THE ROYAL AUSTRALIAN INSTITUTE OF ARCHITECTS

The Royal Australian Institute of Architects

Inquiry into Energy Efficiency

Submission to the Australian Government Productivity Commission

November 2004

SUBMISSION BY

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PURPOSE

- This submission is made by the Royal Australian Institute of Architects (RAIA) to the Australian Government Productivity Commission, in response to the Productivity Commission Issues Paper, dated September 2004, for the Inquiry into Energy Efficiency.

- This submission has been prepared with the assistance of the National Environment Committee of the RAIA, particularly its Chair, Professor Lindsay Johnston.

- At the time of this submission the Executive of the RAIA is: Warren Kerr (National President), Robert Nation (President-Elect), David Parken (Immediate Past President), Carey Lyon and Alec Tzannes.

- The Acting Chief Executive Officer is Ross Clark.

INFORMATION

Who is making this submission?

- The Royal Australian Institute of Architects (RAIA) is an independent voluntary subscription-based member organization with approximately 8,800 members, of which 6,070 are architect members. Members are bound by a Code of Conduct and Disciplinary Procedures.

- The RAIA, incorporated in 1929, is one of the 96 member associations of the International Union of Architects (UIA) and is represented on the International Practice Commission.

Where does the RAIA rank as a professional association?

- At approximately 8,800 members, the RAIA represents the largest group of non-engineer design professionals in Australia.

The Royal Australian Institute of Architects

Inquiry into Energy Efficiency

Contents

1.0 INTRODUCTION

1.1 Inquiry into Energy Efficiency

1.1.1 The RAIA is pleased to provide comment on the Issues Paper dated September 2004 – *Inquiry into Energy Efficiency* to the Australian Government Productivity Commission.

1.2 Expertise of the RAIA

1.2.1 The RAIA seeks to advance the professional development of the architectural profession and highlight the positive benefits of good design in addressing the concerns of the community in relation to sustainability, quality of life and protection of the environment.

1.2.2 The RAIA promotes responsible and environmentally sustainable design, and vigorously lobbies to maintain and improve the quality of design standards in cities, urban areas, commercial and residential buildings.

1.2.3 The RAIA has established high professional standards. Members must undertake ongoing professional development, and are obliged to operate according to the RAIA's Code of Professional Conduct. The Professional Development Unit offers an extensive program at national and state level, continuing to keep members informed of the latest ideas, technology and trends in architecture and the construction industry.

1.2.4 The RAIA represents the profession on numerous national and state industry and government bodies, advising on issues of interest to the architectural profession, other building professionals and the construction industry.

1.2.5 Particular areas of expertise include:

- quality assurance and continuous improvement
- industry indicators and outcomes
- market analysis
- risk management and insurance
- marketing and communication
- policy development and review
- technical standards
- environmental sustainability.

1.3 Role of Architects in a Sustainable Future

1.3.1 The biggest challenge facing humankind at the start of the 21st century is to reconcile the impact of humankind with the ability of our planet Earth to provide resources and absorb waste.

1.3.2 This “crisis” presents a potentially pivotal opportunity for architects, who have a crucial role to play in addressing this challenge. Sustainable cities and sustainable buildings are the building blocks of a peaceful and sustainable world.

1.3.3 In recognition of the responsibility of the architectural profession, as a key player in the construction industry, to address the environmental impact of building and the built environment, the International Union of Architects (UIA) developed the 'Declaration of Interdependence for a Sustainable Future' in 1993. In doing so, the role of the architect in a sustainable future was articulated. This included not only the creation of buildings which ‘*significantly reduce adverse human impacts on the natural environment while simultaneously improving quality of life and economic well being*’ but also the educative role of the profession and its responsibility to ‘*establish policies, regulations, and practices in government and business that ensure sustainable design becomes normal practice*’.

1.3.4 The RAIA endorsed the UIA declaration in 1993 and has based its Environmental Policy upon its principles. At Appendix 1 is a short overview of the RAIA’s Environmental activities, including its Environmental Policy. Participation in the development of the Sustainable Cites Inquiry provides the RAIA with an opportunity to reaffirm its adherence to the 'Declaration of Interdependence for a Sustainable Future' at its tenth anniversary.

2.0 ISSUES PAPER

2.1 Nature of the Issues Paper

2.1.1 The RAIA notes that the principal aim of the Inquiry is to examine and report on the economic and environmental potential offered by energy efficiency improvements which are cost-effective for individual producers and consumers, with consideration being given to:

- economic and environmental costs and benefits arising from energy efficiency improvements;
- existing and recent Australian and state government energy efficiency programs;
- barriers and impediments to improved energy efficiency;
- the potential for energy efficiency improvements which are cost-effective; and
- consequent policy options for energy efficiency improvements that are cost effective for individual producers and consumers.

2.1.2 The RAIA provides specific comment on the barriers, challenges and opportunities which impact upon energy efficiency.

3.0 SUMMARY OF THE SUBMISSION

3.1 Introduction

The RAIA welcomes the Productivity Commission's inquiry into energy efficiency and the publication of the related Issues Paper. Improved coordination and cooperation across jurisdictions in the delivery of energy efficiency policies and programs is a key step towards increasing the uptake of energy efficient technologies and processes.

The Issues Paper provides an excellent context to confront exploration of barriers to future action and the challenges to be addressed.

3.2 Barriers

The RAIA sees the major overarching barrier as the need to integrate the quest for energy efficiency with the non-negotiable imperative to address serious issues of environmental sustainability.

3.3 Challenges

The RAIA sees the overarching challenge as the urgent and serious need to move the national ‘mind-set’ towards a “vision” of a truly clever country based on a new and innovative value adding economy that will elevate Australia from near the bottom of OECD league tables on energy consumption per capita, greenhouse gas emissions per capita, waste generation per capita and water consumption per capita.

3.4 Opportunity

The imperative of a sustainable country will require macro and micro initiatives in partnership across all levels of the community from the highest levels of government to grass roots levels of society.

This imperative will require some radical and some obvious paradigm shifts demanding courage in politicians and legislators and understanding in society to assure the true concepts of efficiency and sustainability – intergenerational responsibility, the provision for generations of today with a guarantee of resources and a healthy environment for generations of tomorrow.

3.5 Context and Solutions

The RAIA has taken the opportunity to scope these barriers and challenges into a broader context as they specifically impact upon the constructed environment – which accounts for approximately half of the nation’s energy consumption – and upon the profession of architecture, which has wide influence in this sector.

Opportunities and solutions have been highlighted within each of the identified ‘steps’ detailed below.

4.0 STEPS TOWARDS ENERGY EFFICIENCY

4.1 Natural Capital

“*Our land abounds in nature’s gifts…”.* Australia has been blessed with an abundance of natural resources, yet … “Most of the development in Australia over the 20th century took place in an era when energy, like oxygen, water and soil organic matter, was treated as a virtually free resource from the biosphere where only the costs of exploration and extraction were paid.” (Foran and Poldy, CSIRO).

Thus, Australia must move towards a true cost economic model that levies the draw down of precious and irreplaceable natural resources and funds restorative and sustainable practices in the use of fragile natural systems.

4.2 Market Forces

A free market is predominantly an agent only of economic ambitions. Ray Anderson, former Co-chair of the US Council for Sustainability, observes that “the market is at least opportunistic, if not outright dishonest, in its ability to externalise any cost that an unwary, uncaring, public will allow”.

Australia must recognise, as he identifies, that - “the economy is the wholly owned subsidiary of the environment”. The ‘market’ is driven by investors whose objectives are primarily short-term financial profit without immediate regard to long-term energy use or social and environmental sustainability. This characteristic fundamentally impedes innovation and discourages necessary risk taking associated with change.

