

AN EXAMINATION OF THE RELATIONSHIP BETWEEN SUSTAINABILITY AND AFFORDABILITY IN RESIDENTIAL HOUSING MARKETS

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ABSTRACT

To be affordable, a house must be designed and constructed to last; an approach to building that embraces sustainability principles. Energy efficient construction is proven to reduce the long-term costs of owning a house; it also improves building durability by decreasing the probability of moisture-related problems. When homeowners spend less on energy bills, they can better budget for maintenance and repair costs, which will again ensure that their house has longevity. While energy efficiency may modestly increase the up front construction costs, it will ensure that a house built today demonstrates value and will be affordable in the future.

Every new house built in the state of Victoria, Australia is now required to gain a *5 Star* energy rating for building fabric and water saving fixtures. It is unsure whether these measures will lead to the culture change required in the house building industry, namely an increase in housing affordability and a reduction in environmental impact.

A study of the 'entry level' residential housing market in the State of Victoria prompted a review of mandatory and voluntary sustainability measures for house builders; as well as resources made available to purchasers regarding sustainability, particularly energy efficiency and water resourcefulness. Resources from Australia, New Zealand, North America, and UK are presented in order to provide some international comparisons.

This paper discusses the relationship between affordability and sustainability and questions whether affordability, predominantly related to reducing the through life cost of owning a home (sustainable energy and water-efficient measures in particular), is going to be driven by legislation, the market or the consumer.

KEYWORDS: Affordability, energy efficiency, sustainability measures, through life costs

1. INTRODUCTION

Sustainability and affordability are intrinsically linked; both are crucial to the Australian way of life and the health and happiness of future generations of Australians. Both are equally important (Crouch, 2005). The Victorian Government is driving a strong environmental agenda that is underpinned by affordability, as it is perceived that sustainability must embrace affordability, if Australians are to enjoy a successful future. But is the message getting through to the right audience, particularly when housing affordability remains an unbridgeable chasm for many Australians.

The current situation in Victoria, Australia is described; including how sustainable housing is being promoted to bring about longer-term affordability. Australia's performance is compared with that of other countries. Finally, with compulsory 5 Star for new-build and moves to up-grade existing homes, and building on experience from the overseas market, recommendations are made regarding targeting of future guidance and resources.

This research forms part of a larger study for the Building Commission of Victoria, aimed at shifting the concept of affordability beyond first cost, to operating and maintenance cost and ultimately environmental cost. This research is intended to add to the growing evidence that sustainable and affordable housing is not an oxymoron and to help alter the way housing developers, financiers (and consumers) approach sustainable housing projects. It is intended that this piece of work will provide a catalyst to assist the Building Commission in promoting this new way of thinking.

2. HOUSING AFFORDABILITY IN AUSTRALIA'S CITIES

Housing affordability remains out of reach for many Australians if the latest figures are accurate. Homes in Sydney and Melbourne have been ranked among the most unaffordable in the developed world as people move from quarter acre blocks to inner city units (Amber, 2005).

The Demographia International Housing Affordability Report (Wright, 2005) ranked housing in Sydney just behind parts of Los Angeles and San Diego as the least affordable in the United States, Australia, Canada and New Zealand. Melbourne, Victoria's capital city, was not far behind, and just a little more affordable than New York, while Adelaide, Hobart, Brisbane and Canberra were all ranked among the twenty least affordable cities. In fact all the Australian cities (bar Darwin) rank as severely unaffordable markets, with Darwin ranked at the top of the unaffordable market list (Wright, 2005 from *Demographia International Housing Affordability Ranking Index, 2005*).

In an index based on median house prices (financed by the Commonwealth Bank) for Australia's Housing Industry Association [HIA], Hobart is ranked as the most affordable state capital, followed by Perth and Adelaide. Amber (2005) reports that affordability conditions in Brisbane have substantially diminished, with the city now ranking less affordable than Melbourne. Escalating land costs, costly building requirements and excessive levies and charges, are said to be causing the escalation in prices. Entry level housing prices rose during 2005 in Adelaide, Hobart, Brisbane and Perth (Amber, 2005).

Elizabeth Crouch, HIA's Senior Executive Director for Building and Planning Services, in a recent press release stated that, "While the government and the Greens argue over the relative merits of water recycling or desalination, tens of thousands of young people remain locked out of the housing market, unable to even contemplate the cost of taking on a mortgage" (Crouch, 2005). Is it possible for low-middle income families and first time buyers to break into the market if they are given favorable lending packages and are safe in the knowledge that on-costs (running and maintenance) will be affordable? Can they make this kind of decision if they are not armed with information on how to best manage their home and what the true cost of owning that home will be?

