A Case for Establishing a Nationally Based Program for Sustainable Energy and Water Use in the Built Environment:

An Investigation into:
Establishing a vibrant R, D & D Collaborative Centre for Energy Efficient Lifestyles, Developmental Patterns, Building Technologies and Building Design Strategies

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Abstract. For the past decade, politicians have applied different shades of “green-wash” to global environmental issues in order to help juggle their positions in the political spectrum. This has created the illusion that effective measures are being pursued in the public interest for both this and future generations. The reality is, however, that nearly all of these initiatives are “input focused” and the various States of the Environment reports confirm that, despite decades of endeavour and large financial investment, there is little return on investment and that the rate of environmental degradation, particularly of the global atmosphere, continues to increase. Despite fierce posturing from the global warming sceptics, it seems that finally, the long term data indices of global warming are being accepted seriously and politicians around the world are responding by investing public funds in the quest for the search for options. This paper contends that with global warming, humans will need to embrace uncertainty and manage change and that innovation and cooperation across all disciplines and the cooperation of the entire political and social spectrum will be required to solve the ecological disasters that have already begun to unfold and accelerate in frequency. It looks from a strategic viewpoint at how specialist education can catalyse change and play an important role in managing the change. The case study used in this analysis is the RISE Master of Science Course in Environmental Architecture. It explores the implications of linking to converging interests from other emerging course streams for Engineering and other Built Environment disciplines such as Planning, Project Management and Interior design as well as socio-economic disciplines and the integrative discipline of Systems Dynamics.

INTRODUCTION

A National Program for Sustainable Energy in the Built Environment

Everyone in this audience is likely to be aware of the pressing environmental problems that we are now facing on a number of fronts and that energy and water are two of the most pressing of these. As an audience you are likely to be aware of the growing global water crisis. Those of us who live on the driest continent can no
longer hide from our water supply problems - the poor environmental condition of many of our rivers, declining rainfall, the high environmental and economic costs of increased reliance on desalination plant and the sustainability of increasing supplies from underground aquifers.

In terms of climate change, most of us are now familiar with the statistics relating to rapidly increasing global greenhouse gas emissions and the frightening climate change scenarios that the global community is faced with. Australia’s contribution to global emissions may be relatively small in absolute terms, but in per capita terms we are the highest emitters on the planet. To limit the increase in global temperatures to 2°C above pre-industrial levels, global greenhouse gas emissions will need to be reduced by 50% by 2050. This means that the wealthy industrialised countries such as Australia will need to cut their emissions by 60% to 80% by that date.

Achieving such large reductions will be a major challenge and it will be important to reduce emissions from all sectors. Reducing water and energy use in the built environment will be particularly important as a large portion of water and energy use are associated with residential and commercial sectors. Over 33% of primary energy is used in the built environment.

Many current efforts to reduce water and energy efficiency focus on the residential and commercial sectors. The important questions that we need to ask ourselves are “Is what we are currently doing enough?” and “What more could we do?”. This paper describes the Built Environment Program that has been established at the Research Institute for Sustainable Energy (RISE) at Murdoch University and discusses the efforts to explore the opportunities for taking this to the next stage by creating a nationally coordinated research, development and demonstration sustainable built environment program.

RISE’s Built Environment Program

RISE was established in 2003 as a Murdoch University Centre charged with developing a set of research, education, testing and other programs that would assist Australia’s transition to more sustainable energy use and assist the development of Australia’s sustainable energy industries. RISE’s vision is to be a leading renewable and sustainable energy university centre undertaking high quality research and education and providing high quality training and testing services. RISE’s initial focus was renewable remote area power systems (RAPS), including research, education and testing services (laboratory and outdoor testing) for renewable energy systems and components. Testing included inverters, batteries, charge controllers, solar water heaters, fuel cells, photovoltaic systems and small wind turbines. RISE’s testing laboratory, ResLab, is the only laboratory in Austral accredited by NATA for testing inverters. RISE’s focus was expanded over time to include sustainable transport energy, distributed energy renewable energy systems, hydrogen energy systems and the built environment.

The Institute looks at sustainable energy systems and strategies from an environmental, economical and social perspective and the introduction of a Built Environment program has been included as an important part of the scope of its
operations. The development of a Built Environment Program was seen as a logical progression in terms of integrating renewable energy systems into the built environment while at the same time minimising energy demand to maximise the proportion of energy used in the built environment that could be supplied by renewable energy equipment and systems.

