

PART C—PROJECT DESCRIPTION

C1 PROJECT TITLE: SUSTAINABLE HOUSING: RELATING OCCUPANT ATTITUDES, SATISFACTION AND ENVIRONMENTAL IMPACT

C2 AIMS AND BACKGROUND

Aims: Sustainable housing for the communities of Australia is an emerging development type. The overarching research question in the field, to be addressed in the proposed project, is whether the ‘stock’ of embedded design elements and performance characteristics of sustainable housing translates into an ongoing ‘flow’ of residential satisfaction and well-being within the boundaries of reduced environmental impact. The aims of the project are:

- 1) Investigate the attitudes of occupants, their satisfaction and the environmental impact of these new sustainable developments as compared with occupancy of conventional housing. A field station will be set up at Broken Hill through the Teachers Housing Authority (THA), NSW, and in conjunction with the NSW State Architect's Office (AGO). The research intends to investigate their new Eco housing prototypes and to compare their biophysical performance and achieved satisfaction outcomes with the conventional dwellings which exist in the housing portfolio in this location.
- 2) Utilise these data for testing theoretical work on well-being and quality of life (QoL). Well-being is defined by Bruntland (1987) as a central goal of sustainability and is normally measured through QoL (Mawhinney 2002). The proposed project allows us to building on theoretical and methodological advances to QoL measures developed in a previous ARC Linkage grant (LP0774952). Hence, with this enquiry we aim to carry out further work involving dwellings hosting a very different occupier profile, namely non owner-occupiers (tenants) in very different social and environmental conditions to the previous ARC Linkage study in SE Queensland.

Background: The project is nested in broader issues concerning the social and environmental aspects of sustainable housing. Sustainable development models such as balance theory (Mawhinney 2002) suggest that the benefit of sustainability is to integrate social, economic and environmental needs in the context of maintaining or improving the quality of life. The argument focuses on the requirement to address the current dilemma through which high QoL in Australia is traded against high environmental impact (Stimson, R., Western J, and McCrea, R., 2003, Queensland Government, 2003). Research over the last 10 years has been attempting to determine whether such a trade off – high QoL coupled with high impact -- is foundational or culturally manufactured. A major research question therefore centres on how to maintain or improve QoL but within boundaries that limit environmental impacts. The main theoretical thrust will be towards a model offering an acceptable QoL but with reduced environmental impact, calibrated not for regions but for sub sectors such as housing. The idea is to see if such a construct could provide a mechanism for addressing this significant problem.

The application of Balance Theory as espoused by Malwinney 2002 has impacted on the planning and design approach to sustainable housing in a number of projects. Much of this work has involved attempts to change the type of housing through displacement of conventional with more sustainable developments. Research has investigated these projects to provide feedback to occupants, owners and the design professions regarding the effectiveness of this new typology. However, these projects are mostly in areas within or close to the major population centres. Interestingly, there now appear to be new types of sustainable housing located in a wider regional context and in more remote communities where services and widespread infrastructure can be very expensive to provide. Little research has been carried out into housing acceptance or biophysical performance in such locations wherein resource and energy costs could be comparatively high. Research is also beginning to show the importance of environmental attitudes as a surrogate indicator for occupant behaviour and the influence of such behaviour on building performance and environmental impact. Recognised by the International Panel on Climate Changes as a point of leverage for policy makers, it suggests that, while there is strong agreement on this nexus, there little evidence reliably to inform policy. The role of this research is to assist with providing this evidence (IPCC 2007).

International and national progress in the field:

QoL research: The QoL of a population is an important concern in economics and political science. These disciplines have metrics to measure both qualitative and quantitative factors pertaining to the phenomenon. QoL studies, also called livability studies, tend to be macro in scale covering countries, regions or cities and examine dimensions of, and satisfaction inherent in, peoples’ life style in terms of personal physiological needs and wants and to what extent these desiderata are met by the economic and physical environment. Limitations have been advanced in terms of the lack of holism, i.e. lack of connection between outputs and inputs (Luger 1999:749). For

