BDP ENVIRONMENT DESIGN GUIDE

Sustainable Design – a Client Briefing

Lorina Nervegna

This paper was originally published in August 1995 and reviewed by the BDP Environment Design Guide Planning and Development Committee in November 2000. It has now been fully revised and republished to reflect current regulatory standards and industry practices.

Summary of

Actions towards Sustainable Outcomes

Environmental Issues/Principal Impacts

- Current global concerns such as climate change and global warming are real and urgent and very much related to adverse effects of human activity, particularly since the industrial revolution. Ecologically Sustainable Development (ESD) acknowledges that any activity of human endeavour must address past unsustainable practices by charting future practices that are sustainable.
- The built environment is a significant area of human activity directly impacting global concerns such as natural resource depletion, greenhouse gas emissions, salinity and water management and unsustainable industrial processes. However, many options are available as alternatives for achieving sustainable built environments, and architects and other building design professionals have the appropriate training and experience to provide advice, guidance and design solutions to achieve these objectives.
- ESD, through sustainable design, utilises principles and strategies which help reduce the environmental impact of buildings during construction, occupation and end-of useful life (i.e. a building's entire life cycle) and should be viewed as an integral part of the design process, not as an add-on or afterthought.
- Recent amendments to the Building Code of Australia (Energy Efficiency Provisions 2005, 2006) require all new work (residential and commercial) to provide a minimum energy performance standard that achieves a nominal level of energy efficiency. Additionally there are an increasing number of requirements by local and state authorities to meet environmental standards.

Basic Strategies

In many design situations, boundaries and constraints limit the application of cutting EDGe actions. In these circumstances, designers should at least consider the following:

- Establish in your initial brief your environmental goals for the project. Consider materials and products selection and their environmental impacts during manufacture, transport, construction and life cycle.
- Plan the layout of your site and building – in terms of building orientation, layout and form – to take maximum advantage of passive design principles, such as solar access/control and natural ventilation.
- Reduce site impact by minimising excavation and protecting existing natural features such as indigenous flora/fauna and habitats.
- Use elements of the built form of your design, such as windows, thermal massing and external shading, to increase the energy efficiency of your building relevant to your climate type, and zone internal spaces that require similar heating/cooling requirements.
- Consider selecting and specifying materials with low environmental impacts. Avoid using natural materials that are identified as a rare or threatened species (e.g. some select timbers). Consider the use of internal finishes and materials to ensure high indoor air quality levels. Avoid using materials that are known to cause poor indoor air quality and threaten human health.
- Consider whether the use of materials in your building is appropriate for the site climate. Large expanses of glass in alpine areas or arid climates may only be appropriate if off-set with significant amounts of insulated internal thermal mass. In tropical climates breezeways can be employed to assist natural ventilation of lightweight buildings and capitalise on prevailing winds. In temperate and arid climates, external annual sun control will significantly lower heating/cooling energy costs.
- Employ energy saving devices/appliances/management systems in your building and specify green power.

Cutting EDGe Strategies

- Design a passive building that requires zero non-renewable energy inputs (e.g. electricity, natural gas) for heating/cooling.
- Install and make provision for on-site treatment systems for all grey- and black- water and organic (composting) waste.
- Install and make provision for on-site rainwater collection and re-use.
- Select and specify only materials, fixtures and finishes that have a low or zero environmental impact, provide a high standard of indoor air/environment quality, are durable, require little or no ongoing maintenance, are suitable for recycling/re-use, and have a low embodied energy.
- Include contract clauses specifying environmentally responsible construction practices, such as site waste management and minimisation.

Synergies and References

- BDP *Environment Design Guide*, Volume 2: Not 2 – Annotated Bibliography of Environmental Design Publications
- Hyde, R, 2000, Climate Responsive Design, E & FN Spon, UK
- Vale, B and R, 2000, the New Autonomous House, Thames and Hudson

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Sustainable Design – a Client Briefing

Lorina Nervegna

This paper provides information to prospective clients about the role of sustainable design in ecologically sustainable development (ESD) to minimise adverse impacts of building and realise the potential to achieve low or zero energy buildings in any climate or building type.

1.0 Considering Sustainable Design

Current global concerns such as climate change and global warming are real and urgent and very much related to adverse effects of human activity, particularly since the industrial revolution. Ecologically Sustainable Development (ESD) acknowledges that any activity of human endeavour must address past unsustainable practices by chartering a means of future practices that are sustainable.

In the relatively recent past we have become increasingly aware of the significant consequences of our actions on global imperatives such as the greenhouse effect and climate change (global warming) and degradation of natural ecosystems and resources. This awareness can inform individual actions, such as fostering sustainable behaviour through waste minimisation, reduced energy consumption in day-to-day living, recycling and composting. However, significant contributions to reducing the ecological impact or footprint of the built environment can be made during the design, construction and ongoing operation of a building where generally, large quantities of non-renewable resources and energy are consumed.