3. SUSTAINABILITY MEETS AFFORDABILITY

As the concept of sustainability becomes increasingly more prominent, the impact of the built environment on human health and the health of ecosystems has received increased attention. Climate change, diminishing forests, water contamination, air pollution and foreign oil dependence, are concerns associated with building construction and operation. Housing development is of paramount importance. Housing is a critical element of community character and liveability, affecting land use, crime, transportation, urban design and other key facets of community life. As Australians increasingly spend the majority of their leisure time indoors, the quality of our housing also significantly affects human health by way of indoor air quality and exposure to toxic materials (Goldstein and Rosenblum, 2003).

Due to growing health concerns and higher operational costs, questions have begun to emerge about whether the property sector can produce houses that are both affordable and sustainable, minimising adverse impacts on the environment and public health, whilst reducing operation and maintenance costs.

In addition to their environmental benefits, sustainable housing provides direct value to the consumer, including lower operating costs, improved comfort through energy efficiency and better design, as well as improved health through selection of non-or less toxic materials and improved ventilation systems. By making energy saving improvements to homes, energy bills can be reduced by approximately 30%. In addition, awareness of common problems, coupled with proper use of existing technologies and management practices, can reduce utility bills significantly at a relatively low initial cost, thereby greatly increasing housing affordability for low-middle income families (U.S. Dept. Housing and Urban Development, 2004) and first time buyers.

Whether located as part of a mixed-use development, on a Brownfield site, or an infill project, the benefits of sustainable housing in terms of affordability, liveability and promotion of public health address the fundamental needs of residents of low-medium income families, purchasing entry-level housing (Goldstein and Rosenblum, 2003). This is why both housing developer and consumer awareness of the issues are of paramount importance; for developers to understand why they are required to build to a certain standard; and for consumers to understand how best to 'run' their home for maximum comfort and affordability.

4. THE AUSTRALIAN JOURNEY INTO SUSTAINABLE HOUSING

4.1 A focus on energy

On-costs are mostly felt in energy costs and this is where affordability and sustainability become one. Although the proportion of energy directly consumed in the home is relatively small (less than 10%), all energy saved helps reduce greenhouse gas emissions (Australian Bureau of Statistics, 2002). An energy efficient household can make substantial financial savings compared with an energy inefficient household, with the main benefits coming from insulation and solar water heating. In addition to financial savings, insulation and energy efficient design initiatives can also improve the physical comfort of a home.

Figures from the Australian Bureau of Statistics (2002) show that most households that have installed insulation did so to improve comfort (87%) or reduce energy costs (9%) rather than to save energy (2%).

Current residential energy efficiency measures are projected to only slow the rate at which residential energy consumption increases not reduce it! The increasing per capital energy consumption in the home (Australian Bureau of Statistics, 2002) may be related to the trend towards smaller households in larger houses or *McMansions* and the increasing standard of material wellbeing enjoyed by most Australians, reflected in the plethora of electrical appliances used.

4.2 National Standard Approach

Therefore, in agreement with the building sector, the Australian Government has resolved to eliminate worst energy performance practices through a national standard approach to minimum performance requirements for building. For the housing industry this meant minimum energy performance standards being introduced in to the Building Code of Australia [BCA] for detached and semi-detached dwellings as of 1 January 2003, and Multi-Residential Buildings as of May 2005 (Australian Building Codes Board 2003, 2005).

Since the BCA is a performance based code, builders and designers have the option for meeting these new standards either by following the 'deemed to satisfy' prescriptions in the code or by achieving the required house energy performance rating using an accredited software tool. The stringency of this standard equates to an energy efficiency measure of 4 Stars. Given the importance of the energy performance of buildings to the overall abatement of national greenhouse gas emissions, the development of the energy efficiency measures for inclusion in the BCA has been undertaken jointly by the Australian Greenhouse Office [AGO] and the Australian Building Codes Board [ABCB].

4.3 5 Star Energy Efficient Measure

The Victorian Government have gone one step further, and as of the 1 July 2005, all new homes (houses and apartments) in the state had to meet the 5 Star energy rating system which considers building fabric (including house orientation, design, insulation, window size and orientation) and water conservation measures. In addition all homes must now incorporate a rainwater tank or solar hot water system.

It is believed other states e.g. Queensland (Boyle, 2005) are hot on their tail. The current situation across Australia is highlighted in Table 4.1. Most states adopt a 4 star energy rating system, or equivalent whilst New South Wales adopts a Building Sustainability Index (BASIX) which ensures new homes are designed and built to use less potable water and produce fewer greenhouse gas emissions than if they were designed and built to current building regulations (BASIX, 2005).

In a press release on 25 November 2005, the ABCB announced their decision to enhance the existing provision to a nominal 5 star energy performance level across the board. In reaching its decision, the ABCB noted that at least four

states and territories, representing around half of housing starts, will have adopted 5 star energy efficiency measures in 2006. Should a minimum of 5 star not be included in the BCA, their concern was that this would lead to a discrepancy in national consistency (ABCB, 2005). However this has received mixed press, particularly with respect to housing affordability (Crouch, 2005). There are concerns over the additional cost being passed on to the consumer, whether legitimate, or otherwise, relating to the added 'cost' of sustainability, pricing low-income families and first time buyers out of the market.