Necessary attention to social and environmental responsibilities demands that society puts in place an enlightened legislative framework of incentives and disincentives to ensure a balance in economic, social and environmental sustainability.

4.3 Biodiversity

The natural environment is the source and the sink that sustains human life and endeavour. Maintenance of a healthy natural environment is crucial in our cities, in food producing regions, in catchments, in forests and in wilderness areas.

Pressures for development threaten to decimate vegetation and habitats. These must be realistically balanced against the contribution healthy natural systems make to air and water quality and to mitigation of demand for artificially controlled building environments predicated on energy consumption sourced from non-renewable resources.

4.4 Energy Supply

Herbert Giradet, author of books on ‘Sustainable Cities’, at a lecture in Sydney in 2001, said he had come to bid farewell to an old friend – fossil fuels – and welcome a new friend – solar and renewable power. Australian black coal supply is abundant, and it is projected that production could expand from 300 million tonnes today to 1.24 billion tonnes by 2050.

The Australian energy supply industry is in large part electricity sourced from coal burning non-renewable polluting power stations that do not pay for the draw down of Earth’s ‘natural capital’ nor meet the full environmental cost of the damage accruing from their emissions.

Thus power is priced at levels that do not reflect its true cost to present and future generations, thus encouraging irresponsible wastage in its application at all levels of society and mitigating against competitive development of clever energy production from clean green and renewable sources.

Initiatives such as the ‘Green Power’ option, and mandating energy suppliers to deliver a proportion of their production from renewable sources are positive but tentative steps to foster alternative energy production and encourage energy use efficiency.

Progression towards a vision for energy efficiency requires more radical commitment in this regard that will pursue solar, wind and other natural energy sources, and will also foster the concept of on-site energy harvesting and production thus reducing infrastructure required for distribution.

4.5 Energy Consumption

Although coal produced energy is abundant, it is projected that domestic production of oil and gas will decline through to 2070 throwing the demand balance for these crucial resources from surplus at 2020 into deficit at 2050. It is projected that total energy demand in Australia could rise to between 145% and 175% of current levels by 2050.

To make any serious impact on this alarming and unsustainable statistic will require radical paradigm shifts in energy consumption. This will require commensurate radical changes in building design, construction and use practices.

Given the huge existing building stock, this will require extensive retrofitting of existing buildings and will require new buildings to be designed for energy use even below 50% of current levels – a major challenge.

4.6 Greenhouse Emissions

There is little remaining argument that modern human activity is generating global climate change, with resultant potential for extreme weather events, global warming and increasing sea levels. CSIRO has already scoped the implications for regional economies in Australia of progressive change in weather patterns, principally higher temperatures and lower rainfall.

Various projections based on different variables indicate that carbon emissions by 2050 could be 215 – 260% of 1990 levels, or even as high as 300% 1990 levels, whereas the Kyoto protocol required Australia to reduce its carbon emissions to 108% of 1990 levels by 2008-12. In 1998 we were already 21% above 1990 levels.

Although Australia only contributes 1 – 2 % of global greenhouse gas emissions, it continues to ignore this issue at its peril. Suggestions are already emerging of sanctions against non-complying countries industries and major international financial institutions and insurance companies are taking climate change seriously mandating ‘green’ environmental responsibility to manage their risks.

Clever countries are seeing this challenge as an opportunity to link energy efficiency and cost saving programs with greenhouse emission reductions and to develop clean and ‘green’ strategies that will possibly deliver, what Amory Lovins describes as, ‘Factor Four’ – doubling wealth and halving resource consumption.

4.7 Cities

Uncontrolled urban expansion and demand for additional land cannot be satisfied without large environmental negatives and huge infrastructure costs. Low density development in suburbs impact on the natural environment and create irreconcilable conflicts.

Infrastructure to support low density development is expensive in cost and energy terms – roads, water, sewers, electricity, community services, schools, shopping, etc.

New models of higher density urban development, informed by precedents from smaller denser nations, need to be engaged to increase residential densities and achieve more efficient use of infrastructure and resources. The overall environmental footprint of urban development should become the integral guiding principle in planning.

4.8 Infrastructure

Regional and urban development requires a planned and integrated strategy for transport and infrastructure that recognises social and environmental as well as economic implications of options. Inter-city travel and the supply of goods and services may not be best served by a market driven short life-cycle investment framework but may require, for example, long-term investment in high speed rail, commuter transport and community supporting air services.

Urban renewal requires pre-planned upgrading and renewal of urban infrastructure and services that cannot necessarily be delivered by free market forces.

4.9 Residential Buildings

There are 500 new dwellings completed every working day in Australia, 98% are built by private developers.

There is an encouraging trend towards compact urban apartment and town house developments, many designed by qualified architects. The majority, however, are low density detached dwellings in sprawling suburbs, almost none designed by qualified architects, the majority fundamentally unsuited to the climatic environment of Australia.

Cellular internalised European housing models ignore potentials for inside-outside living and natural cross-ventilation. Designs fail to be “bioclimatic” – naturally responsive to local climate - and depend on energy and resource consumption to make them habitable.

Construction techniques, with thermal mass exposed to unwanted solar heat gain and dark roofs with inadequate natural ventilation, ignore key design strategies for thermal comfort and resource efficiency.

Steps already in place or in progress to regulate energy performance of new residences (application of NatHERS and other rating tools or derivatives through the Building Code of Australia) appear to be largely ineffective and address only a small part of a much bigger problem – unnecessarily large houses are rewarded, total energy consumption in dwellings is ignored. The more inclusive and integrated approach to environmental and energy assessment being introduced in NSW through the “BASIX” program, for both single and multiple dwellings, should be considered for wide national application.

4.10 Non-residential Buildings

The great majority of commercial, office and shopping facilities are driven by private developers, focussed on short term economic gain and disregard design strategies for energy efficiency and thermal comfort.

The international ‘glass box’ office block exemplifies this. Best practice in non-residential buildings is at present predominately demonstrated in Government funded and university buildings where enlightened clients have a long-term interest in energy performance and human well-being. These projects apply innovative principles that are now well understood and available for wider application.

Initiatives such as the Australian Building Greenhouse Rating Scheme (ABGR), the National Building Environmental Rating Scheme (NABERS) and the ‘Green Star’ program, introduced by the Australian Green Building Council, are all worthy initiatives that are bringing both legislative pressure and market rewards for improved practices.

4.11 Retrofitting

Adaptive reuse of existing building stock is a primary strategy towards sustainable cities for two main reasons:

First, to 'throw away' the existing buildings is to throw away much of the energy consumed in their making (embodied energy) and to generate more demand for more energy consumption and associated greenhouse gas emissions.

Second, notwithstanding the possibility of increasing intensity of land use through demolition and redevelopment, existing buildings are often located where there is good local infrastructure, particularly transportation, and the re-use of this valuable serviced land through recycling of the existing building stock for new uses makes good energy sense in comparison to constructing new buildings on the city fringes.

Because of the longevity of the building stock, opportunities to affect energy consumption occur more frequently in renovations and retrofits than in new construction. Many existing Australian residential and commercial buildings are fundamentally unsuited to the Australian climate and require excessive use of energy, with resultant greenhouse gas emissions, in order to sustain their uses.

4.12 Heating and Cooling

Up until the industrial revolution and humankind's ability to mine the Earth's resources for fuel to create artificial environments within buildings, all buildings were, what is called "bioclimatic", naturally responsive to climate and place. Thus building envelope design was inextricably linked to solving issues of human comfort in "passive" natural ways, rather than in "active" energy and resource consuming ways.

Good building envelope design, cognisant of passive design principles, is the first line of action towards reducing energy loads, resource depletion and greenhouse gas emissions.