example, it is difficult to identify the precise factors influencing the satisfaction levels found amongst respondents. The use of these studies at a detailed policy level, whilst giving useful information about macro conditions, has been questioned. Luger argued that outcomes of QoL enquiries can be more attributed to demographic, socio-economic and environmental factors than economic dimensions. He continued that, because these factors are not tracked in a traditional QoL calculus, it makes the studies' valueless and atheoretic with regard to policy formulation. New models of QoL have evolved such as that developed by the UK Government (1999, 2005), which follows a 'principles to indicator' approach with a broader set of factors, including social, economic and environmental ones (Mawhinney 2000). This approach arguably qualifies as a new QoL paradigm. It offers to address the new framework of sustainability and examines the phenomenon from a range of scales -- regional, city and neighbourhood -- and also provides emergent methodologies for understanding the issues at stake. The holistic model may offer a richer information base to facilitate policy formulation for the planning and design of particular aspects of regional infrastructure such as neighbourhoods and precincts. Research in the USA has followed a different path through work by the American Institute of Architects posing an agenda for change. This organisation has made important submissions to the United States Congress to establish policy development and research in this area. A focus on what are called QoL principles provides a planning and design research agenda for built infrastructure but it is broadly based and has not been formulated into a model for housing (AIA 2006).

Research into QoL based around housing is found in the environmental planning field through the work of authors such as Anne Beer and Cathy Higgins in the United Kingdom U.K.). They acknowledge limitations to the planning process in dealing with housing. 'It is recognised generally that land use planning and co-ordinated land management are required at local, regional and national, as well as international, levels if we are to ensure human well-being and even survival. With such strategic issues to be dealt with by the planning process, alongside the basic social and economic needs of a local population, it is perhaps not surprising that the less quantifiable aspects such as those which influence the quality of human life have been rather neglected in the development of many housing projects.' From all this assorted evidence, there is clearly a research agenda to be undertaken in relating micro-level housing outcomes to a much broader urban or regional framework and, from those levels, to matters like national resource consumption and the production of greenhouse outputs.

The absence of effective planning and design of sustainable housing: Research in the U.K. is attempting to address the above problem by linking QoL and housing quality and also by identifying key barriers to improvement. The Department for Environment, Food and Rural Affairs (DEFRA), in a study of public perceptions, found that housing quality was ranked ninth as a QoL issue along with climate change and wildlife. Overall, nine out of 10 people thought it was fairly or very important. Existential factors such as money, health, crime and jobs are primary issues. Biophysical factors such as neighbourhood, transportation and housing quality and environmental problems are rated more or less equally as second priority issues affecting QoL (DEFRA, 2001). Work in the U.K. by the World Wildlife Fund (WWF) has suggested that a number of barriers to improving housing quality span environmental social and economic factors (Wheeler 2003).

Research into QoL at the precinct level: British research into these barriers has proceeded through the use of demonstration projects, i.e. a project which identifies principles, process, technologies and tools, to address housing quality in a context of sustainability. One notable example is the BedZED project – the Beddington Zero Energy Development at Sutton, UK (BRESCU 2002). It is a zero energy project: that is, the onsite renewable energy generation is balanced with the energy drawn from the grid to create net zero carbon emissions. Beddington Zero also addresses environmental, social and economic issues. In BedZED economic parameters support environmental parameters, which in turn underwrite progress. For example, the use of retail units within the housing development is aimed at subsidising the housing rental. The multi use, retail and housing strategy creates a scale effect, which supports the co-generation energy strategy leading to the zero energy capability of the scheme. Yet, for all these innovations, and while the project aims to achieve high quality of life for its residents, its claims remain largely untested (Dunster, B., 2006).

Contribution of the project to the field: In summary, traditional QoL studies focus largely on macro studies of regions and cities using broad survey methods to identify people's perceptions and options about livability. Limitations of this approach are that it lacks the identification of key inputs and outputs to create a useful descriptive model of the phenomenon for policy purposes. New research has identified refinements, which drill down from the regional scale to the precinct level, focusing on housing quality in the context of sustainability. The key determinants of this revised approach can be found in various demonstration projects but claims for improved quality of life combined with reduced biophysical impact are under researched and not substantiated.