The primary tasks undertaken within RISE’s Built Environment Program to date have been educational. A postgraduate (Master) course in sustainable architecture has been developed and is now being offered. Professional development and short courses have also been developed. Consulting and advisory services are also provided. Industry sponsorship has been instrumental in enabling these courses to be developed. No funding has been provided by government for the development of the Built Environment Program to date. The longer term goal is to develop further postgraduate courses, including research courses.

Providing postgraduate courses and professional development training are a necessary component of any long term strategy. However, the translation of this into increased sustainability in the built environment will take time. More needs to be done.

**A Proposal to Establish a Built Environment CRC**

RISE recognises that more needs to be done and has attempted to facilitate this by proposing the establishment of a national Built Environment CRC, in which RISE would be one of the participants. The aim would be to bring together a number of existing university and industrial endeavours to increase their effectiveness and to facilitate the development of new activities in this area. The focus would be the generation of new, sustainable built environments by speeding up the practical application of greenhouse saving designs, equipment and technologies in buildings.

Garry Baverstock AM, the Manager of RISE’s Built Environment program, visited a number of interstate companies, universities and research organisations in order to undertake an initial assessment of interest in participating in a national collaborative built environment program. The response was encouraging, although no firm commitment was expected or sought at this stage. A precedent CRC, ACRE is an excellent case study on the pitfalls of CRCs in their current form.

**The Original Rationale for the Establishment of ACRE**

The Australian Cooperative Research Centre for Renewable Energy (ACRE) was established in July 1996 following a special round of CRC applications in 1995. ACRE was hosted by Murdoch University in Perth, WA and began with 21 members who formed a company known as ACRE Ltd to run the CRC. The original members consisted of eight universities, seven small companies, four power utilities and two government agencies. The Board of ACRE Ltd appointed a Managing Director to run the CRC and he selected program managers and project leaders (ACRE Annual Report, 2003).
BRIEF HISTORY OF ACRE – EXPERIENTIAL LESSONS

ACRE commenced operations early in 1997 with eight programs and 28 projects and work began on a ninth program soon after. After failing to obtain extension funding for this additional program, that ninth program was suspended in 1998.

Murdoch University was subsequently provided with funding through the RRPGP to further develop its laboratory and testing capabilities and to undertake other industry development activities. The testing facilities were incorporated into the University’s new centre, RISE. (see RISE web site).

Lessons from the ACRE Experience

There is much that can be learned from the ACRE experience and there were many successes that provide useful models for future applications and some failures that point to pitfalls to be avoided in the future.

The greatest successes of ACRE came about through the synergies provided by Commonwealth funding and the interaction of groups that would not otherwise have been able to collaborate. This is illustrated by the success of the testing laboratory, Bushlight; the wind power project, the development of training materials and the solar concentrator work. Some industries were able to increase their competitiveness in the market place. The additional funding provided to the TAFE and University education projects, the policy analysis and short course training also led to impressive outcomes that will benefit Australian industry over the long term. The ACRE web site was an outstanding success attracting more than 100,000 hits over seven years.

ACRE also experienced many difficulties and disappointments and it is worthwhile listing some of these as a guide for future applicants for CRCs in renewable energy and related areas of research. The major problem was having too many participants for the funding available and the unreal expectations we had about what could be achieved in seven years. Commercial outcomes need substantial funding and lengthy time frames for success. Seven years often, is not long enough in an emerging industry where most of the companies involved are small and under-capitalised. As a result ACRE lacked sufficient industry funding support to justify a second term.

Refer to www.solar-e.com (“who has the answers to my problems?”) for a summary of the expanded history of ACRE and the lessons there to be learned by CRC proposers. The following URL will direct you to the complete article on which this paper is based: http://www.solar-e.com/answers/researchorganizations.htm
THE SUSTAINABLE ENERGY SILK ROAD OF THE
21ST CENTURY: PERTH TO TOKYO

The 21st Century is going to be very challenging for the global community. The prospects of social and economic disasters caused by dramatic climate change, is making environmental issues in the built environment and transport of significant importance in government circles. The use of solar and renewable forms of energy is no longer a novelty or a fringe activity by environmentalists. Security of energy supply will also be a factor in a growing terrorist influenced world.

Communication of ideas, information and state of the art solutions is the key to speeding the evolution of the solar energy solutions.

WHY AUSTRALIA? WHY PERTH?