Research suggests that humans can accommodate greater thermal fluctuations than those written into international standards, but research also indicates that non air conditioned environments are unacceptable for modern working in hot climates.

Correct manipulation of sun control and solar access to minimise unwanted summer heat and admit welcome winter heat can be combined with correct use of thermal mass and ventilation to moderate internal temperatures, emit warmth and ‘coolth’ and promote air movement. Such design strategies can crucially reduce peak load demand for energy, particularly in periods of heat wave, thus obviating the expensive infrastructure investment associated with meeting demand peaks.

Steps under way to regulate energy consumption of, and associated emissions from, both residential and non-residential buildings will focus developers, owners and users attention on exploring greenhouse efficient energy options.

It has been suggested that 80% of the future environmental performance of a building is commonly determined during the expenditure of about the first 1% of the total cost – at the initial design stage.

Modern computer based simulation techniques facilitate sophisticated design modelling of thermal and energy performance of buildings and must become the norm. Integrated design team working methods, need to be supported by investment in appropriate professional design fees and the allocation of necessary design time.

4.13 Lighting

Just as “bioclimatic” buildings through history were responsive to localised thermal conditions, they were also naturally conditioned for solar access and daylight. However, modern internalised lifestyles have created greater demand for increased lighting levels.

The crucial balance between admission of natural light for working environments and the exclusion of unwanted solar heat gain, is difficult to achieve and focuses necessary attention on clever design solutions and material choices.

Modern computer based simulation techniques also facilitate sophisticated design modelling of lighting and associated energy performance of buildings and must become the norm.

Regulation of energy consumption in commercial buildings will accelerate adoption of energy saving lighting systems and use of movement sensors to switch off lighting areas not in use.

In the residential sector, widespread adoption of compact fluorescent globes should be a priority, which might be given out free, just like the Southern Californian Edison Company did to reduce power demand.

Amory Lovins indicates that investment in the manufacture of compact florescent light bulbs costs about one thousandth of the capital required to expand energy supply systems. He suggests one compact globe can save one barrel of oil in its lifetime – “we can make the world more prosperous, better educated, less polluted and, of course, safer through shared prosperity and justice – one light bulb at a time."

4.14 Refrigeration

Apart from refrigeration for industrial, commercial and air-conditioning, domestic refrigeration is a high priority for attention. Refrigeration accounts for between 13 - 20% of greenhouse emissions and associated energy demand in the residential sector. This is more difficult to resolve as there is no obvious solution such as direct access to passive cooling.

Strategies need to be put in place to get low efficiency refrigerators out of use and off the market and to promote the replacement and use of high efficiency products. The 'star' system is already in place to facilitate change. There may be opportunity to innovate in the location of refrigerators in homes to minimise cooling loads.

4.15 Hot Water

The single biggest energy demand in housing and many other types of residential accommodation, such as hotels, is for water heating. New technologies that explore co-generation, and equipment such as micro-turbines, offer potential for energy production combined with production of hot water that could supply district hot water for apartment and group housing or for swimming pools.

In the residential sector, greenhouse gas emissions associated with water heating account for between 24 - 39% (depending on fuel) of total residential emissions.

This is an area for priority attention. Every house should be availing of "free" solar water heating, given the abundance of sunshine available. Excessive hot water consumption exacerbates the energy demand for water heating – particularly "long shower abandon" – that results in precious energy being run straight down the drainage system.

Strategies should be introduced to promote the use of solar water heaters and to integrate these into the building design. Hot water consumption should be reduced through water efficient equipment and – a simple device – on/off shower-head cocks to switch off shower water when "soaping up". Use of 'green power', off-peak and gas back-up options should be promoted for water heating systems.

4.16 Equipment and Appliances

In commercial buildings, new legislative and incentive initiatives will focus developers, owners and users on selection of systems for elevators, escalators, and other equipment that will be energy efficient.

In residential buildings, this is seen as difficult to influence, certainly from a pre-design or predictive viewpoint. Use of equipment and appliances in dwellings, other than water heating, lighting and refrigeration, accounts for around 25% of residential energy demand. Incentives need to be put in place to encourage users to choose energy efficient equipment and to reduce energy consumption in their application.

The energy efficiency labelling of equipment and appliances needs to be expanded. A specific area for immediate potential energy savings is to switch off the 'sleeping' consumption of business and domestic appliances and equipment left in "standby" mode.

4.17 Embodied Energy

Embodied or embedded energy is the energy required to extract, manufacture, transport and place materials, components or equipment in a building or construction. Considerable research has been carried out to identify the embodied energy associated with different materials produced under various energy and resource contexts.

There is a general understanding, through reference to an embodied energy league table, that high energy materials include materials such as aluminium and low energy materials include timber and rammed earth with steel, plywood, clay bricks and concrete in a hierarchy in between.

Research has also been carried out to assess the relative total embodied energy of various common forms of construction from steel and concrete framed commercial and office buildings to timber framed and rammed earth houses.

A simplistic view suggests that the latter are good news and the former less good news, or bad news. Assessment of materials on purely embodied energy criteria, ignores long-term performance, maintenance demands, durability, re-use potential and recyclability.

However, choice of materials and equipment that are efficient from an embodied energy viewpoint is a key design strategy toward achieving sustainable buildings and focuses specification decisions on resource, energy and transportation issues that can highlight transgressions of environmental good practice.

4.18 Life Cycle Design

Balancing design decisions and materials choices for sustainable buildings requires integrated life cycle assessment that will evaluate the relationship between, first, investment in embodied energy, second, commitment to long term operational energy consumption energy use and, third, concomitant environmental performance, such as thermal comfort and natural light.

Studies have indicated that annual operational energy of most buildings, and associated greenhouse emissions, currently far outweigh the total embodied energy amortized into an annual component over a life cycle of, say, forty years. Figures in the range 80% to 20% are cited.

Thus there is a need to give first priority to solving operational energy implications over a life cycle.

There is also a need to reconcile potential for improved environmental performance and user satisfaction with investment in higher embodied energy in providing high thermal mass; components for solar control, ventilation and other passive 'bioclimatic' features and equipment for on-site energy production.

However, as operational energy demand is reined in, and buildings become more energy efficient, the proportional implications of the embodied energy component will become more significant and will reaffirm the necessity of on-going attention to this area.

Integrated life cycle design requires wider application of holistic design team practices that bring all key consultants and specialists to the design table from the outset.

Achievement of high performing energy efficient buildings requires investment in time and professional fees to allow design professionals to fully engage their expertise and access available computer simulation technologies.

Financial incentives to private developers to facilitate 'early intervention' and good design of his nature, as has been piloted in Victoria, should be further explored.

4.19 Private Transport

Issues of energy consumption associated with transportation. However, there are both direct and indirect energy implications of the Australian transport lifestyle.

Typical low density urban development is predicated on the use of private cars. Projections suggest an increase in Australia's car population from 10 million at present to 14 – 17 million by 2050 requiring 3,000 – 10,000 km of new roads.

There are serious non-fuel related energy implications of the construction of infrastructure and vehicle manufacture to meet these projections. One traffic study assesses that the cost to the national economy of traffic congestion will be $30 billion per year by 2015.

Vehicle emissions contribute substantially to air pollution problems and greenhouse gas emissions.

Incentives need to be introduced to discourage private vehicle use and promote the use of public transport. Low energy low emissions hybrid power vehicles need to be facilitated and technical innovations, such as fuel-cell power, must be supported towards achieving vehicles with zero emissions.