C3 SIGNIFICANCE AND INNOVATION

Problem and its Significance: Newman (2006) argues that initiatives to address these issues are found in six main areas; better governance, improved global stewardship in the use of natural resources, biophysical efficiency in settlement patterns, the creation of social capital through community and, finally, improving efficiency in business through a 'Factor 4' policy: i.e double the wealth but also double the resource efficiency. The proposed research examines initiatives concerning biophysical efficiency in the settlement patterns and the creation of social capital through community elements involved in the implementation of sustainable housing. Prior (LP0774952) Initiatives in SE Queensland involved efforts to address the six barriers identified by Wheeler (2003). They include: 1) Disincentives in the fiscal system. 2) Perceived higher costs. 3) Lack of consumer demand. 4) Lack of investment interest by developers. 5) No agreed standards. 6) Planning system does not support sustainability.

There are measures in place to provide incentives in fiscal systems for sustainable housing through reduced mortgage costs for green design, along with subsidies for use of green technologies such as water tanks, solar hot water heaters and photovoltaic systems. Incentives such as those provided by Australia's Bendigo Bank, which offers a 0.50% per annum reduction on the Bank's Residential Variable Rate and no monthly service fee, achieve an interest saving of more than \$48,000 over the life of the loan. It is argued that this is sufficient to provide equity for developers and homeowners to improve the design specifications needed to upgrade homes to meet environmental criteria. This measure also addresses issues identified by Wheeler concerning the additional costs of sustainable housing, but research is needed to establish how these barriers are overcome in practice.

New concepts and Innovation: Consumer demand is the focus of a number of Federal and State initiatives. The Department of Climate Change and Energy Efficiency has developed the 'Your Home' marketing initiative (2010). It targets, amongst other issues, homeowner perceptions about the QoL improvements involved in owning a sustainable home. No exit studies of users have been carried out to gauge the effectiveness of the marketing policy, so questions must remain about the effectiveness of this costly exercise.

Improved metrics in the form of prescriptive and performance standards such as Energy Rating tools are in place. A good example is the BERS (Building Energy Rating Software), which is now adopted by local councils to assess housing development. Its application has translated into legislation. As of 1 January 2003, minimum energy performance standards have been introduced in to the Building Code of Australia (BCA) for detached and semi-detached dwellings. Since the BCA is a performance based code, builders and designers have the option of meeting these new standards in one of two ways either by following the 'deemed to satisfy' prescriptions in the code; or by achieving the required house energy performance rating using an accredited software tool. The stringency of this standard equates to four stars. Queensland has additional measures for water. The measures are designed to reduce water and energy use by 36 and 33 per cent respectively.

Table 1: A mapping hierarchy of sustainable development in relation to available standards, metrics and measures (Hyde 2005).

Levels	PLANNING and DESIGN (input measures)	OPERATION (output measures)
Level 1: Macro	Sustainable Cities/ Regions	
Standards/Tools	Strategic development assessment	Eco Footprinting. Quality of Life, State of the Environment Reports
Level 2: Meso	Sustainable Neighbourhoods/Precincts/ Mixed use development	
Standards/Tools	GG 21 Precinct Planning & Design Standard BRE Sustainable Development Rating LEED ND	Eco Footprinting ISO 14000 GG 21 Community Standard AHURI TBL method
Level 3 Micro	Sustainable Buildings	
Standards/Tools	GG 21 Design and Construction (Tourism buildings) Green Star (Offices, schools and other types)	ISO 14000 GG 21 Company Standard NABERS (houses and offices)

In summary, research into QoL is seen as a macro level issue with little drilling down to community level impacts of sustainable housing. Input measures are in place to address change, such as reducing water and energy use for new buildings, but that leaves the majority of the housing stock following a business-as-usual approach. Few output metrics are in place across Australia such as monitoring the QoL in communities in terms of existential or biophysical factors. Models of the interaction of factors at a community level are largely descriptive and lack empirical validation. (McManus 2005: 85.)

New methodologies: Research into new methods to examine the sustainability of buildings and precincts has started at the Centre for Sustainable Design, The University of Queensland, in conjunction with Professor Deo Prasad at the Centre for a Sustainable Built Environment, the University of New South Wales, and through Dr Veronica Soebarto the School of Architecture, University of Adelaide. Supported by the Australian Housing and Urban Research Institute (AHURI) and the Sustainable Tourism CRC, metrics were developed for examining sustainable buildings and neighbourhoods. Initial work funded by the AHURI supported a Triple Bottom Line study comparing the social, economic and environmental impacts for types of urban subdivisions.

