embodied water use (right)

The traditional approach to auditing a facility involves the mapping of direct energy and water consumption, followed by recommendations of capital investment projects that have a return on investment less than a given time frame (typically to years [22]). If the project had used this traditional energy and water and auditing approach –focusing only on direct water and energy consumption – the finding would have overlooked 54.3% of the global warming impact and 94% of the water use. One limitation of the indicators selected (CO_2e and water) were the inability to capture the impact that solid waste has from the facility. Incontinent pads disposed to landfill have the potential to contaminate soil and water supplies [23], and would be worthy of further attention.

From the results of phase I, four themes have been proposed to be the focus of our participatory design workshops. These are: Theme 1, energy: capital investment strategies towards zero carbon; Theme 2, energy: thermal comfort; Theme 3, food: reducing the global warming impact associated with food; and Theme 4, towards zero waste. The above four themes provide clarity for creativity tools to be applied in the participatory design workshops – where key personal from UACVT will generate potential solutions within the above themes. If the streamlined LCA was not used then it is assumed that the problem definition and themes of focus for the project would differ.

4 CONCLUSION

To return to the title of the paper – beyond light globes and water buckets, the methodology attempts to enable designers to critically engage in the most significant areas of ecological impact. While the project is ongoing, the problem definition provided from phase I is markedly different to the traditional approach used for environmental auditing in that it considers embodied CO_2e and water. This has resulted in an altered problem definition for design to engage in – with the expectation that this will lead to more substantial design solutions capable of addressing the ecological crisis - how you define is how you design. By including a participatory approach to design, it is hoped that the client (UACVT) will absorb ownership of the ideas and engage in a variety of solutions that include both capital projects and behaviour change initiatives to reduce the ecological footprint of the industry.

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