4.20 Public Transport

Underpinning almost every model of a modern sustainable city is an efficient and affordable public transport system. Famous exemplars, such as the often quoted city of Curitiba in Brazil (where the influential former mayor was architect and visionary Jamie Lerner, now President of the International Union of Architects), have introduced radical yet often obvious solutions for investment in transportation systems.

Over reliance on the private motorcar is the foremost challenge for the modern city and the costs of the provision of roads, and the costs of the environmental damage through vehicle emissions, are not part of the economic equation determining investment in public transport.

4.21 Waste

There is a direct link between energy use and municipal waste as waste products represent discarded energy. It is alarming that a high proportion of the products of the energy consuming productive Australian economy are destined, within a very short life cycle, for landfill.

New initiatives must address the problem of the proliferation of waste associated with very short-term packaging, plastic bags and plastic bottles that often account for more cost and energy, and consequential environmental damage, than the products they wrap or contain.

New initiatives must also address the problem that most medium-term consumer products are soon obsolete and redundant with no route to re-use.

Significant paradigm shifts have already taken place in Australian society with excellent initiatives in municipal waste 'classification', recycling and composting. These facilities need to be made more comprehensively available in all areas, and more effort needs to be made to ensure that all members of society direct waste material to appropriate recycling.

4.22 Recycling

We live in a take, make, waste society. Initiatives introduced internationally, such as ‘The Natural Step’, commenced in Sweden by Dr. Karl-Henrik Robert, map the way to transform energy wasteful linear industrial processes and lifestyles into closed loop cyclical and renewable ones.

These programs have inspired companies such as Ray Anderson’s carpet empire ‘Interface’ to introduce the ‘Evergreen Lease’ – taking responsibility for a product through its full life cycle, through leasing carpet to the customer and taking it back and reprocessing it at the end of its first life.

Architect Bill McDonough, and his partner Michael Braugart, have raised the proposition of going beyond life cycle “cradle to grave” considerations and extending the mission of recycling to one of “downcycling” or “upcycling”, as the title of their book on subject is entitled, “Cradle to Cradle”. A plastic bottle, on its way to being a flower pot, on its way to being a speed bump on its way to become landfill – that is “downcycling”. If we can make products that can get better and become higher performance products – that is “upcycling”.

Enlightened European countries are placing mandatory commitments upon manufacturers of white goods to take similar life cycle responsibility for their products.

4.23 Food Production

It is said that Rome ultimately fell because it could not feed itself and that its local food production failed due to pollution - the first instance of adverse ‘Ecological Footprint’, as it has been called by Canadian economists Rees and Wackernagel. Herbert Girardet talks of the city of Shanghai, one of the ultimate modern cities, where there is the remarkable policy of making sure that the vegetables eaten in the city come from land made available within the city for food production. He contrasts this with large areas of the Amazon forests being cleared for soya grain production to feed cattle to supply beef markets on the other side of the world.

In Australia, we have rural communities under threat because of deregulation of the milk market and milk being trucked interstate because production costs are cheaper where the grass is greener, externalising the environmental and infrastructure costs of transport.

Attention needs to be paid, therefore, to demographic and ecological aspects of the food supply, as the energy and environmental costs of food are areas for scrutiny that may far exceed other facets of the national energy profile.

4.24 Negative Incentives

Sticks - basically “regulation”, should be adopted to eliminate worst practice and to penalise ‘misconduct’. The result may be production of the lowest quality that still remains legal.

Apart from areas of the development industry that have been regulated for many years such as structural, fire safety and health, recent initiatives to regulate energy and environmental efficiency appear to have had little or no impact on soaring energy demands and the impacts of the built environment.

Enormous effort has gone into defining regulatory criteria, through standards and codes. A cumbersome regulatory framework and a doubtful ‘industry’ created to police it have, as yet, failed to deliver noticeable improvement in building design for energy efficiency or environmental performance.

Compliance, in many cases, absorbs disproportionate effort and professional time and addresses only minor parts of a much larger problem.

4.25 Positive Incentives

Carrots - “incentives” to improve practice by investors, producers, developers and consumers and reward innovation should also be introduced.

Amory Lovins and Ray Anderson have recognised the potential, and the reality, that paradigm shifts in favour of desirable environmentally sustainable practices can be driven by the positive dynamic of the market place and the possibility of “Doing well, by doing good”.

Thus, discouraging excess by pricing valuable resources at their true cost - their environmental cost - can be reciprocated by tax breaks and business concessions to overcome in-built conservatism in an absolutely free unregulated market place and encourage risk taking and innovation that can lead to long term energy efficiency and sustainability and foster a competitive edge over conservative competitors.

Commerce at all levels is now beginning to recognise the ‘green’ imperative and the potential of transformation towards sustainability, and this recognition needs to be facilitated and rewarded.

4.26 Education

It may, ultimately, be public opinion that will shape the future.

In our own lifetime, we have seen huge positive paradigm shifts, particularly over the last decade – one used to be able to smoke in the cinema, chimneys reeked black smoke, big cars were an entitlement, garbage could be dumped anywhere and solar homes were the concern of 'hippies'.

Public opinion, particularly among the younger generation, has elevated issues of the environment and sustainability to near the top of the league table of priority concerns. Children coming through school are, possibly, paralleling their second nature computer literacy with environmental responsibility. It is their parents, the Australian voting public and the key 'influencers', who remain oblivious and recalcitrant. Thus more attention needs to be paid to public education programs to turn around public opinion.

In schools, colleges and universities, there needs to be an on-going commitment to infuse primary, secondary and tertiary education with matters of resource efficiency and sustainability and tertiary qualifications should be mandated to have competency in these fields as part of their accreditation.

Professional development education across all disciplines and at all levels needs to be a priority to promote new thinking and deliver necessary skills.

Research in academic and research institutions and in industry is crucial to understanding the problems and potential solutions and RAIA supports the nomination by the Minister for Education, Science and Training of 'An Environmentally Sustainable Australia' as a national research priority.

4.27 Information

In order to effect both changes in mind sets and changes in professional practices, there is a need for improved statistical information on identifiable measurables.

For the public, there is a need to make the average home owner as familiar with their energy consumption and greenhouse gas emissions figures as they are with petrol prices or house values. *They need to have the ability to relate these to, perhaps, a 'star' rating system that might be printed on their energy bills.*

Total lifestyle energy and emission rating schemes are available as educational tools (eg. ‘Chappy developed by BHP Research) but have not been developed to inform consumer attitudes and practices.

For professionals, there is currently still a general lack of awareness of statistics on the energy consumption and greenhouse emissions for various categories of buildings, both residential and non-residential, and in many instances this information is not available.

There is a need to bring this information into general availability in the way that building element and floor area costs are well understood by design professionals.

Supporting information on both lifestyle and professional aspects of energy efficiency and sustainability will need to be expanded but is not in short supply – there are many publications and references now dealing with these issues that need to be brought to more common reference.

4.28 Leadership

Who will lead? Will our politicians wait to follow the march of public opinion, or can they overcome the short life-cycle of political expediency driven by election success to achieve necessary transformational change?

The 2003 AusCID (Australian Council for Infrastructure Development) Report ‘Sustainability Framework for the Future of Australia’s Infrastructure’ notes that “European Governments … are vigorously developing concepts of sustainable development and entrenching them as core policy drivers. The key influence has often been global warming but, pollution, land degradation and natural resource depletion are among other drivers for innovation.”

While the Australian Government may defend its reluctance to commit to international protocols for greenhouse gas emission reduction and other environmental agendas on the basis that it cannot afford to - or the cost of doing so might be too difficult to sell to the electorate - all the indications are, from both rural Australia where land degradation and salinity are widespread, to our cities where water shortages and threats of power supply failures are now a reality, that we are at the end of the road of over-exploitation of our nation’s abundance of “nature’s gifts”, and we cannot “not” afford to make the necessary transformational changes towards energy efficiency and sustainability.