Table 4.1: Housing energy measures currently adopted by the different Australian states

Rating required by state regulation	States
4Star equivalent	Northern Territories Queensland South Australia Tasmania Western Australia
5Star	Victoria
Building Sustainability Index (BASIX)	New South Wales (incl. Australian Capital Territory)

4.4 Promoting energy efficiency and sustainability

Within Victoria, the Building Commission, as the statutory authority that oversees the building control system in Victoria, and the Sustainable Energy Authority for Victoria [SEAV] are driving sustainable housing and determined to convince the consumer of the gains that can be made from owning a 5 Star home¹. To this end, "5 Star Houses Are Better Houses", was published by the Building Commission in 2004 to introduce the general public to 5 Star and the benefits of owning a 5 Star home. The Building Commission wants to ensure consumers get the best from their home by asking the housing developers to consider sustainability in the design process. They stress the fact that sustainable design solutions benefit both the occupant/end user and the environment. They demonstrate simple choices including orientating the house for sun, energy efficient lighting in high use areas, low flush toilets and efficient showerheads, compost bins, and recycling plastics, paper and glass. The booklet outlines, in simple language, the benefits of 5 Star to both the homeowner and environment.

SEAV have also produced a manual to enable builders, designer and homeowners to maximise the energy saving potential of any property or house design. The "Energy Smart Housing Manual", proposes that through sensible design, energy costs are lowered, comfort is maximised, non renewable resources are conserved and green house gas emission are reduced (SEAV, 2002).

There are also countrywide schemes to support sustainability. GreenSmart[®] is an initiative set up by the AGO and the Housing Industry Association Ltd. GreenSmart[®] is a practical approach to building that focuses on educating builders, designers, product manufacturers and consumers about the benefits of environmentally responsible housing. Another national source of information for the housing developer and end user is ENERGY STAR, an international standard for energy efficient electronic equipment. It was created by the U.S. Environmental Protection Agency in 1992 and has now been adopted by Australia. But are these enough to move Australian housing forward? Can the Australian housing sector learn from the mistakes of others by looking at the journeys other countries have taken into sustainable and affordable housing?

5. LEARNING FROM OTHERS

5.1 More stringent building regulations

As a direct result of the need to inform consumers of the benefits of 5 Star housing (sustainability and affordability) the Building Commission of Victoria commissioned research to examine approaches taken by other countries, seen to be leading the way on sustainability and affordability, to establish what has transpired and any lessons that could be learnt from the experiences of others.

This research is timely as a recent investigation for the Australian Greenhouse Office [AGO], comparing international building energy performance standards, shows that the Australian 5 Star standard is not an onerous requirement when compared to housing performance levels being achieved in comparative overseas locations in UK, USA, Canada (Horne et al., 2005; Hayles et al., 2006). Indeed the current efficiency of Australian homes is well below comparative international standards in terms of energy efficiency and greenhouse gas emissions.

¹ On October 1 2005, Sustainable Energy Authority Victoria and EcoRecycle Victoria joined forces to become Sustainability Victoria.

During this research, 51 house designs from North America and the UK were energy rated using AccuRate in order to test the relative stringency of the proposed 5 Star Australian standard against housing designs, in areas of comparative climates (Hayles *et al.*, 2006).

The mean star rating overall was 6.8 (to 1 decimal place). This indicates clearly that the performance of overseas equivalent housing is significantly out-performing both current Australian housing and the proposed Australian 5 star national requirement. There was no particular pattern of performance according to warmer or cooler climates and dry or humid climates (Hayles *et al.*, 2006).

The house designs obtained from the UK and Canada suggest that in these countries, houses are built to very high standards, in compliance with more stringent building code requirements, with star ratings ranging from 6.5-8.5. Houses in the USA tend to be more akin to those in Australia with the typical format of lightweight construction on slab seen in new housing in Australia also seen in the USA. However the overall performance is comfortably above the Australian 5 Star standard in order to meet more stringent building codes requirements for building fabric (especially roofs) and windows (mean star ratings for the different states ranging from 5.4 - 7.6). USA house designs generally incorporate more insulation and lower window area per unit floor area. As a result, predicted energy use is typically cut by 30-50% beyond the proposed Australian 5 Star requirement (Hayles *et al.*, 2006).

The adoption of 5 Star as a minimum standard is clearly a step forward for energy efficiency of Australian homes, assuming it is activated across the board. However typical houses in comparison countries use significantly less energy than the 5 Star standard houses (Horne *et al.*, 2005). This demonstrates an opportunity for more stringent standards and further reduction in energy demand in the future.