It involved developing a new methodology to measure this range of factors. Many of those examined issues concerning QoL but also considered input measures, i.e. characteristics of the biophysical factors as well as existential (commonly found in QoL) and environmental factors. Allied to this project is work with the Sustainable Tourism CRC which led to the development of a new Precinct Planning and Design Standard (PPDS), which can be used for examining neighbourhoods. The intention is to mainstream this standard. Table 1 shows the current standard for measuring sustainability in at different scales and stages of development, whether in design and operation. From this background, PPDS provides one of a select few tools for work at the meso or, commonly called, community level. PPDS is a quantitative framework for assessing the sustainability of precincts at both the planning, design and operational phases. Other methodologies such as LEED ND used in the United States for this kind of study lack rigour and quantitative assessment of many of the qualitative aspects of precinct design, (Mapes & Wolch, 2011).

Contribution to National priorities: The research is targeted in the research priority area of a Sustainable Australia, looking in particular at issues concerning transformation of the building development industry towards reducing environmental impacts. The federal Department of Sustainability, Environment, Water, Population and Communities has developed a new initiative for the management of the \$10.1 million Measuring Sustainability program. It was announced as a measure under the *Sustainable Australia - Sustainable Communities: A Population Strategy for Australia* in the 2011-12 Budget. 'The strategy recognised that, to build a sustainable Australia, we need improved information about our economy, environment and society, and the linkages between them, to better inform decisions and policy making. We also need to take a longer-term view and consider how actions and decisions today affect the opportunities available to future generations. The Measuring Sustainability program supports these objectives by establishing a National Sustainability Council and a set of sustainability indicators for Australia' (<http://www.environment.gov.au/sustainability/measuring/index.html>).

Environmental, social and economic benefits: The QoL model used in this study is called QoLe as it includes environmental issues in the determinants of Quality of Life. This innovation, absent in other models, makes this a more comprehensive measure of well being. As reported by the Sustainability Council of Australia, sustainability requires that 'the wellbeing of society - the combination of community liveability, environmental sustainability and economic prosperity - is maintained or improved over time. Measuring sustainability is about monitoring how each of these indicators is tracking over time.' QoLe is an important method of carrying out such measurement and can provide essential import into the work of the Council (Upadhyay, A. K., Hyde, R., & Wadley, D. 2010).

Benefits to the partner organization: THA in conjunction with the State Architect will benefit from the monitoring of the Eco complex at Broken Hill and also with regard to the conventional housing which they own in this area. Moreover, this feedback, characterised as post occupancy evaluation, adds a further dimension of providing insight into the environmental attitudes of the occupants and their role in the driving the intention of the Eco housing.

C4 APPROACH AND TRAINING

Conceptual framework: The first research aim is to revise LP07 outcomes regarding selected sustainable housing projects in SE Queensland to assess their QoL outcomes with respect to existential and biophysical criteria. Second, this monitoring work will be used to generate a QoL model, which represents the major dimensions of the phenomena in question and provides a comparative overview of the performance of projects examined. In this way, inputs, specifically, design and planning features, can be mapped against outputs, QoL measures (hedonic and eudiamonic) and biophysical factors such as water, energy and waste.

Research Design and Methods: The methodology will be used to investigate the attitudes of occupants, their satisfaction and the environmental impact of these new sustainable developments as compared with occupancy of conventional housing. A field desk will be set up in Broken Hill through the THA of NSW and in conjunction

with the NSW State Architect, to investigate their new Eco housing prototypes and to compare performance with the conventional housing that exists in the housing portfolio in this location.

Table 2: States of Quality of Life (modified after Noll, 2000)

<i>Objective condition (Environmental and existential features)</i>	<i>Subjective condition (Perceived satisfaction)</i>	
	Good	Bad
Good	Well-being	Dissonance
Bad	Adaptation	Deprivation