4.29 Architects

Through history, master planning for urban settlements and the design of individual buildings have been the domain of architects. These abilities are complemented by detailed technical competencies in the design of energy efficient buildings and systems that are “bioclimatic” and respond to place, climate and resource availability.

In Australia, architects have a proven track record in conception and realisation of large complex planning, infrastructure and building projects, such as the Sydney Olympics, which are exemplary and world class in terms of their ‘green’ credentials.

There are already completed and under design in Australia, outstandingly innovative individual buildings that demonstrate the imperatives for energy efficiency and sustainability.

The professional training of architects, over at least 7 years of university education and associated practical experience, is underpinned by attention to integrative problem solving across discipline boundaries and diverse areas of study.

This integrative education of architects is almost unique in today’s environment of modular education, where many graduates acquire unconnected ‘boxes’ of knowledge. Rather, architects learn the dynamic ability to define and address complex multi-disciplinary problems in creative ways.

Perhaps it is for this reason that architect Jamie Lerner, as Mayor of Curitiba in Brazil, effected transformational change in a way so seldom seen – through creative integrated vision. Jamie Lerner is now President of the International Union of Architects (UIA). The UIA committed to sustainability through the Chicago Declaration in 1993. This declaration has been adopted by the RAIA as the basis for its environmental policy, which applies to all RAIA members. As part of its environmental strategy the RAIA initiated the Environmental Design Guide (EDG), which now operates as a project of the Australian Council of Building Design Professions (BDP) and has become the primary reference for information on energy efficiency and sustainability for the built environment.

A deeper involvement of design professionals in the quest for energy efficiency and an environmentally sustainable Australia will deliver positive results in every aspect of this multi-faceted challenge.

Appendix 1

ARTEM·PROMOVEMUS·UNA
THE ROYAL AUSTRALIAN INSTITUTE OF ARCHITECTS

RAIA Environmental Activities

In recognition of the responsibility of the architectural profession, as a key player in the construction industry, to address the environmental impact of building and the built environment, the following activities have been undertaken by the RAIA:

1. RAIA Environment Policy

The RAIA Environment Policy consists of a vision and 5 principles – commit, develop, educate, formalise and implement. A strategic directions' document is an appendix to the policy. Within this document objectives for the RAIA and for its members are identified for each of the above principles.

The vision of the policy is based upon the International Union of Architects 'Declaration of Interdependence for a Sustainable Future' which the RAIA adopted in 1993. In doing so the following vision for sustainable design was endorsed:

'sustainable design integrates consideration of resource and energy efficiency, healthy buildings and materials, ecologically and socially sensitive land-use, and an aesthetic sensitivity that inspires, affirms and ennobles; sustainable design can significantly reduce adverse human impacts on the natural environment while simultaneously improving quality of life and economic well being.'[1]

A copy of the policy is **attached**.

2. BDP *Environment Design Guide*

The BDP *Environment Design Guide* (EDG) is a technical journal aimed at building design professionals. Four issues are published annually, and each issue comprises of 5 'notes' and a case study on designing and building sustainably.

The RAIA initiated EDG in 1995. However in recognition of the importance of integrated design in the development of a sustainable built environment, EDG became a product of the Australian Council of Building Design Professions (BDP) in 1999. The target audience includes architects, engineers, landscape architects, quantity surveyors and planners. Education bodies, local government bodies and non-government organisations also subscribe to the guide. The Guide is published by the RAIA on behalf of the BDP.

Since its inception, EDG has accumulated over 180 notes and 36 case studies written by experts in the field, and is considered the most comprehensive single source of information on environmental issues specifically tailored to the needs to Australia's planning and building design professionals. In order to keep the Guide up-to-date, notes are reviewed every 4 years.

3. The National Environment Committee

Previously a sub-committee, the National Environment Committee (NEnvC) was elevated in 2003 to report directly to National Council. The Committee, consisting of experts in ecological sustainable design and related issues, is an advisory group to National Council and RAIA staff in relation to environmental issues with a national focus.

The NEnvC had its inaugural meeting in Sydney on 28 and 29 August during which it identified key areas for action. It is actively engaged in developing submissions to key Australian government bodies to embrace sustainability priorities for Australia. The committee is also engaged in assessments of energy rating tools as well as developing continuing education opportunities to promote environmental sustainability across the built environment industries.

In addition to the NEnvC, the RAIA Chapter in each State/Territory has an Environment Committee, which responds to more local issues. The NEnvC plays a coordinating role for the Chapter Environment Committees.

4. National Award for Sustainability

The National Award for Sustainability is one of nine categories of the RAIA Architectural Awards. Projects within this category are works of architecture that excel in improving total quality of life by enhancing individual and community well-being by following a path of economic development that safeguards the welfare of future generations. Entries are evaluated against an Ecologically Sustainable Design Award Checklist and an Energy Award Checklist. Other works which are not built projects but which contribute to the art and science of architecture may be considered for this award.

Forest Tasmania's Forest EcoCentre by Morris-Nunn Associates received the RAIA 2003 National Award for Sustainability. The Forest Eco-Centre, along with a growing number of environmentally sensitive buildings, exemplifies how the integration of environmental criteria during the design concept stage can lead to buildings which not only tread lightly on the earth, but are healthy and aesthetically inspiring.

RAIA ENVIRONMENT POLICY

The Royal Australian Institute of Architects

VISION

In 1993, The Royal Australian Institute of Architects adopted the International Union of Architects 'Declaration of Interdependence for a Sustainable Future'. In doing so, the RAIA recognises that:

- *A sustainable society restores, preserves, and enhances nature and culture for the benefit of all life, present and future; a diverse and healthy environment is intrinsically valuable and essential to a healthy society; today's society is seriously degrading the environment and is not sustainable.*
- *We are ecologically interdependent with the whole natural environment; we are socially, culturally, and economically interdependent with all of humanity; sustainability, in the context of this interdependence, requires partnership, equity, and balance among all parties.*
- *Buildings and the built environment play a major role in the human impact on the natural environment and on the quality of life; sustainable design integrates consideration of resource and energy efficiency, healthy buildings and materials, ecologically and socially sensitive land-use, and an aesthetic sensitivity that inspires, affirms and ennobles; sustainable design can significantly reduce adverse human impacts on the natural environment while simultaneously improving quality of life and economic well being.*[1][1]

The RAIA affirms the responsibility of the architectural profession, as a key player in the construction industry, to embrace an integrated approach to ecological, social and economic sustainability. This should be done through individual practice and by bringing to bear our collective expertise and influence in the community. In order to achieve this, the RAIA and its members should abide by the following principles:

PRINCIPLES

1. Commit

Place sustainability at the *core* of our practices and professional responsibilities.

2. Develop

Research and develop policies, regulations, practices, products, curricula, services, standards, contracts and other mechanisms that will facilitate the implementation of sustainability.

3. Educate

Educate ourselves, our fellow professionals, the building industry, clients, building users, students, government, manufacturers and the general public about the critical importance and substantial opportunities of sustainability.

4. Formalise

Encourage policies, regulations and practices in government and the private sector of the construction industry to ensure sustainability becomes, and remains, normal practice.

5. Implement

Implement, and continually improve, subject to our professional responsibilities to our clients, sustainability in the resourcing, construction, use and reuse of buildings and the built environment.

The Strategic Objectives set out in the following Appendix are a guide for the RAIA and its members to give effect to this Policy.