Perth is arguably at the crossroads of international attention in the S/E Asian/Pacific run region of the world. Australia is of significance as a role model in terms of innovation, and although not significant as a consumer of energy on the world scale, its per capita consumption is very high. Strategically it is a secure, safe, stable continent to house research and development. The track record is impressive in various aspects of solar technology applications but the rest of the world is not always aware of that. It’s the old story. We are fine at innovation but lack the culture to bring our ideas to market. This can only be assisted with the wider dissemination of the basic ideas and the creation of market responses that will encourage innovators.

It would be a good business marketing / management centre for such a CRC initiative or national Built environment framework.

Refer to www.solar-e.com (“who has the answers to my problems?”) for an expanded case for Perth being a marketing/management centre for such a CRC. The following URL will direct you to the complete article on which this paper is based:

THE IMPORTANCE OF SUSTAINABLE ENERGY IN THE BUILT ENVIRONMENT

“Sustainability” has been a grossly misused word since the concept was introduced to protect the ecology for future generations by a UN decree in 1987. It has taken on a meaning of “business as usual” in perpetuity for many in western society. Clarity of thought and the main objective must be maintained if there is to be any hope of delivering the environmental outcomes needed to avoid the economic, social and environmental catastrophes facing the globe. The following illustrates and example of first principles thinking that could be one of the early focuses of a CRC in its fresh look at all governance systems existing throughout Australia and other places in the world:
The Sustainability Cycle

There are two critical aspects of sustainability, if one politicizes the issue:
- An audit framework for assessing the main (or “sacred” elements of life).
- The priorities of the sustainability loop of “global” air through to “local” air.

The full explanation is posted on the www.solar-e.com satellite site sustainable-world.net. The diagram can be accessed from the URL:

http://www.solartec.iinet.net.au/satellite/sustainable/sustainabilitycycle.htm

This first principles approach is an ideal way of not only evaluating current sustainability rating systems but developing a universal, or globally applied system that is free from political and industrial interference and therefore a valuable tool at an academic or scientific analysis level of investigation.

To achieve results, this maybe the only credible way forward. Such could be the fresh analysis and review of assessment rating systems of a new CRC, so that Australia can build on what has been developed to date and establish an analysis system that delivers state of the outcomes.

DISPELLING THE MYTH

The 2000 Sydney Olympics dispelled the myth that solar architecture was an idea for the future. It is the way of the present! In this paper we have seen that from the early beginnings of solar housing from the late 1970’s, Australia has been one of the leading nations in the field. Though in historical terms, it is still early days for the discipline, higher education and information dissemination will assist in the mainstream adoption in the built environment. Important steps forward are now needed in the fields of Urban Planning and Design before it will be an economic reality for the average citizen to be able to live and work in Passive Solar buildings.

THE CRC FOR SUSTAINABLE ENERGY IN THE BUILT ENVIRONMENT

Over the last decade there has been very little penetration of passive solar and energy efficient principles into the Australian development and construction industries. One of the problems for this has been a “silver” or magic bullet approach by government using mainly industry approved rating systems to improve standards of performance. CRC’s on the face of it appear to be an attractive funding option to produce integrated results with inputs from academia, industry, professions and government. But the management style is in need of a comprehensive revamp. A recent paper (Barker, 2006) analysing the future of CRC’s for Murdoch University, clearly shows the governance requirement for outputs and outcomes. It is clear that task oriented inputs and some outputs was considered the desirable results since 1990 when the funding model was introduced by the Australian government. But
with the greenhouse issue, as with its closely aligned water use problem, it is now obvious that appearing to act is no longer an option. Our scientists and the community simply have to achieve results and workable outcomes.

A NEW GOVERNANCE, MANAGEMENT AND CORPORATE MODEL NEEDED

In order to succeed at the management level, it is important that several do’s and don’ts are observed. The field of adaptive management requires a special approach. For an Institute to avoid costly dead ends and inconclusive outputs, the management core must stay in control of the process as alluded to in Jenning’s preceding critique of ACRE. The following aspects must be incorporated into the management modus operandi (Parker, 2006):

- A New Systems Dynamic Management Approach Needed
- Accountability for Outcomes
- Avoiding the Sheltered Workshop Syndrome
- Developing a Supporting Role with Industry
- Creating a Relationship with the Public
- An Importance Place for the Collegiate Atmosphere Within
- A Supportive Network with Other Universities
- A Long, Workable, Productive Relationship with Government

THE NATURE OF THE BUILT FORM CRC
(OR NATIONAL NETWORK?)