Therefore a decision was made to compare experiences in Australia with USA, UK, Canada (mirroring the AGO research) and New Zealand. So what is the story in these countries and can Australia learn from their experiences? How have other countries made the journey to sustainable and affordable housing? Table 5.1 provides a summary of sustainability measures taken in these countries, including building codes, standards and rating schemes. These various approaches are discussed, country-by-country, in the following sections. By understanding what has happened in other countries, it is hoped Australia can move forward quickly in the pursuit of sustainable, affordable housing.

Table 5.1: A summary of sustainability measures through codes, standards and rating schemes, currently adopted in Australia, North America, United Kingdom and New Zealand.

Country	National approach	Additional requirements	Rating schemes	Additional Tools
Australia	BCA Performance based codes (equivalent to 4 Star)	1. 5Star in Victoria 2. BASIX (Building Sustainability Index) in New South Wales	5 Star	GreenSmart ® Energy Star ®
North America	USA: International Building Codes - International Energy Conservation Code Canada: Canadian National Building Code – model energy conservation code	USA: Varies from state to state Canada: varies from province to province. Note some states/provincial building codes contain additional requirements relating to energy conservation	LEED® for Homes	Energy Star ®
United Kingdom	Building Regulations - England & Wales - Scotland - Northern Ireland	None	BREEAM Ecohomes	Envest 2 for whole life performance evaluation
New Zealand	Building Code and Building Regulations	Building Code compliance methods	BRANZ Green Homes Scheme	Energy efficiency and conservation authority

5.2 United Kingdom

In the UK BREEAM (Building Research Establishment [BRE]'s Environmental Assessment Method) has been used for more than 10 years. It is the World's most widely used means of reviewing and improving the environmental performance of buildings. Since its launch in 1990, BREEAM has been increasingly accepted in the UK construction and property sectors as offering best practice in environmental design and management, marketing the value of sustainable construction (BRE, 2005).

Although a simple rating tool, it actually draws together a comprehensive environmental assessment process. Areas assessed are outlined in Table 5.2. The system is able to add performance in a number of disparate environmental effects together to produce a single score by using a weighting system based on a measure called ecopoints, based on the average impact of a single UK citizen in one year. The performance against each distinct credit can also be identified from the report. All ratings are in excess of current statutory requirements (building regulations), and therefore significantly more stringent than Australia's 5 star requirements. Assessment can be carried out on both new build and refurbishment schemes for all building types.

The homes version of BREEAM is called EcoHomes. It provides an authoritative rating for new and converted or renovated homes, and covers houses, apartments and sheltered accommodation. Ecohomes is a mechanism to assess certain defined aspects of the sustainable aspirations of housing and mixed-use developments. The rating system, produced by BRE, is adhered to by licensed assessors who carry out both predictions and assessments. BRE regularly updates the criteria in line with changing legislation e.g. Building Regulations. The Ecohomes scheme considers the broader environmental concerns (climate change, resource use and impact on ecology) and balances them against the desire for a high quality of life with a safe and healthy internal environment. The issues are grouped: energy; water; materials; transport; ecology and land use; and health and wellbeing (BRE, 2005).

The Sustainable Buildings Task Group report, "Better Buildings—Better Lives" which was published in 2004, provided recommendations for the UK Government regarding sustainable building. In it the task force proposed a single national code for sustainable buildings (CSB) be established and that this should be based on BREEAM and incorporate clearly specified minimum standards in key resource efficiency criteria (energy and water efficiency, waste and use of materials). There is therefore a move to standardise and add rigor to current practice.

BREEAM doesn't directly tackle affordability but another BRE tool has recently been developed to simplify the process of designing buildings that are both sustainable (with low environmental impact) and affordable (with low whole life costs). Invest 2 software allows both environmental and financial trade-offs to be made explicit in the design process, allowing the client to optimise the concept of best value according to their own priorities. Invest 2 is web based, allowing large design companies to store and share information in a controlled way, enabling in-house benchmarking and design comparisons. Invest 2 estimator uses default environmental and financial data about the whole life performance of the building it has been developed for use by design teams who are particularly interested in the environmental performance of a building, but also find it useful to provide an estimate of relative whole life costs for different designs. Invest 2 calculator provides default environmental data but allows the user to enter their own capital and lifetime financial cost information. This provides a powerful tool for design teams for whom the whole life costs are of prime importance, who have their own specific data available and who are also find it useful to have access to the environmental performance of the design. This or a similar tool will be a useful addition to Australia's cause if the Building Commission and others are going to meet the challenge set by the HIA to demonstrate that both sustainable and affordable homes can be provided (BRE, 2005).

In the UK there are a number of groups whose purpose is to provide advice and help with improving the environmental performance of individual homes. The sizeable public housing stock means that a lot of the information has been directed at registered social landlords (housing associations and local authority housing providers). This is important when linking sustainability with affordability as public housing is by definition entry-level housing and tenants have the opportunity to buy their homes from the provider at a later date, so long term affordability is a meaningful issue. It is also important because public housing developers invariably work on mixed schemes, and the push coming from the public sector becomes a driver to promote best practice and sell the (entry level) private housing on these mixed schemes.

