SUBMISSION TO THE STATE SUSTAINABILITY STRATEGY

ON

THE RESIDENTIAL HOUSING SECTOR

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Preamble

The residential housing sector is a key component in the development of a sustainable urban form that minimises its use of resources and waste output, as well as promoting sustainable communities in terms of employment, equity of access, affordability and social interactions.

In considering sustainable housing, the following factors have been identified as being the most influential and have guided the preparation of this paper:

- Urban form
- Housing design
- Housing Construction
- Housing Consumption
- Household perceptions and expectations

Of these factors, urban form is considered to be by far the most important. Without sustainable urban form, sustainable housing is problematic. For example, lot orientation and street layout affect the degree to which a dwelling takes advantage of solar passive design principles. Urban form also determines factors such as the availability of transport options and proximity to services and employment.

The issue of sustainability in urban form is a topic in itself and has been well covered in other reports and publications. For that reason, this paper will not be addressing urban form in any detail and will instead be concentrating on the other four areas of influence. Nevertheless, it is strongly acknowledged that urban form is critical to a sustainable housing sector and this paper should be read in conjunction with these other publications.

Sustainability has emerged in the past decade as a key principle guiding human interaction with the natural environment. It is acknowledged as a major theme, influencing all aspects of the housing sector, ensuring the integration of environmental, social and economic goals.

Much of the focus nationally has been on environmental sustainability with very limited consideration of the social or economic sustainability of housing or the urban form. This is reflected in the fact that there are no discrete portfolios at national level dealing with housing or with fundamental aspects of how we live[1].

[1] National responsibility for housing sits within the broader portfolio of Commonwealth Department of Family and Community Services. DFACS has responsibility for administering the CSHA and Commonwealth Rent Assistance.

1. INTRODUCTION

This paper is a submission to the State Sustainability Strategy on the residential housing sector of Western Australia.

The submission is based on work currently being undertaken by the Office of Policy and Planning, Department of Housing and Works in the preparation of the State Housing Strategy. This work will result in the publication of a Sustainability Issues Paper; one of a series of issues papers covering the five themes adopted by the Strategy – Sustainability, Affordability, Access and Equity, Tenure and Location.

To assist in the development of the Sustainability Issues Paper, a reference group was established comprising representatives of organisations with a broad interest across the housing continuum and sustainability. A list of the membership of this group is at Attachment 1.

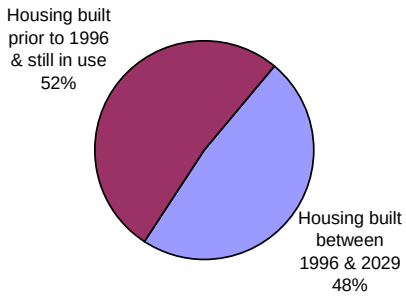
1.1 Why is sustainability of housing important?

Housing has consequences for sustainability in the following ways:

- Because the way we construct our homes has a major bearing on the use of resources such as energy and water, housing form is important.
- Building homes, and living in them, result in significant emissions of greenhouse gases.
- The residential construction industry is a large consumer of natural resources.
- Construction and demolition waste is the largest contributor to the waste stream going to landfill.
- Housing design and the materials used in construction have a major influence on the liveability, thermal comfort, safety, health and quality of life of its occupants.
- The location of housing has impacts on transport and employment opportunities.
- Housing has an important psychological and cultural importance in terms of concepts such as ‘home’, ‘shelter’ and as a store of wealth.
- Housing is a long term investment and once built, can influence the sustainability or otherwise of the urban form for many years.

The 1997 State Planning Strategy projected that 52 percent of the housing stock constructed before 1996 would still be in use in 2029. This highlights the long-term nature of housing investment and the need to focus on both the established and new housing sectors in discussing housing sustainability. This approach will assist in identifying unsustainable aspects of the current housing system that can provide important lessons for the future.

Figure 1 – Projected Housing Stock in 2029
Source: State Planning Strategy



1.2 What is sustainable housing?

The Western Australian Government has adopted the following definition of sustainability:

"Sustainability is the simultaneous achievement of environmental, economic and social goals."

Sustainable housing aims to balance these simultaneous goals, in order to meet the needs of present and future generations. It is housing that:

- Minimises the use of energy and resources, throughout the life cycle of the building
- Minimises waste products and maximises recycling and reuse of materials
- Has easy access to services and amenities
- Provides reasonable levels of privacy and security
- Is accessible to people from a diversity of backgrounds and abilities
- Is affordable
- Assists the financial viability and competitiveness of the industry
- Assists in the strengthening of communities

1.3 How is housing delivered in Western Australia?

It is important to put the delivery of housing in Western Australia in a context as it potentially has a major influence on sustainability. Housing provision has been very much a product of market demands and a number of statutory requirements across a range of Government portfolios including local government.

Housing sits at the end of a fragmented supply chain that is heavily influenced by the:
- planning system,
- land development and building industries
- finance and marketing sectors

Therefore housing provision remains predominantly one of individual choice, location and cost.

In addition to consumer preference, the nature and form of housing is controlled by a range of statutory instruments of State and local government with various taxes and charges levied on transactions for both new and established housing.

The State provides public housing (5% of the State's housing stock) for those in greatest need in the community and provides funding support for the development of the community housing sector

1.4 Key Features of Western Australia's housing sector

- As at June 1996, there were 698,000 dwellings in WA of which 534,000 (76.5%) were single detached houses, 83,400 (11.9%) were semi-detached and 50,400 (7.2%) were flats.
- 60% of the existing housing stock was constructed in the last 30 years.
- Double brick and tile is the dominant form of construction (76%), compared with the national average of 30%.
- 70% of households either fully own their home (38%) or are purchasing (32%). 22% of households are in private rental with the remainder in public (5%) or other tenures.