The nature of the built form CRC will need to be responsive to provide solutions to previous design inadequacies as well as the necessary innovation to manage a changing climate. Emergent trends and estimates suggest tweaking design will not achieve adequate results.

It is therefore envisaged that tomorrows built form research should be setting a goal of a huge improvement in water and energy efficiency and to achieve that, the authors suggest a significant departure from previous approaches to the structure and administration of the CRC.

The CRC needs to be more than an array of research streams aimed at focussing technical reductionism to some assumed osmotic uptake in the future by someone. It needs to be a holistic entity, part of a learning system that includes the community, industry and governance. It needs to be able to account the performance of the built form at multiple scales, from structure planning stage, through construction and on to operation for economic, social and environmental indices.

The CRC will need agile thinking partners capable of embracing uncertainty and managing change, including some in landscape architecture committed to landscape function at multiple scales.
The Attributes of Potential Partners

- Able to work across disciplines, scales and time
- Able to embrace uncertainty and manage change
- Adaptive
- Able to see the need for linear and non-linear thinking to work cooperatively and supportively
- Disposed to expansive, imaginative, positive thinking
- Solution focused
- Be involved in innovation in the built form or in thinking that enables those working in the built form to be more effective

Suggested Logic Train Analysis (as Prepared by Parker)

- Global Warming is an accepted emergence (Rupert Murdoch)
- By 2025, 3 billion people are expected to be living in water deficit (UN Report)
- Fossil fuel reserves are finite and the current world is increasing its demand for fossil derived energy
- Burning fossil fuels at an incremental rate in the face of global warming would normally indicate that plan B is going to be very important
- In Australia, we are expected to be affected disproportionately more than other countries by global warming
- Climate warming in Australia is likely to increase energy consumption
- We are currently experiencing drought and for the first time are being seriously challenged by water shortages
- We expect water shortages to be with us permanently and the challenges to increase
- The only thing that is certain is uncertainty
- We don’t have a quantitatively based plan B
- “Do nothing” is not an option
- We have about 7.5M dwellings in Australia and there are about 150K housing starts a year
- We currently have research underway on Urban Development (eg AHURI)
- We need to “dig deeper”. The question is “how much deeper”
- With an incremental curve of global warming and ensuing complexity, how will we recalibrate the deepness of the digging?
- Specifically, how can we improve design in the built form, including its relation to the unbuilt form so that the human footprint is minimized?
- What sort of thinking would we need to apply? (Holistic, solution focused, multi-disciplinary, multiple scaled, multi-dimensional, adaptive, accountable)
- What sort of thinking would we need to avoid? (Input focused, block scaled, static, uni-dimensional, simplistic)
• What parameters can be explored to retro-fit and future-fit the built form for water and energy efficiency?
• Which parameters should receive priority?

FUTURE DIRECTIONS/NATIONAL RECONNAISSANCE

A recent reconnaissance by the current Built Environment program Manager at RISE (G Baverstock), produced some lively debate and input. The following points are a summary of those points brought up at this Stage:

The Findings/Suggestions from the Round Table Meetings

Meetings were held in Adelaide, Melbourne, Canberra and Sydney. There will be one such meeting held in Perth early in the New Year. Participants from Tasmania were invited to the Melbourne meeting and representatives form Newcastle and Queensland was invited to the Sydney meeting. In addition to the round table meeting individual meetings were held in Sydney, with Boral Ltd and Martin Greens PV research group at UNSW.

The attendees had invaluable input to this early process and were excellent sounding boards for the Baverstock / RISE presentation.

It now remains for the Australian scientific and professional community to taken this early initiative and gain the large industry support needed and a management approach that delivers outcomes. A forthright financial commitment by one or two large industries is needed at this stage to make this vision a reality.

Refer to www.solar-e.com (“who has the answers to my problems?”) for a summary of the work done by this committee to date. The following URL will direct you to the complete article on which this paper is based:

REFERENCES


Web Resources:

www.solar-e.com, 2002, Wise Earth P/L, (generally for case studies, examples, philosophical issues and sustainable urban design)
www.solartec.iinet.net.au/satellite/architecture/BCAregulations1.htm, 2003, Wise Earth P/L, (For archetypal solutions for ESD subdivisions and the impact of the R-codes and BCA changes)