Two resources which can be used as model examples are the Green Street website (<http://www.greenstreet.org.uk/>) and the Routes to Sustainability website (www.routestosustainability.org.uk). Green Street is particularly useful because they have collated material that covers building standards, costs, potential funding routes and procurement as well as technical information. It also provides real action through case study examples. The principle aim of Green Street is to encourage housing associations to go beyond just providing minimum standards in order to meet affordable warmth targets and in doing so reduce running costs for residents. This should also have a knock-on effect of cutting maintenance and management costs if tenants are getting a well insulated and damp-free home.

Routes to sustainability supports registered social landlords to achieve more sustainable housing. Again it provides information on new products and technologies that can help deliver sustainable outcomes as well as suggestions for reducing running costs. The Housing Corporation and English Partnerships are looking beyond lowest initial costs and demanding that development goes further than the minimum standard required by the building regulations.

However it is not just the public housing developers that are striving for sustainability and affordability. The Worldwide Fund for Nature [WWF] published a report in 2004, "Building towards Sustainability: Performance and Progress among the UK's Leading House Builders". This report provides the findings of a survey of 13 of the UK's

largest listed house builders and demonstrates very clearly that each recognises the growing importance of sustainability issues, particularly in terms of their business. Some companies have already gone a long way to ensure this is reflected in their governance, management resources, policies and operational performance (WWF, 2004). One of the interesting things to come to light in this survey is that *public disclosure of information on sustainability issues is lacking* (WWF, 2004). It appears if the consumer wants to know the sustainability aspect of their new home or what they would want from a new home, they must seek the information out for themselves. In the private housing sector this is the same as for Australia, the onus is on the house purchaser to find out how best to operate the home for sustainability and affordability.

In June 2001, Merseyside Green Housing Alliance [MGHA] published a report entitled "Green Housing for the Future". The report was targeted at the register social landlord sector (because as landlords they have particular interest in the long-term sustainability of the housing they produce), however, they acknowledge that many of the suggestions made in the report apply to the private housing building sector *where volume is greatest, and who can have a potentially bigger impact on the achievement of sustainable or green housing as a standard expectation of people in the 21st century* (MGHA, 2001). In their recommendations they conclude that the way forward needs to be government-lead. They contest that the individual or groups of housing developers, whether in the private or social sector, do not have enough weight to overcome the obstacles before them. They cannot make enough difference quickly enough, without direct government action (MGHA, 2001). Equally, it is important that consumers for housing, whether as tenant or owner-occupiers, actually demand sustainability from their homes (MGHA, 2001).

If the Sustainable Buildings Task Group's recommendations are met, sustainability will be driven by further legislation, however there is still the need to educate the consumer as to the benefits of an environmentally sustainable, affordable approach to home ownership. The green consumer guide (www.greenconsumerguide.com) is an on-line resource for consumers (as well as corporate and government use), and includes information on energy efficiency, personal products for the home, and environmental improvements that can be made, amongst other information. This website is possibly the best place for consumers to go although it lacks a housing theme *per se*. It is for the consumer who knows where they are going but wants to know the best way to get there.

In the UK sustainability is predominantly being driven by building regulations (mandatory) and affordability within the public housing sector, with the private housing sector lagging behind. With significant private housing stock, it is surprising there is so little information made available to the home-owner, a fact which is reducing the likelihood of sustainability (and affordability) being the watchword of the majority of UK's homeowners for a very long time.

5.3 North America

The U.S. was slightly slower than the UK to consider sustainability in building. However in 1993 the U.S. Green Building Council [USGBC] was established to work out a system to define and measure 'green buildings'. A committee was formed that developed Leadership in Energy and Environmental Design [LEED®], a sustainability checklist and measurement system. The current Version 2.1 was released in May 2003 (Kirk, 2005). The LEED® rating system is based on proven technology. It evaluates environmental performance from a whole building perspective over a building's life cycle, providing a definitive standard of what constitutes a green building (Kirk, 2005). Canada's LEED® [LEED® BC] is based on the US version 2.1, but there are some differences (USGBC, 2005).

The LEED® for Homes programme has only just been developed, as a voluntary initiative promoting the transformation of the mainstream home building industry towards more sustainable practices. Its aim is to provide a tool for house builders, homeowner, and local government to build environmentally sound, healthy and resource-efficient places to live. A pilot scheme of the LEED® for Homes programme was launched in August 2005. The objective of pilot-testing LEED® for Homes is to ensure that the rating system is practical for application and will become an effective tool for introducing green building practices for a significant portion of the new home building marketplace. The pilot is planned for August 2005 – early 2007.

LEED® for Homes will rate qualified homes at the certified, silver, gold and platinum performance levels, according to categories identified in Table 5.2.