Every building project provides an opportunity to positively respond to sustainable challenges. Current knowledge exists to design, construct and operate buildings to use energy and resources more effectively and efficiently, produce less waste and greenhouse gas emissions, harvest water, and provide a high standard of indoor environment for occupants over the entire life of the building.

2.0 Using an Architect

2.1 How an Architect Can Assist

Architects have the appropriate training and experience to design, coordinate and manage your building project. Members of the Royal Australian Institute of Architects (RAIA) must be professionally qualified, registered to practice by the relevant state or territory registration board and are bound by a Code of Professional Conduct. The RAIA's Environment Policy alerts its members to the aims of ecological and social sustainability. (Refer to BDP *Environment Design Guide*, Volume 1 – General Issues, Gen 1 or view at http://www.architecture.com.au)

Sustainable design is an integral part of the design process and needs to be considered at every stage of the building process. It should not be considered in isolation from other aspects such as aesthetics, cost, materials selection and ongoing use of the building over its life.

Architects with experience in sustainable design are able to advise you of appropriate strategies for targeting sustainability in your project. On large scale projects architects are in the best position to lead and coordinate a team of expert consultants in key areas of sustainable design such as integrated systems engineering (including passive heating/cooling), cost control and quantity surveying, urban planning and water/waste management.

2.2 Advantages

Good design minimises the ecological impact or footprint of the building, and improves the quality of life, thermal comfort, health and safety of the building's occupants. Architects are capable of creating aesthetically pleasing building designs, integral to the building's surroundings.

It is generally accepted that an architect designed project enhances the value of your building and is more likely to produce significant savings in terms of ongoing operation (e.g. reduced cooling/heating costs through passive solar design) and occupying/tenanting the building. An architect has many years of education and training enabling complex and creative means of interpreting the challenge of sustainability into built form.

3.0 Sustainable Design

3.1 Definitions

Sustainable design is, in short, the use of design principles and strategies which help reduce the ecological impact of buildings – for example, by reducing the consumption of energy and resources, or by minimising disturbances to existing vegetation.

The concept of ecologically sustainable development (ESD) was outlined in *Our Common Future*, the report of the 1987 United Nations World Commission on the Environment and Development (the Bruntland Commission). It defined ESD as '… development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. Following the 1992 United Nations Conference on Environment and Development (the Rio Earth Summit), a long term strategic program was developed for achieving sustainability, namely Agenda 21.

3.2 Sustainable Design and Regulatory Frameworks

Recent amendments to the Building Code of Australia (BCA) Energy Efficiency provisions for Classes 1 -10 buildings (2005 and 2006) mandate a minimum energy performance standard that achieves a nominal level of

energy efficiency (i.e. for residential buildings equivalent to 5 stars under the Nationwide House Energy Rating Scheme, NatHERS and for commercial buildings refer to Building Code of Australia for methods of compliance). For further information regarding the Building Code of Australia Energy Efficiency Provisions, visit http://www.abcb.gov.au.

Additionally there are an increasing number of requirements by local and state authorities to meet environmental standards. An architect can assist in interpreting and achieving these requirements in creative and cost effective ways.

However, minimum practice should be viewed as a departure point in sustainable building design and not the destination. Much more is achievable and possible with considered design. Sustainable building design goes way beyond energy efficiency and addresses aspects not currently in the BCA such as indoor air quality, materials selection, resource efficiency and waste, water harvesting, building management and user operation.

3.3 Aims of Sustainable Design

The RAIA's Environment Policy sets out some of the aims under its key principles:

- maintain and, where it has been disturbed, restore biodiversity
- minimise the consumption of resources, especially non-renewable resources
- minimise pollution of soil, air and water
- maximise the health, safety and comfort of building users
- increase awareness of environmental issues

In order to work towards achieving sustainability in building design, consideration should be given, but not be restricted to, the following specific principles, bearing in mind that each project and the relevance of each principle to a particular building may vary.

4.0 Sustainable Design Principles

4.1 The Design Brief

The quality of your design brief – your description of your needs and requirements for the building project – will have a large influence on the success of the design solution. In considering the ways in which to incorporate sustainable features into your building, you should discuss the cost and ecological implications of your decisions with your architect. Critically review and re-examine your needs and requirements. For example, reducing the size and scope of the building, rethinking how you use the building or your required levels of thermal comfort may well have cost and ecological benefits.