- 1) The project is focused on N.S.W. THA housing in Broken Hill. A group of eight new Eco houses will be intensively studied and a control group of eight recent conventional houses selected. The houses will be matched according to number of bedrooms to control key variables concerning family and house size. Four data sets will be created. The first determines the physical aspects of the houses and the stock of sustainable features, the second residents' environmental attitudes, the third residents' perceived satisfaction and the fourth the biophysical impacts such as energy and water use.
- 2) The physical aspects of the design and planning features of the housing will be assessed. The PPDS standard (Hyde et al 2005) will be used to assess the level of sustainability in the housing.
- 3) Intensive quantitative and qualitative data collection will start in 2013. A request letter will be sent by post to all households who have been living in the Ecovillage or in the conventional housing for more than six months. Initial information about the suburb and houses will be obtained from RP data - an online database for property information in Australia (www.rpdata.com). Households will be asked to nominate one adult to participate in the survey. A detailed face to face questionnaire with opportunities for open ended items will be administered to eight households from the Broken Hill Ecovillage and eight from the conventional suburb) in March and April 2014. Objective environmental data will be obtained through field study and secondary sources, whereas objective evaluation of subjective material will be determined through a questionnaire. The questionnaire will comprise three parts related to: demographic and personal information, environmental attitudes (EA), and perceived residential environmental quality (PREQ) and neighbourhood attachment (NA). The combination of both subjective and objective QoL measures allows comparison of the possible variations between the two perspectives. Interaction of these two approaches should produce four states of QoL defined as well-being, deprivation, adaptation, or dissonance (Table 2). Zapf (1984) explains that a state of well-being can be achieved with good living conditions and positive well-being; bad living conditions combined with negative well-being highlight a state of deprivation; bad living conditions and positive well-being are termed adaptation (and this combination is also known as 'satisfaction paradox'); dissonance refers to the inconsistent combination of good living conditions and dissatisfaction (which is also known as 'dissatisfaction dilemma') (Noll, 2000).
- 4) Data collection of biophysical factors. A collection program will be set up in each development to capture data on biophysical aspects such as user comfort, water, energy use and waste generation. Data loggers and sensors will be used. The research team has expertise in developing the detail of this process. The methodology will be adapted from the successful LP07 research project.
- 5) Data analysis of each of the four data sets will be used to examine the factors in the results over the period of two years using a statistical analysis package SPSS, which can carry out factor and regression analysis of the data sets (O'Callaghan, B., Green, H. J., Hyde, R. A., Wadley, D., & Upadhyay, A. (2012). The data from the Eco village study will be compared with that of the Broken Hill field station.

Table 3 Research Time Line

Time line:	2013	2014	2015
Stage 1 Pilot Study- Broken Hill	XXXX		
Stage 2 Ecovillage Study- Broken Hill		XXXX	
Stage 3 <i>Conventional Housing Study</i> Broken Hill		XXXX	
Stage 4 <i>Comparative study</i> Broken Hill and Currumbin (Qld) Eco village			XXXX
Stage 5 <i>Model developments and testing</i>			XXXX

Research Plan: The research plan involves three stages and according to the time lines in Table 3.

Stage 1 Data collection, Primary Study Group- Rental housing
- Teachers Eco Village, Broken Hill.

Stage 2 Data collection, Control group- Rental housing (matching for house size by bedroom count).

- Teachers' Conventional Housing, Broken Hill

Stage 3 Comparison of Data from Stages 1&2

- Influence of difference in sustainable attributes on residential satisfaction and QoL

Stage 4 Comparison of data from prior Study- Owner occupiers in southeast Queensland

- *The Ecovillage Currumbin Queensland*
- *The Conventional Housing Currumbin Queensland*

Research training: Through this the project we will be able to provide research training for our Masters of Sustainable Design students (at the University of Sydney) with assistance both of the thermal modeling of the houses and also analysis of the biophysical data. This type of grounded, practice-based research will be very valuable and consistent with a number of course units currently offered. For example, DESC 9150 Sustainable Design Research Project is targeted to provide students with understanding of post occupancy evaluation and research data analysis skills. In addition, we will recruit further postgraduate student to continue this work with the THA in the future to maintain the research.

Current research in this area not in the public domain: The conclusion of LP07 will be reached in the middle of 2013 with the submission of a PhD thesis on the QoL model, which has come from the work on the Ecovillage in Currumbin (SE Queensland). In addition a Masters thesis is currently under examination. It looks at the relationship between QoL and biophysical performance.