The U.S. also has the Energy Star® Programme which was established by the US Environmental Protection Agency [EPA] in 1992 and has provided an energy efficiency platform for builders of new homes since 1995. This is therefore more established than LEED® in the housing sector. The programme provides information on how to construct homes that are 30% more efficient than homes built to the Model Energy Code (now superseded by the International Energy Conservation Code). Builders can promote Energy Star® qualified homes as energy efficient, comfortable and affordable, 'the only truly affordable home is an energy-efficient one', and supporting the US Department of housing and urban development in its integration of Energy Star® into home energy programmes and other affordable housing efforts. Presently more than 20,000 active homebuilders partner with the EPA in the Energy Star® programme. EPA has set a goal of more than 500,000 Energy Star® qualified homes by 2006 (EPA, 2003).

Table 5.2: A summary of the rating schemes currently available in Australia, North America, United Kingdom and New Zealand

Country	Assessment method overview
Australia	5 Star assesses the energy performance of housing in the following areas: <ul style="list-style-type: none"> • Building fabric (including house orientation, design, insulation, window size and orientation) • Water conservation • All homes must incorporate either a rainwater tank or solar hot water system.
North America	LEED® for Homes assesses the performance of housing in the following areas: <ul style="list-style-type: none"> • Efficient use of energy resources • Efficient use of water resources • Efficient use of building construction • Resources (through improved design, materials selection and utilisation, and construction practices) • Efficient use of land resources • Enhanced indoor environmental quality to safeguard the health of the homes' occupants
United Kingdom	BREEAM Ecohome assesses the performance of housing in the following areas: <ul style="list-style-type: none"> • Management: overall management policy, commissioning site management and procedural issues • Energy use: operational energy and carbon dioxide (CO₂) issues • Health and well-being: indoor and external issues affecting health and well-being • Pollution: air and water pollution issues • Transport: transport-related CO₂ and location-related factors • Land use: greenfield and brownfield sites • Ecology: ecological value conservation and enhancement of the site • Materials: environmental implication of building materials, including life-cycle impacts • Water: consumption and water efficiency
New Zealand	BRANZ Green Homes Scheme assesses the performance of housing in the following areas: <ul style="list-style-type: none"> • Energy use • Sustainable materials • Water economy • Health related issues – indoor pollutants • Waste disposal and recycling • Transport links

There are countless local and regional green homebuilding programmes in North America (USGBC, 2005). A number of these are specifically targeted at affordable housings. A selection of the best programmes are outlined below, these are all taken from the U.S.:

The Enterprise Foundation is working to bring the benefits of green building and sustainable development to affordable housing at a large scale, and believes there is an emerging commitment to that goal across the U.S (Trassos, 2005). The Enterprise Foundation has made a major commitment to making green building more mainstream in affordable housing through its Green Communities™ initiative, the programme has committed more than \$550 million in financing, plus training and technical support, to encourage and enable developers to 'go green' in a cost effective manner.

Green Communities™ intends to build more than 8,500 environmental and healthy homes for low-income families over a five-year period (from 2004). It is envisaged that Green Communities™ will transform the way America thinks about, design and builds affordable communities. The initiative provides grants, financing, tax credit equity, and technical assistance to developers who meet Green Communities™ criteria for affordable housing that promotes health, conserves energy and natural resources, and provides easy access to jobs, schools and services (<http://www.enterprisefoundation.org/resources/green/index.asp>).

One of the partner programmes is the Minnesota Green Communities™, and a Minnesota green affordable housing guide has been made available online. This web-based resource (<http://www.greenhousing.umn.edu/index.html>) has been put together to assist designers, contractors, and housing agencies to integrate sustainability, health, durability, and energy efficiency into cold climate housing. It includes design strategies, decision-making tools, comparative analyses, best practice examples and resources (Regents of the University of Minnesota, 2004).

Evergreen affordability has produced a publication on tools for building sustainable housing (Horton *et al.*, 2004). This publication, produced under the affordable sustainability technical assistance for homes [Home ASTA] of the national centre for appropriate technology, provides technical assistance for incorporating sustainable design into affordable housing.

“Energy efficiency makes homes more affordable” is a Southface Energy Institute technical bulletin for the state of Georgia (1998). This is a practical guide demonstrating why energy efficiency is so important, the financial incentives and ways of improving how small design changes can reap benefits longer term. The pamphlet advocates careful planning, training and quality control during construction and as a technical bulletin is aimed at the builder.

Habitat for Humanity is another organisation that is generating awareness in energy efficient homes as the answer to affordability as well as sustainability. Research they have undertaken looking at the remodeling of existing homes demonstrates that by incorporating proper planning and quality control during remodeling, it is possible to reduce air leakage in the building envelope and duct system, and improved efficiencies of the insulation, water heater, and space conditioning equipment. Habitat for Humanity has lowered energy use in older homes to about the same levels as for new, energy efficient homes. Habitat for Humanity claim the key to success is a systems approach that considers all energy usage, including heating, cooling, hot water, lighting and appliances. *It is also crucial to educate homeowners on how to operate their homes in an energy efficient manner* (Habitat for Humanity, 1996).