4.2 Site Planning

While site factors such as capitalising on views from the building or responding to the streetscape are desirable, a building's design and placement on a site should also respond to the site's environmental opportunities. These include solar access, natural ventilation, prevailing winds and climate type, existing landscaping and structures and facilities such as public amenities. The ecological impact of the building can also be reduced by minimising site excavation, optimising local ecosystems and respecting conservation issues. On larger sites, when assessing the potential of existing buildings, your architect can arrange for a site evaluation and audit to assess existing features in order to optimise your design choices.

Consideration of transport and delivery of materials to site may inform decision making regarding materials selection. Remote sites may need to consider transport of materials to site as a significant cost (both economic and environmental) in terms of materials specification and selection. Urban sites may be suitable for access to common building materials, whereas quarried stone for feature finishes may be substituted or minimised to take into consideration their environmental cost.

4.3 Built Form

The function of the building, site conditions, local regulations and the shape of your property (and regulatory prescribed setbacks) could determine the form of your building. However, factors such as the building's depth, massing, window design and external shading may affect the energy efficiency of your building and, in turn, it's ongoing operating costs (of heating/cooling) and the comfort of building occupants.

4.4 Internal Layout

The internal arrangement of rooms and spaces should reflect not only the functional relationships between spaces, but also the grouping or zoning of spaces with similar heating, cooling and lighting requirements to help reduce energy consumption. In temperate and arid climates year round external solar gain is a significant contributor to the efficiency of the building's performance for heating and cooling. In cooler months, maximum solar gain is desirable to help reduce heating costs and in warmer months, external solar control is desirable for reducing cooling requirements. This solar control is pivotal to passive solar design and is best optimised with a component of internal thermal mass (concrete floors, exposed masonry walls, stone fireplaces, stone or concrete benches, stairs or other internal building elements).

4.5 Materials

The selection and use of construction materials has a significant ecological impact. Materials selected should be the least polluting, and from renewable/sustainable sources. Where practical, the use of recycled and recyclable materials should be considered.

The use of heavy materials (concrete, brick or stone), appropriately positioned inside a building acts as a thermal mass where it stores energy/heat and improves the energy efficiency of a building. (See section 4.4 above). The building's ecological footprint and the performance over its life cycle may also be further reduced by avoiding the excess use of metals and plastics which have a high embodied energy (i.e. energy used in the manufacture and assembly of the material).

The second most consumed substance on earth after water is cement, the key ingredient in concrete and mortar. Virtually no building project is possible without using at least some of it. One tonne of ordinary (Portland) cement produces at least one tonne of greenhouse gas during manufacture giving it a relatively high embodied energy. However, cement can be blended with supplementary materials (such as the waste products fly-ash and slag from coal and iron industries) resulting in a relatively low embodied energy material. As thermal mass is a critical component of sustainable (particularly low energy) buildings in most climate types, using low embodied energy concrete should be encouraged. Most concrete suppliers will be able to assist in achieving suitable mixes for projects and some blended cements are currently available as proprietary products.

Avoid specifying rare or threatened timber species unless certified by the supplier as having been sourced from a sustainable forestry operation. Many commonly used, cost-effective timbers (used for external decks, feature fences, window sills and assemblies and internal feature veneers) are cost-effective because they are not from sustainable sources but from questionable forestry operations in developing world markets. The continuing use of these products is not sustainable or equitable in assisting the development of these economies.

Similar questions should be asked regarding quarried stone and marble and other non-renewable building products, and if answers are not available, the precautionary principle should apply as to their selection: when in doubt, don't.

4.6 Insulation

Correct insulation of walls, roof, floors and window and door openings will reduce the amount of winter heat loss and summer heat gain. Reduced operating energy costs for a building may be achieved provided that insulation is considered as part of a thermally balanced design approach.

The Building Code of Australia gives specific insulation requirements for all eight climate types around Australia with a minimum performance standard resulting. However, these insulation amounts can be exceeded, and the more the better.

4.7 Energy

The use of renewable energy sources, passive solar design, natural ventilation, daylighting, low energy lighting, insulation, energy efficient appliances and energy management systems improves the energy efficiency of the building. This in turn increases occupant thermal comfort and reduces operating costs and greenhouse gas (CO_2) emissions over the building's life cycle.

Some of the more cutting edge renewable energy sources currently available include geo-thermal (ground source heat pumps), and phase change materials. More common are photovoltaic solar electricity panels and solar water heaters. Subscribing to green-power electricity through a utility supplier is another way to access renewable power from larger scale generators.

4.8 Finishes

The selection of finishes such as floor and wall coverings may have consequences for occupant health (e.g. toxic off-gassing), and will influence the building's embodied energy audit. Many adhesives, paints and finishes have volatile organic compounds (VOCs) that are known carcinogens and toxic to human health. A high standard of indoor air environment can be achieved by avoiding these products altogether and specifying environmentally friendly alternatives. For example, timber floors can be finished with natural oils and beeswax and many bio-paints are available for internal painting.