[1] 'Declaration of Interdependence for a Sustainable Future', UIA/AIA World Congress of Architecture, Chicago, 18 - 21 June 1993

RAIA ENVIRONMENT POLICY – APPENDIX

Strategic objectives

1. Commit

Objectives	Examples
The RAIA will:	
1.1 place sustainability at the core of the Institute's objectives, not as a peripheral activity;	*1.1.1 Ensure the programs, activities and administration of the Institute enables it to implement sustainable goals.*
1.2 promote a shift in values throughout the profession towards ecological sustainability; and	*1.2.1 Raise and maintain the profile of sustainability in all aspects of Institute business.*
1.3 become known as the industry leader in the philosophy and practical application of sustainability in the built environment.	*1.3.1 Seek and where appropriate act upon the advice of national and state environment committees.*
Members should:	
1.4 work towards placing sustainability at the core of their practice structure.	*1.4.1 Actively encourage clients to include sustainability as an integral principle in the briefing, design and commissioning of projects.*
	1.4.2 Maintain commitment to the delivery of sustainable outcomes throughout the life of projects.

2. Develop

Objectives	***Examples***
The RAIA will:	
2.1 continually develop and improve its own practises, procedures, professional development curricula and services relating to sustainable design; and	*1.1.2 2.1.1 Integrate, where possible, a sustainability component in all professional development programmes.*
	1.1.3 2.1.2 Continually contribute to the improvement of the BDP Environment Design Guide *to make information on sustainable design more accessible and useful.*
2.2 continually research, support and make available external products, curricula, services and standards that will enable its members to implement sustainable practises.	*1.1.4 2.2.1 Support the development and enhancement of sustainable content of specifications, product selection aids and manufacturers' data.*
Members should:	
2.3 promote sustainability through appropriate built environment solutions; and	*1.1.5 2.3.1 Test and evaluate sustainable principles, through innovative design, to the extent supported by clients.*
2.4 continually develop and improve their own sustainable practises and procedures.	*1.1.6 2.4.1 Undertake ongoing research into sustainable practises and processes.*
	2.4.2 Continually update product library and project specifications to reflect the latest technical information and examples of sustainability in the built environment.

3. Educate

Objectives	*Examples*
The RAIA will:	
3.1 encourage architectural education institutions to incorporate all aspects of sustainable design throughout their course content; and	*1.1.7 3.1.1 Promote comprehensive integration of sustainable design into the syllabus of all architecture schools.* *1.1.8 3.1.2 Promote lectures at architecture schools by experts in sustainability in the building industry.*
3.2 encourage the education of its members, students, the general public, governments at all levels and, where possible, the building industry, about the critical importance and substantial opportunities of sustainable design.	*1.1.9 3.2.1 Lobby for sustainability to become a formal part of every school and university syllabus.* *1.1.10 3.2.2 Promote sustainability through the BEE Program.* *1.1.11 3.2.3 Provide a professional development programme on sustainability to members.* *1.1.12 3.2.4 Advocate the role of architects in contributing to a sustainable society, and promoting and marketing architects' skills and expertise in sustainable design.* *3.2.5 Encourage the introduction of environmentally acceptable products, processes and systems.*
Members should:	
3.3 promote to their clients the critical importance and substantial opportunities of sustainable design; and	*1.1.13 3.3.1 Discuss sustainable opportunities with clients, at briefing and at relevant stages during a project.*
3.4 provide opportunity to educate their staff and maintain a level of skill which enables informed decision making on sustainability.	*1.1.14 3.4.1 Seek a variety of environmental literature for ongoing education, which might include the* BDP Environment Design Guide. *3.4.2 Encourage staff to attend Professional Development courses and seminars on sustainability.*

4. Formalise

Objectives	*Examples*
The RAIA will:	
4.1 establish policies and procedures for its members to encourage sustainable design to become normal practise;	*1.1.15 4.1.1 Periodically review and update this Policy and supporting documents.* *4.1.2 Base all award categories on a minimum agreed set of sustainability criteria.*
4.2 attempt to influence government regulations and practises to ensure that they are appropriate for sustainability and they do not stifle 'good design';	*4.2.1 Ensure early participation in development of regulatory measures, particularly through the Australian Building Codes Board.*
4.3 recognise that special temporary measures may be required to integrate sustainability into normal practise; and	*4.3.1 Maintain ESD and Energy awards as separate categories until sustainable criteria become a prerequisite of all awards.*
4.4 highlight issues and lobby government at all levels to improve incentives, policies and regulations to ensure that sustainable design becomes normal practise.	*1.1.16 4.4.1 Support implementation of improved energy rating schemes which allow for all building types and conditions.* *1.1.17 4.4.2 Support the development of a national environmental performance system which will rate multiple sustainability criteria.* *4.4.3 Lobby for government support and incentives for sustainable industry based projects and products.*

Members should:	
4.5 formalise practises within their own organisations to ensure that sustainable design becomes normal practise; and	*1.1.18 4.5.1 Implement sustainability check-lists.* *4.5.2 Continually review sustainability of projects.*
4.6 assist in the formulation and development of future outcomes and visions for the RAIA.	*4.6.1 Actively participate in RAIA and other forums on sustainability, such as community consultation, education processes and ideas competitions.*

5. Implement

Objectives	***Examples***
The RAIA will:	
5.1 progressively bring its own existing and future elements of the built environment up to sustainable design standards - in their design, production, use and eventual reuse.	*1.1.19 5.1.1 Aim, through changes to office procedures, to become a model sustainable organisation.* *5.1.2 Encourage members to do likewise.*
Members should:	
5.2 give holistic consideration to the range of environmental effects which may arise from the planning, construction and use of buildings and their infrastructures;	*1.1.20 5.2.1 In implementing sustainable design practises, consider a combination of effects on:* • *bio-diversity – protect and restore ecological diversity, health and functionality* • *resources (including materials, energy, water, amenity and waste) – optimise their use, especially non-renewable resources* • *pollution – minimise pollution of soil, air and water* • *quality of life – improve the health, safety and comfort of building users.*
5.3 attempt to consider the effects, from local to global, on ecosystems over the entire product life cycle – from short to long term; and	*5.3.1 In selecting and specifying construction materials consider all aspects from extraction, processing and transport through to possible fire, demolition and disposal or reuse.*
5.4 aspire to bring all projects up to sustainable design standards - in design, production, use and eventual reuse.	*5.4.1 For a summary of this core aspect of the policy, refer to the associated document – 'Sustainable Design Strategies', located in the* BDP Environment Design Guide.

RAIA ENVIRONMENT POLICY – SUPPLEMENTARY DOCUMENT

SUSTAINABLE DESIGN STRATEGIES FOR ARCHITECTS

This Note is a back-up document to the RAIA Environment Policy. It is also intended for use as a checklist and prompter of ESD issues that should be considered during the creation and use of buildings.

INTRODUCTION

The RAIA Environment Policy states an objective to implement sustainable design practices. In order for architects to meet the objectives they should consider the four following inter-related tenets of environmental sustainability at all stages of a building's life:

- bio-diversity – protect and restore ecological diversity, health and functionality
- resources – optimise their use, especially non-renewable resources
- pollution – minimise pollution of soil, air and water
- quality of life – improve the health, safety and comfort of building users.

To assist in making appropriate sustainable design decisions, the following specific design strategies and actions are recommended. They do not form a comprehensive list, merely a prompt for the most commonly encountered issues. They do not all offer solutions, sometimes just raising issues to be considered. Any recommendations are contingent upon current knowledge and technology and are therefore subject to change over time. The architect must, as always, ensure that professional advice offered is based on all relevant and available information (refer to the other Environmental Design Guide [EDG] notes for detailed information).

In the context of these strategies, 'sustainability' always refers to 'environmental sustainability'; and ESD means 'Ecologically Sustainable Development'.

1. Pre-design

If possible, influence site selection and briefing for the project.