The Master Builders Association are also involved in developing programmes to promote sustainability, one example is the Built Green™ ‘Imagine if Everyone Did’ programme, designed to provide builders with a unique opportunity to meet the growing demand for environmentally friendly home building. Built Green™ was developed by the master builders association and is a network of architects, builders, subcontractors, suppliers and real estate agents working together to improve quality of life in King and Snohom’s Counties, by providing quality homes that are cost-effective to own and operate healthy and safe, and protective on the Pacific NorthWest environment. Colorado has a similar Built Green® programme (www.builtgreen.net).

Again the U.S. experience demonstrates the plethora of good intentioned programmes but also the lack of resources going into directly educating the consumer regarding simple sustainability concepts and what can be done in existing homes (as demonstrated by Habitat for Humanity) to make maintenance and running costs significantly cheaper, thus increasing affordability.

5.4 New Zealand

It goes without saying there are significantly less resources available in New Zealand due to the size of the country and its population. However the Building Regulations Association of New Zealand [BRANZ], New Zealand’s resource centre for building excellence has produced detailed literature, consumer guides and toolkits, relating to sustainable design and green homes. The BRANZ Green Home Scheme is a method of eco-assessing New Zealand’s domestic building designs. It is a domestic building environmental auditing tool that has been operating in New Zealand since late 1997. The scheme offers new homeowners, designers, architects and developers a means by which key environmental issues can be examined, using a rating system, similar to BREEAM (see Table 5.2).

A review of the BRANZ Green Home Scheme was undertaken in 2004. Jaques (2004) determined that in terms of the technical aspects, Green Home Scheme as an assessment tools is working well, specifically on the issues addressed, the information provided assisting designers to introduce eco-principles into the design process; and the eco-representativeness or environmental accuracy of the assessment procedure. In terms of the operational aspects, the things that worked well were accessing BRANZ support, its usefulness, and the fact that it was produced as hardcopy. However the two operational aspects respondents did not think worked well were a *very marked lack of publicity and a lack of ‘buy-in’ from the industry and public in general*. The UK, U.S. and New Zealand, the same story!

There is consumer literature made available to the homeowner, and comparatively more than in the UK and US, possibly responding to the higher proportion of self-build. The BRANZ brochure “What is Sustainable Design” (2005), provides consumers with an overview of how to ensure they get the best from their home by considering sustainability in the design process. They stress the fact that sustainable design solutions benefit both the occupant/end user and the environment. They demonstrate simple choices including orientating the house for sun, energy efficient lighting in high use areas, low flush toilets and efficient showerheads, compost bins, and recycling plastics, paper and glass. This is an entry-level brochure to capture interest and draw the consumer in with suggestions of up to 70% savings in heating energy by harnessing the sun’s rays through housing orientation and up to 40% savings in lighting costs by using energy efficient lighting in high use areas.

The Energy Efficiency and Conservation Authority have published a working manual on “Design for the Sun, Residential Design Guidelines for New Zealand” (1994). They also provide consumers with general energy efficiency information. As a lot of housing is timber frame, Friends of the Earth have published “The New Zealand Good Wood Guide” (1999) to ensure sustainable choices are made. The New Zealand institute of architects [NZIA] produces a series of environmental position papers, which overview sustainability issues relating to buildings (BRANZ, 2005).

The city councils also provide consumer literature. Waitakere City Council provides consumers with useful information on sustainability and housing. One example is their “Eco-friendly House guidelines” (Waitakere City Council, 2005) which encourages the consumer to save money, build a healthier house and reduce impact on the environment by

considering design, materials, water, energy, health, ecology and safety decisions. It would appear the onus is on the individual consumer to find out any information they may need to live sustainably.

6. LESSONS LEARNT

The UK, Canada, U.S. and New Zealand are more advanced in their approach to sustainable, affordable housing because of a number of reasons:

- More stringent building regulations;
- More established ratings systems (they started the journey sooner);
- A greater proportion of public or supported housing schemes and mixed housing schemes, driven by affordability;
- Sustainability driven by energy efficiency; and
- Significant financial investment in initiatives and schemes.

The problems that these countries have encountered in their move towards sustainable, affordable housing appear to be shared too, namely:

- Slower to build sustainable affordable housing compared with commercial building;
- A plethora of information, not always consistent;
- Often too many organisations replicating work; and most importantly of all
- No focus on the consumer.

If looking at sustainable, affordable housing information in these countries has shown anything, it is the need to educate the consumer. Unless the consumer understands that e.g. by operating their homes in an energy efficient manner, they will both benefit themselves (by saving money) and the environment; they are not going to seek out energy efficient home.