4.9 Waste and Recycling

Minimising the amount of waste generated during construction and providing for the recycling of both construction and occupant wastes can reduce the financial cost and the ecological impact of building projects. Additionally, making adequate provision for ongoing waste management in the design and fitout of a project can contribute to reducing waste going to landfill over many years of occupation (e.g. for separating organic, recyclable and non-recyclable waste in commercial or domestic wet areas).

In remote sites, composting toilets should be considered in addition to grey-water treatment rather than commonly used septic systems. Urban grey-water treatment systems are currently available and should be viewed as a viable option in any project.

4.10 Water

On-site use of rainwater and water efficient appliances will minimise mains water consumption and contribute to lower ongoing water bills. Urban rainwater collection is now a common feature of new projects and will continue to grow as an easily achievable measure as demands on urban water supplies continue to grow at an unsustainable rate.

4.11 Life Cycle

The design of a building should consider the cost and ecological impact of the building over its entire life – from the extraction and processing of the building materials through to construction and occupation, as well as the building's eventual demolition at the end of its useful life. In this context, important factors include running costs, energy efficiency, maintenance requirements and durability of materials, pollution minimisation, the energy embodied in the materials during their manufacture and the building's potential for re-use or changed uses.

5.0 Further Information

The RAIA has published a booklet, *You and Your Architect*, which provides detailed information and advice about the architect's role in the building project. For a free copy, contact your architect, or one of the RAIA offices listed below or download from http://www.architecture.com.au:

Australian Capital Territory
2A Mugga Way, Red Hill ACT 2603
Telephone: (02) 6273 2929 Facsimile: (02) 6273 1953

New South Wales
'Tusculum',
3 Manning Street, Potts Point NSW 2011
Telephone: (02) 9356 2955 Facsimile: (02) 9368 1164

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1 Shepherd Street, Darwin NT 0800
Telephone: (08) 8981 2288 Facsimile: (08) 8981 3042

Queensland
70 Merivale Street, South Brisbane Qld 4101
Telephone: (07) 3846 4900 Facsimile: (07) 3846 5087

South Australia
100 Flinders Street, Adelaide SA 5000
Telephone: (08) 8228 9100 Facsimile: (08) 8228 9199

Tasmania
1/19a Hunter Street, Hobart Tas 7000
Telephone: (03) 6234 5464 Facsimile: (03) 6234 9063

Victoria
1st Floor, 41 Exhibition Street, Melbourne Victoria 3000
Telephone: (03) 9654 8066 Facsimile: (03) 9650 3360

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QV1 Upper Plaza Level,
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Place your business card here

Biograpghy

Lorina Nervegna BArch is a Melbourne architect, editor and author currently Manager Sustainability Royal Australian Institute of Architects and Managing Editor of the BDP Environment Design Guide. Lorina was director of Lorina Nervegna Architects Pty Ltd for ten years and has been involved in passive and low-energy building design and construction for over twenty years with an interest in building ecology and environmentally friendly construction materials. From 2001 to 2003 Lorina was National Architect at the Cement and Concrete Association of Australia, Strategic Development department.

Guidelines for Environmental Claims

The Trade Practices Commission has established guidelines regarding environmental claims in marketing. Those relevant to architectural practices include:

Unqualified general statements: Avoid using terms such as 'environmentally friendly' or 'environmentally safe' or 'green' as very few products or services could justify a claim that they are totally free of adverse environmental impacts. In addition, these terms will do little to assist a client in making an informed purchasing decision.

Be specific: Environmental claims should refer to specific products and services and explain the benefit (and its significance) using language the average person understands (avoid archi-eco-speak).

Real benefits: The environmental benefit must be real, relevant and not overstated.

Scientific or technical terms: If the target audience lacks a degree of scientific sophistication, scientific and technical terms and symbols should not be used unless they are accompanied by a clear and accurate statement of their meaning.

Effect on performance: Sometimes enhancing the environmental benefits of a product may involve a trade-off which results in some loss of performance – consumers should be informed of this effect.

Product recycling: Claims about the use of recycled materials should differentiate between products made from recycled materials and others, such as materials made from reclaimed waste. Claims about the recyclability of a product should not be made if consumers do not have access to facilities to handle that product.

Endorsements: The Trade Practices Commission warns that where a private organisation is commissioned to assess a product or service for the purposes of endorsement, the following should apply:

- the awarding company should be independent;
- the evaluation process should be no less rigorous or relevant than implied in the promotion of the endorsement;
- the endorsement should not be represented as an official endorsement; and
- the endorsement should be limited to the terms of the evaluation process.

Adapted from: Trade Practices Commission 1992, *Environmental Claims for Marketing – a guideline*, TPC, Canberra.