C5 RESEARCH ENVIRONMENT

Research and Collaborative Environment: The University of Sydney is committed to the discovery and responsible communication of new knowledge and understanding through free enquiry. It has a long history of excellence in research across a diverse range of fields. Our research tradition is built upon strong disciplines supported by faculties and schools, cross-disciplinary initiatives, and commitment to both rigour and depth in research and research training. The University's Strategic Plan 2011-15 includes the goals of; 1. Identifying, developing and supporting talented researchers at all stages of their career; 2. Contributing to the cultural, social and economic benefit of Australia and the international community; and 3. Building areas of research capacity and strength. These goals coincide with the objectives of ARC Linkage research and the research participating in this scheme. A significant driver has been the University's support for sustainability and the built environment research. The Institute for Sustainable Solutions

http://sydney.edu.au/agriculture/research/institute_for_sustainable_solutions.shtml, is providing support for this work. In addition a number of research networks are now active in the area of this research project funded from the University. The Energy Storage Research Network has emerged which is relevant to this project as it fuses a range of faculties involved with inorganic chemistry, chemical engineering, policy and administration, law, and architecture to provide solutions to the development, integration and management of large-scale energy storage dealing with issues of urban sustainability.

Divisional and Faculty Research Support: The project will be located in the University of Sydney's Architectural Science Discipline in the Faculty of Architecture, Design and Planning, Division of Architecture and Creative Arts. The support for research infrastructure comprises dedicated office space for Discipline staff, studios, computer lab facilities and access to administrative support staff through a Research Officer. The Faculty policy for research includes new staff start up grants, incentive funding including input funds for Category 1 grants applications, travel funding for publication of research outputs and small grant funding to support staff and students. The Faculty will provide additional salary and equipment funding to particular hard and soft infrastructure for research for this project. The Faculty supports diffusion of results through industry and practitioners through a number of web-based platforms, as well as lectures and seminars. An important research field developed in the Faculty includes 'The Emerging Cities Network' chaired by Associate Professor Nicole Gurran with a focus on urban sustainability.

Discipline/ research support: Management and oversight of the project will be through HOD, Professor Richard de Dear in the Discipline of Architectural Science. The Discipline was founded in 1958 by Professor Henry Cowan AO, with the first Chair of Architectural Science in the world. It has six full time staff and 23 EFSL postgraduate research student teaching load. It is noted for its research into audio acoustics, lighting, indoor environmental quality and sustainable design, which form its key research areas. Research leadership was increased with the strategic appointments of Professors Martens, de Dear and Hyde in 2008 and 2009 to strengthen these key research areas. Notable staff includes Emeritus Professor Warren Julian and additional adjunct positions that connect with

major research intensive industry partners such as Arup, AECOM and INVESTA, and with research partnerships in countries such as the U.K., United States, Japan, Korea, China, Malaysia and others world wide.

The Discipline boasts seven laboratories, which support a research-led teaching approach to its MDesign Science degree and undergraduate teaching in Architecture and Allied Arts. Cross-disciplinary activities have grown in the area of the proposed project. They include strengthening research in the area of Energy, Society and Culture, with links to the Faculty's Sustainability Cluster. Publication outputs have increased in recent years with the hosting of 45th ANZAScA conference in 2011 at The University of Sydney and the ongoing editorial leadership of the leading journal, *Architectural Science Review* by the Discipline. *ASR* is now in its 56th edition, spanning over half a century of research leadership by the Discipline, and is an indicator of its strong contribution to an international research environment.

Faculty Research Plan: The strategic planning process initiated by the University in 2010 and 2011 set in train the evolution of both vertical and horizontal organizational support for research within the Division and across Faculties. The Faculty, having established cross-disciplinary clusters in 2009, is now focused on Discipline growth around ARC Priority areas with increased development of national and international research networks and teams supported by growth in postdoctoral research students and research fellows in niche knowledge areas.

Communication plan of research results: Academic: Journals: *Urban Design and Planning*, *Architectural Science Review*. Public communication: The Faculty of Architecture, Design and Planning, Sustainability Cluster has provided seed funding for this project and has assisted publication of results of past projects through the Faculty web site.