One way of doing this may be in the provision of green mortgages at preferential interest rates, for those willing to invest in new (or refurbished) 4 or 5 Star homes. In Australia, with the Bendigo Bank, Maleny Credit Union and Green Home Loan Company offering preferential interest rates to those customers investing in houses rated 4 or 5 Stars (Harper, 2003), this may provide a catalyst for change. The advantage over some other countries whose mortgage lenders offer green mortgages is that these Australian banks are actually offering a reduced interest rate as opposed to the promise of contributions to charities that support the environment (e.g. reforestation schemes) or offer to monitor energy use. This approach does not support the ethos of sustainable, affordable housing, but relies on altruistic and informed consumer practice.

7. CONCLUSIONS

Sustainable, affordable housing by definition, must meet multiple goals. In order to be affordable, it must be designed in such a way that the value to the consumer in its performance outweighs its financial cost. Energy efficiency is of paramount importance because low operating costs make houses more affordable over their lifespan. However housing cannot be made more efficient at the expense of occupant health. Therefore indoor air quality must be considered in the design through ventilation design, construction systems, and materials selection.

Durability and low maintenance are critical issues as well, long lasting systems and materials are more affordable in the long run. Sustainable and affordable housing also means selecting systems and materials with the least lifetime impact on the environment. Housing must be well designed so it adds value to the community and makes the individual home owner want to stay and improve their property. Energy and water costs are commonly the largest single housing expense after food and mortgage repayments for low-middle income families. Often, utility costs are an overlooked component of housing costs (U.S. Dept. Housing and Urban Development, 2004).

Purchasing a home is the most expensive and thus the most important economic decision made by the majority of individuals. With such a crucial decision, the amount of information on the affordability of that purchase, not only the purchase price but also the impact choices may have on running costs and on the environment, is significantly deficient. Whilst the cost of housing is traditionally measured as a one-off capital cost at the time of purchase, it is recognised that the financial burden of owning a home is dynamic and fluctuates over time. However this 'cost' is seldom qualified. The choice to purchase a home built to meet sustainable measures will result in reduced energy and water consumption over time, resulting in reduced 'cost' both financially and to the environment.

It has long been contended that running costs (operating and maintenance) should be considered in the decision to purchase a home, however appropriate data is not readily accessible and customers rarely consider the impact their initial decisions will have further down the line.

To properly consider the affordability of a sustainable or green home requires a life cycle costing approach that assesses not only the initial design and construction costs, but also the operational and maintenance costs over the life of a building. It may cost a little more to design and construct a home that is highly energy efficient, but the annual operational savings from lower utility costs should also be considered when analysing the economics or financial viability of a house-building project (Goldstein and Rosenblum, 2003).

It is important to recognise that the affordability of an entry-level housing project must be considered from multiple perspectives. Developers of a project, with a very short ownership horizon, are usually not concerned with longer-term operational savings (except the meeting of mandatory requirements), or unless the value of such savings can be reflected in the selling price (by inflating the capital cost). In contrast, operational savings should be important to developers with a long-term ownership interest and other e.g. public housing authorities and community developments. Unfortunately given the relative newness of mainstream sustainable housing, such value has generally not been reflected in the market. As a result the economic benefits of green housing have largely been ignored by project financiers in their assessment of lending and investment opportunities in affordable housing.

Also, all too often, banks and other financing organisations focus on 'first costs', i.e. the initial capital costs required for design and construction, although there are moves in Australia to counter act this with three banks offering preferential mortgage rates to 4 and 5 Star home owners.

8. RECOMMENDATIONS

The aim of this review of current practice and guidance was to look at the situation in Australia and experiences of other countries adopting sustainable housing programmes, and to recommend a way forward.

It is suggested that there is the need for both a top down and a bottom up approach; sustainable, affordable housing will only be driven by the government and the consumer, not the market. The onus is on the government and other regulatory authorities to provide a consistent message, and one that educates the consumer of the benefits (both financial and environmental) of purchasing a 5 Star home; how environ or energy literate is the modern house-buyer is depends on this.

As the market will not drive sustainability, there is a need to educate the consumer to actually demand sustainability from their homes, and this will only happen if they are given reliable, up-to-date information. Australians need to know that sustainable housing project can be financially viable, energy and water efficient, while at the same time providing them with significant improvements in comfort and health. They also need to understand that 5 star is in many ways a starting point, and that they can strive for further sustainability and thus even more affordable homes. The "5 Star Houses Are Better Houses" goes some way to meet this need, but there needs to be independent, authoritative advice given if consumers are going to believe it is in their own and best interest to consider purchasing or renovating a home to meet sustainability criteria.

It is time to provide accurate financial data to demonstrate this. The next stage of this project is to calculate through life costs for typical entry-level homes currently being built to 5 Star standards and demonstrate the true cost of owning a sustainable home, comparing its affordability with other existing entry-level homes.

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