Design strategies	Actions/examples	EDG references
1.1 Brief client on potential of ESD opportunities.	*1.1.21 1.1.1 Ensure client is appraised of all ESD opportunities, and the broader benefits of taking such actions.*	GEN 2, GEN 6, GEN 13, GEN 18-19
	1.1.2 Actively participate in client briefing to ensure space and services in buildings will efficiently provided for the foreseen end use.	DES 1, DES 5, DES 34
1.2 Evaluate appropriateness of building project and site.	*1.1.22 1.2.1 Use instruments such as Environmental Impact Statements.*	GEN 16, DES 18
	1.1.23 1.2.2 Check availability of public transport.	DES 16
	1.1.24 1.2.3 Negotiate with local government authorities to improve sustainable opportunities and outcomes.	GEN 17, GEN 36
	1.1.25 1.2.4 Evaluate 'no-build' or 'non-structural' options, or re-use of existing facilities.	DES 11, DES 26, DES 31, DES 38, DES 39, PRO 9
	1.2.5 Consider the nature of subdivisions, which can greatly effect sustainable design options for individual sites or buildings.	DES 8, DES 9
1.3 Adopt an inter-disciplinary integrated approach to design.	*1.1.26 1.3.1 Ensure selection of consultants with sustainable design credentials.*	DES 1, DES 36
	1.3.2 Encourage a suitable fee structure.	GEN 38

2. Siting and planning issues

Develop an understanding of the opportunities and constraints of the site and utilise this knowledge to appropriately plan at the macro level.

Design strategies		Actions/examples	EDG references
2.1	Evaluate site and local ecosystems to ensure they are maintained and enhanced.	*1.1.27 2.1.1 Preserve vegetation and topsoil as much as possible*	1.1.28 GEN 32, GEN 37
		1.1.29 2.1.2 Rehabilitate and restore habitat corridors.	1.1.30 GEN 39, DES 18, DES 40
		2.1.3 Minimise construction practices which encourage erosion.	1.1.31 DES 18, DES 26, DES 29
2.2	Maximise re-cycling of existing building stock.	*2.2.1 Evaluate opportunities to adapt and/or utilise existing buildings, facilities, infrastructure, etc.*	1.1.32 DES 11, DES 31, DES 38, DES 39
2.3	Appropriately site with regard to microclimate.	*2.3.1 Position buildings on site to allow for optimum passive design opportunities - consider prevailing winds, solar access, water supply, etc.*	1.1.33 GEN 12, DES 3
2.4	Appropriately site and design with regard to effects on natural and built surroundings.	*1.1.34 2.4.1 Consider effects on adjacent natural features such as bushland and watercourses.*	1.1.35 DES 8, DES 9, DES 41
		1.1.36 2.4.2 Maintain or provide solar access to adjacent sites.	1.1.37 GEN8
		2.4.3 Maintain and protect lifestyle and amenities of neighbours.	1.1.38
		2.4.4 Avoid visual and noise pollution for neighbours.	1.1.39 GEN 24
2.5	Facilitate pedestrian and non-motorised forms of transport.	*1.1.40 2.5.1 Consider proximity to public transport and people as part of site selection.*	1.1.41 GEN 17, DES 16
		1.1.42 2.5.2 Design in pathways and cycle-ways.	1.1.43 GEN 17
		1.1.44 2.5.3 Ensure secure storage facilities for transport other than cars.	1.1.45
		1.1.46 2.5.4 Provide shower and change facilities.	1.1.47
		2.5.5 Design to allow for future changes to cars fuelling – e.g. electric re-charging.	1.1.48
2.6	Recognise, respond and design to support the local social context.	*2.6.1 Provide or utilise local community and business facilities which minimise the need to use motorised transport.*	1.1.49 GEN 17

3. Concept design

Employ well considered knowledge about environmentally responsive design to appropriately plan and design at the micro level.

Design strategies		***Actions/examples***	***EDG references***
3.1	Design to maximise building and siting orientation opportunities.	*1.1.50 3.1.1 Consider appropriate building orientation with regard to micro- climate.*	*1.1.51* GEN 12, DES 32
		1.1.52 3.1.2 Consider appropriate orientation for different zones of the building.	1.1.53 DES 2
		3.1.3 Consider appropriate orientation for external areas.	1.1.54
3.2	Design for appropriate solar access through all seasons and for specific climate and location; maximise passive solar design strategies.	*1.1.55 3.2.1 Consider how the form of the building will effect the solar access for internal and external areas.*	1.1.56 GEN 8, GEN 12 *1.1.57*
		1.1.58 3.2.2 Design to maximise sun penetration and minimise sun shading in winter (except in tropical climates).	1.1.59 DES 6
		1.1.60 3.2.3 Design to minimise sun penetration and maximise sun shading in summer.	1.1.61
		3.2.4 Design to allow for flexibility during intermediate seasons and unseasonal weather.	1.1.62
3.3	Determine appropriate building form to maximise natural lighting and ventilation for specific climate and location.	*1.1.63 3.3.1 Consider window sizes, spacing, details such as light shelves and devices such as atria and courtyards to optimise natural lighting.*	1.1.64 DES 6, DES 20, PRO 3, PRO 19 1.1.65
		1.1.66 3.3.2 Consider building depth and location, operation of openings in external walls to optimise natural ventilation.	1.1.67 TEC 2
		3.3.3 Consider building form and amount of external wall area to optimise thermal performance of the building envelope.	1.1.68 TEC 10
3.4	Consider integrated sustainable systems at concept stage rather than during detailed design.	*1.1.69 3.4.1 Design for integrated energy, water and waste systems.*	1.1.70 GEN 29, GEN 30, DES 4, DES 14, DES 36
3.5	Ensure building design supports and encourages ecologically sustainable lifestyles.	*1.1.71 3.5.1 Connect users to external environment in a meaningful and educative manner.*	1.1.72 GEN 12, GEN 23, DES 19
		1.1.73 3.5.2 Ensure building systems are easy to understand and operate.	1.1.74
		3.5.3 Design for ease of recycling of all wastes by users during occupation.	1.1.75

4. Resources – Material selection

Consider all issues regarding the life cycle of materials in order to ensure most appropriate and least damaging selection and design.

Design strategies	Actions/examples	EDG references
4.1 Select 'renewable' resources in preference to finite resources.	*1.1.76 4.1.1 Protect old growth forests - avoid specifying old growth timbers; check timber sources.*	1.1.77 PRO 10, PRO 11, PRO 15, PRO 21
	4.1.2 Support agro-forestry timber forestry and milling techniques.	1.1.78
4.2 Minimise the use of new materials in buildings and construction processes.	*1.1.79 4.2.1 Consider adaptive re-use of existing buildings.*	*1.1.80* DES 38, DES 39
	1.1.81 4.2.2 Design for minimal material use through reduction in overall size of building and interior installations.	1.1.82 TEC 1
	1.1.83 4.2.3 Design for minimal waste through modularisation and appropriate sizing for specific materials.	1.1.84 GEN 29, PRO 22
	4.2.4 Use recycled and recyclable building elements and materials where possible.	1.1.85 DES 31, PRO 9
4.3 Design for appropriate levels of durability and re-configurability.	*1.1.86 4.3.1 Use the concept of 'loose fit' to ensure adaptability of buildings over time.*	*1.1.87* DES 31
	1.1.88 4.3.2 Recommend the use of materials and equipment with the potential for longer lives and the capacity of reuse or changed use.	1.1.89 PRO 16
	1.1.90 4.3.4 Specify appropriate levels of quality and finish to avoid future replacement.	1.1.91
	1.1.92 4.3.5 Design for component update, particularly in areas of rapidly developing technologies and changing environmental standards.	1.1.93 DES 31
	4.3.6 Design for integrated physical solutions rather than chemical pest control.	1.1.94 PRO 23
4.4 Select materials with appropriate properties for the application.	*1.1.95 4.4.1 Consider thermal mass to moderate temperature variations.*	1.1.96 DES 4
	1.1.97 4.4.2 Appropriate levels of insulation – more insulation for extreme climates.	1.1.98 PRO 7, PRO 8
	4.4.3 Consider durability.	1.1.99 PRO 16
4.5 Evaluate and select materials and products with lower embodied energy.	*1.1.100 4.5.1 Use life-cycle analysis techniques to evaluate embodied energy.*	1.1.101 GEN 22, DES 35
	4.5.2 Consider selection of materials with regard to proximity of site.	*1.1.102* PRO 1, PRO 2
4.6 Select materials and products with low toxicity and off-gassing; consider pollution caused during extraction of raw materials, production, transport, installation, in-situ and removal.	*1.1.103 4.6.1 Consider impact of selection of following:* • *paints* • *varnishes, polishes etc* • *glues, adhesives* • *upholstery and treatments* • *particle and other board products* • *carpets, underlays* • *PVC products.*	1.1.104 GEN 15, PRO 4, PRO 5, PRO 6, PRO 13, PRO 14, PRO 20 1.1.105