C6 PARTNER ORGANISATION COMMITMENT AND COLLABORATION

Contribution to the partner organization: The background to the collaboration of the partner organization is important to understanding the commitment of the partner NSW_THA and its consultants NSW Government Architect's Office (GAO). THA strategically allocated funds to provide for a prototype sustainable housing project in Broken Hill and the GAO was appointed as the consultant for this project (hence the GAO is considered inside the THA organisation for the purposes of this grant. Subsequent research through this ARC Linkage project will utilise the results to obtain feedback on the effectiveness of the design of their Eco housing and its environmental impact. The diffusion of results falls into two categories: academic and industry related. Whilst the development of the model of QoL will be published thorough academic avenues such as refereed papers, the information for industry such as the case studies will be published through the collaborative organization web sites and media. In addition workshops and presentations to industry groups are anticipated.

Strategic purpose and value of the project to the partner organization: The value to the project partner is to ground its work in a broader State and national agenda towards sustainability.

Development of long-term alliances: The objective of the study is to build a stronger relationship with the THA and the GOA to support monitoring of new building prototypes and to assist with providing feedback on the operation of the building infrastructure.

C7 ROLE OF PERSONNEL

1. CI and PI roles and responsibilities: A Steering Group will be set up involving the CI's and the PI's (the THA and GAO) who will meet regularly to manage the project. Hyde and Wadley will manage the day to day running of the project supervision of, the students on academic issues and facilitate industry training with the industry partners. They will have major input into all Stages. Wadley will assist with Stage 4 relating the data on this project with the environmental impact, residential satisfaction and QoL issues following the earlier work in SE Queensland.

2. Research Associate (RA roles and responsibilities. An appointed RA will work on all Stages of the project. The tasks allocated to the RA are as follows.

- Collect background data on the project including selection of candidate control group of conventional houses, detailed planning of the field work and logistics.
- Prepare questionnaires, prepare plans for location of data loggers and apply for ethics approval. Via fieldwork visits install data loggers, administer the initial questionnaire study and undertake analysis of results.
- Compilation of reports and Steering Group meetings and paper preparation.
- Carry out thermal and water balance modeling to establish benchmarks for energy and water usage.
- Carry out the comparative study for data from Ecovillage and conventional houses.
- Oversee the final report, Steering Group meetings and project completion, paper preparation.

3. Partner the THA and GOA. Assist with providing research training for postgraduate students who will work on the data collection in Stages 2 and 3. In this way industry training can be organised. Within this schema, industry partners would assist and coordinate Stages 1, 2, and 3. This multidisciplinary team has experience in a broad range of social, environmental and economic factors necessary to bring this project to a successful conclusion.

C8 REFERENCES

- American Institute of Architects, 2006. *The AIA's "Win-Win" Agenda for a Better Quality of Life for All Americans*, On line. Available HTTP: <http://www.aia.org/adv_gen_agenda> (accessed 7 April 2006).
- Australian Greenhouse Office 2005, *Your home*, Online. Available HTTP:< <http://www.greenhouse.gov.au/yourhome/index.htm>> (accessed 9 April 2006).
- Australian Greenhouse Office 2006. On line. Available HTTP: <http://www.greenhouse.gov.au/buildings/code.html#houses>> (accessed 7 April 2006).
- Beer, A. and Higgins. C., (Editor), 1997, *Environmental Planning for Site Development*, Spon Press, UK.
- Bendigo Green Home Loan. Online. Available HTTP: <http://www.bendigobank.com.au/public/personal/green_loans/residential_detail.asp> (accessed 9 April 2006).
- Blair, J., Prasad, D., Judd B., Soebarto, V., Hyde, R.A., Zehner B., Kumar, A., 2003, *Affordability and Sustainability Outcomes of 'Greenfield' Suburban Development and Master Planned Communities – A Triple Bottom Line Assessment*, progress report for the Australian Housing and Urban Research Institute, University of New South Wales-University of Western Sydney Research Centre, pp24.
- Brindle, R., 1999, *Integrated Planning and Sustainable Development*, Heidi Lansdell,
- Bruntland Report, 1987, *Our Common Future*, United Nations World Commission on Environment and Development.
- DEFRA, 2001, *e-Digest Environment Statistics, Public Attitudes*, On line. Available HTTP:< <http://www.defra.gov.uk/environment/statistics/pubatt/ch3h07.htm>> (accessed 7 April 2006).
- Dunster, B., 2006, *ZedFactory*. On line. Available HTTP:< <http://www.zedfactory.com/home.html>> (accessed 7 April 2006).
- Hyde, R.A., Moore R., Kavanagh, L., Watt, M., Prasad, D., And Blair, J. 2005, 'Development of a planning and design tool for assessing the sustainability of precincts.' ANZAScA Conference, Wellington, New Zealand, p 29, CD publication.
- Hyde, R.A., Gardner, T., Skoein, P., Rutherford, L., Walton, C., Wadley, D.A., *Towards a Quality of Life Framework for Sustainable Housing in South East Queensland*, ARC Linkage LP0774952 2007-2012.
- IPCC (2007) *Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (Eds), Cambridge, UK.
- Luger, M.I., 'Quality of Life Differences and Urban and Regional Outcomes: A review,' in *Housing Policy Debate* • Volume 7, Issue 4. 749. ©. Fannie Mae Foundation, 1996
- Mawhinney, M., 2002, *Sustainable development: understanding the green debates*, Blackwell Science; Oxford.
- McManus, P., *Vortex cities to sustainable cities: Australia's urban challenge*, Sydney: University of New South Wales Press, 2005.
- Mapes, J., & Wolch, J. 2011, 'Living Green': The Promise and Pitfalls of New Sustainable Communities. *Journal of Urban Design*, 16(1), 105-126
- Newman, P. and Kenworthy, J, 2006, *Sustainability and Cities Overcoming Automobile Dependence*. Island Press, Washington D.C.
- Noll, H.-H. (2000). Social Indicators and Social Reporting: The International Experience Retrieved 17th May, 2012, from <http://www.ccsd.ca/noll2.html>
- O'Callaghan, B., Green, H. J., Hyde, R. A., Wadley, D., & Upadhyay, A. (2012). Exploring the influence of housing design and occupant environmental attitudes on energy and water usage. *Architectural Science Review*, 55(3), 176-185. doi: 10.1080/00038628.2012.693813
- O'Callaghan, B, 2013 forthcoming MPhil, University of Sydney
- Stimson, R., Western J, and McCrea, R., 2003, *Assessing Quality Of Life In Brisbane-South East Queensland: An Overview Of Findings From The 2003 Survey*, Centre for Research into Sustainable Urban and Regional Futures (CR-SURF) and The Centre for Social Research, The University of Queensland. On-line. Available HTTP: < www.cr-surf-ims.geosp.uq.edu.au/QOL/Assessing%20QOL.PDF > (accessed 7 April 2006)
- UK Government. *A better quality of life - strategy for sustainable development for the United Kingdom* – 1999, 2005. On line. Available HTTP: <<http://www.sustainable-development.gov.uk/publications>> (accessed 7 April 2006).
- Upadhyay, A. K, 2013 forthcoming PhD, University of Sydney
- Upadhyay, A. K., & Hyde, R. (2011). *Does sustainable housing contribute to Quality of life for residents? A study of the Ecovillage at Currumbin*. Paper presented at the 12th APRU Doctoral Students Conference, 2011, Tsinghua University, Beijing, China.
- Upadhyay, A. K., & Hyde, R. (2012). *Role of people-environment relationships in sustainable development* Paper presented at the 46th Annual Conference of the Architectural Science Association, ASA 2012, Griffith University, Gold Coast, Australia.
- Upadhyay, A. K., & Hyde, R. (2012). *Understanding environmental attitudes of residents living in ecologically intentional housing: A study from South East Queensland, Australia*. Paper presented at the 22nd IAPS conference 2012, University of Strathclyde, Glasgow, UK.
- Upadhyay, A. K., Hyde, R., & Wadley, D. (2010). *Exploring models and methodologies for measuring environmental Quality of Life (QoLe) in Sustainable Housing*. Paper presented at the 44th Annual Conference of the Architectural Science Association, ANZAScA 2010, Unitec Institute of Technology, Auckland, New Zealand.
- Wheeler J, 2003, 'One million sustainable homes' in *UNEP Industry and Environment*.
- Wilrath, H, 2006. <http://www.solarlogic.com.au/ContactUs.htm>
- Zapf, W. (1984) *Individuelle Wohlfahrt: Lebensbedingungen und wahrgenommene Lebensqualität in der Bundesrepublik*, In: W. Glatzer and W. Zapf (eds), *Lebensqualität in der Bundesrepublik*. Frankfurt am Main and New York: Campus, pp. 13–26.