Design strategies	Actions/examples	EDG references
	1.1.1064.6.2 Consider material characteristics: • *low absorption* • *discouragement of micro-organisms* • *ease of cleaning with benign processes and materials.*	1.1.107
4.7 Design for minimal energy use during construction.	*1.1.1084.7.1 Consider impact of different building technologies on machinery requirements during construction.*	*1.1.109* PRO 1, PRO 2
	1.1.1104.7.2 Consider how size and weight of material components will impact on machinery requirements during construction.	1.1.111

5. Resources – energy

Ensure the detail design, selection of appliances and energy sources results in a reduction in the building's operational energy impact across all seasons.

Design strategies	Actions/examples	EDG references
5.1 Encourage reduction of power consumption through design.	*1.1.1125.1.1 Passive solar design.*	*1.1.113* See Section 3
	1.1.1145.1.2 Improve thermal performance of buildings.	*1.1.115* See Section 4
	1.1.1165.1.3 Design for efficient building use.	*1.1.117* DES 2, DES 17, DES 21, DES 22, DES 23
	1.1.1185.1.4 Re-evaluate accepted comfort standards.	*1.1.119* See Section 8, GEN 15, DES 12, GEN 20
	5.1.5 Provide natural clothes drying facilities.	*1.1.120*
5.2 Select energy efficient appliances and operating systems.	*1.1.1215.2.1 Select high efficiency lights and sensor systems for operation.*	*1.1.122* GEN 14
	1.1.1235.2.2 Select high efficiency equipment – especially for heating and cooling – throughout.	1.1.124 DES 7, DES 37, TEC 3
	1.1.1255.2.3 Zone equipment systems for appropriate settings and more responsive occupation usage.	1.1.126
	5.2.4 Employ smart building management systems to minimise energy requirements.	1.1.127 DES 36
5.3 Encourage use of alternative and low impact power sources.	*1.1.1285.3.1 Encourage inclusion of appropriate rewnewable anergy forms:* active solar design – solar panels, hot water systems geothermal wind power co-generation mini hydro.	*1.1.129* DES 10, DES 28, TEC 4, TEC 5, TEC 6, TEC 7, TEC 8
	5.3.2 Encourage use of gas in preference to electricity.	1.1.130

6. Resources – Water and others

Understand and acknowledge the opportunities to sustainably harvest, use, re-use or recycle on-site resources during the life of the building.

Design strategies		Actions/examples	EDG references
6.1	Practise on site water conservation.	*1.1.1316.1.1 Collect and use rainwater.*	*1.1.132* DES 13, DES 14
		1.1.1336.1.2 Use water cycle management techniques.	1.1.134 DES 19, DES 24, DES 27
		1.1.1356.1.3 Use grey water reticulation systems.	1.1.136
		1.1.1376.1.4 Utilise water efficient technologies, e.g. composting toilets.	1.1.138
		1.1.1396.1.5 Use water efficient appliances.	1.1.140
		6.1.6 Avoid specifying water-hungry construction techniques.	1.1.141
6.2	Design landscape to minimise water requirements.	*1.1.1426.2.1 Select plants appropriate to climate.*	1.1.143 GEN 9, DES 40
		6.2.2 Incorporate landscaping features such as swales and dams to reduce additional water input required.	1.1.144 DES 13, DES 14, DES 19
6.3	Practise land and soil conservation.	*6.3.1 Recommend building on and rehabilitating already disturbed and degraded land.*	1.1.145 GEN 32
6.4	Design to facilitate recycling of waste.	*1.1.1466.4.1 Design for easy access to recycling facilities and separation of materials on site.*	*1.1.147*
		1.1.1486.4.2 Allow adequate storage space for recycling materials on site.	*1.1.149*
		6.4.3 Where appropriate design for on site recycling of organic waste.	*1.1.150*

7. Construction management

Ensure that the ESD initiatives included in the design process are actually implemented during the construction stage, and that the Contractor undertakes best work place practices.

Design strategies		Actions/examples	EDG references
7.1	Ensure all ESD requirements are clearly set out in specification and contract documents.	*1.1.1517.1.1 Use a 'green' specification.*	1.1.152 PRO 17, PRO 18
		7.1.2 Refer to appropriate standards and procedures.	1.1.153 DES 26, DES 29
7.2	Restrict tenders to include contractors with appropriate ESD credentials.	*7.2.1 Check contractors' position and track record prior to inclusion on tender list.*	*1.1.154*
7.3	Specify for on site environmental control.	*1.1.1557.3.1 Ensure storm water run-off controls are put in place.*	1.1.156 DES 18, DES 29
		1.1.1577.3.2 Stage work and employ appropriate site management techniques to preserve top soil, flora and fauna.	1.1.158 DES 26
		7.3.3 Require all contractors and subcontractors to engage in non-polluting construction techniques.	1.1.159 DES 30
7.4	Specify for on site waste minimisation.	*1.1.1607.4.1 Require all demolition material to be recycled.*	1.1.161 DES 30
		1.1.1627.4.2 Ensure contractors and sub-contractors sort on-site waste for recycling.	1.1.163
		7.4.3 Give preference to suppliers who take back and recycle off-cuts and wastes.	1.1.164

8. Building operation and management

Ensure that the ESD initiatives of the design and construction stages are properly understood and utilised by the users of the building over its lifetime.

Design strategies		Actions/examples		EDG references	
8.1	Incorporate delivery of Building Operations Manual as part of standard service.	*1.1.1658.1.1*	*Directly report to building users on best way to manage building.*	1.1.166	
		1.1.1678.1.2	*Manual to include easily understood diagrams and words demonstrating how the passive design aspects of the building and equipment work.*	1.1.168	
		8.1.3	*Ensure that Manual is included as part of the settlement documents if the building is sold.*	1.1.169	
8.2	Ensure building performance is able to be easily monitored and managed.	*8.2.1*	*Separately meter various aspects of building systems to ensure performance of each can be understood.*	1.1.170	DES 36
8.3	Work with client to formulate suitable maintenance strategy.	*1.1.1718.3.1*	*Set up regular maintenance schedules to ensure all materials and equipment properly cared for.*	*1.1.172*	
		1.1.1738.3.2	*Work with client to employ appropriate cleaning methods for carpets, fabrics, timber, etc.*	1.1.174	
		8.3.3	*Determine ongoing pest management system.*	1.1.175	PRO 23

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