- 48% of total households consist of singles or couple without dependants.
- In 1999, 45% or 320,000 homes in WA had two or more spare bedrooms, while 3% (approximately 20,000) of households had an unmet need for 1 or more bedrooms.
- The Perth Metropolitan Area has 72% of the State's population and housing stock.
- Of the remainder, 75% live in urban centres (>1000) and localities (>250)
- More than half of new dwellings in Perth are built in the outer suburbs.
- 45% of the dwellings approved in the Perth Metro area in recent years were in the inner and middle ring suburbs.
- In 1999, there were 43,000 sales of established dwellings in WA with a turnover value exceeding $10 billion.
- Transfer payments on property transactions in WA represent more than 25% of State taxation revenue.

1.4 What are the influences on housing sustainability?

1.4.1 Urban Form

Urban form is the main factor influencing the sustainability of housing. A house may meet all environmental criteria in terms of solar orientation, energy efficiency, and waste and water recycling. However it is unlikely to be truly sustainable if its location and placement does not provide appropriate access to employment opportunities, services and transport options, or provide for opportunities for social and cultural interaction within the community.

The urban form is affected by factors such as the regulatory planning framework, government policy, market forces and cultural values and expectations. These factors can act as barriers to increased sustainability. For example, the range of planning policies at state and local government level has resulted in significant differences in the application of codes and regulations. This can make it difficult for a developer or builder attempting to incorporate sustainable features into a development.

Urban form in Western Australia is predominantly characterised by low density, dispersed suburbs. This is particularly the case in Perth where urban development has spread largely north and south along the coastline. A number of problems have been identified with this type of urban form including:

- A high dependency of the populace on car travel with its attendant costs to the community due to pollution, health impacts, high fossil fuel use and destruction of environment (eg. to build roads).
- Loss of quality agricultural and bush land to development.
- The increasing costs to the community of providing infrastructure to development on the urban fringes.
- The loss of opportunities for improved efficiency in the provision of services such as water, energy and public transport through more compact urban development.
- The development of a separation between the location of dwellings and employment opportunities.
- Social isolation, particularly for those who do not have access to a car.

The legacy of planning policies and land development practices over the past decades has contributed to this unsustainable urban form. Many of Perth's suburbs for example are based on a curvilinear system of streets that do not support the solar orientation of lots or ease of pedestrian movement. Suburbs are also not well integrated with transport options and services and do not lend themselves to redevelopment in the same way as grid pattern neighbourhoods with rectangular blocks.

A number of reviews of planning policies are currently underway, in part as a response to the sustainability agenda. This includes reviews of the Western Australian Residential Planning Codes and METROPLAN (known as Future Perth). There is also encouraging evidence that sustainability principles are beginning to influence both infill redevelopment and the development of greenfield sites. For example, the *Liveable Neighbourhoods Community Design Code* is influential in the design of the Brighton subdivision in the City of Wanneroo, Mont Clair Rise in Dianella and Coolamon Village in Ellenbrook. The principles of *Liveable Neighbourhoods* are also being applied in the revitalisation of Gosnells, Midland and Armadale.[2] GreenSmart principles will guide the new development at Atwell South, 25km south of Perth.

The State Infill Sewerage Program, commenced in 1994, is also providing the impetus for significant infill and redevelopment across urban centres in Western Australia.

1.4.2 Housing Design

Design is a very important influence on the sustainability of housing. The incorporation of solar passive principles into housing design can minimise the need for energy for space heating and cooling, leading to savings in both operational energy costs and greenhouse gas emissions. Other design features can enhance the capacity of the disabled to live independently in their homes, or increase the security of the home for its occupants.

Initiatives in sustainable design have been slow to be adopted in Western Australia. The predominance of project home builders constructing standard 'off the plan' project homes constrains opportunities to take account of climate or solar orientation, energy/water efficiency or the environmental impact of housing. Climate-sensitive design has been mainly offered through a limited number of individual architects. Some demonstration projects have also been undertaken by agencies such as the Department of Housing and Works in partnership with universities and industry[3].

The drive to incorporate sustainability in housing design in WA is supported by programs run by government (eg. Australian Greenhouse Office's 'Your Home' design manual and the Sustainable Energy Development Office's Community Program) and industry (the Housing Industry Association's GreenSmart program and the MBA's Housing for Life).

One aspect that is not addressed by these housing design initiatives is consideration of cultural diversity and the appropriateness of housing. This is nevertheless an important facet in the sustainability of indigenous communities, particularly in rural and remote areas of the State. Design in this context needs to go beyond the obvious requirements to address differences in climate, to also incorporate the cultural requirements of these communities and to support healthy living practices. This should also be considered in relation to indigenous people and large migrant families living in urban centres across WA.

1.4.3 Housing Construction

Housing construction impacts on environmental sustainability in terms of its use of energy, water and raw materials. There are also associated impacts on the environment in terms of land clearance, loss of biodiversity and greenhouse gas emissions.

The choice of building materials can have an influence on the thermal properties of a dwelling, determine the level of its embodied energy, and affect the health of its occupants.

[2] Rebecca Armstrong & Glen Head, 'Liveable Neighbourhoods, Guiding New Developments for a More Sustainable Urban Future', Sustainability Case Study

[3] Low Allergen Homes Project (Ellenbrook), Grey Water reuse trial (Palmyra), Energy Efficient House (Stratton).

It can also affect the affordability of a dwelling, an important aspect when considering the capacity for people within the community to access sustainable housing.

The housing construction industry is also a significant contributor to the State economy.

- Average investment in new housing over the past 10 years was approximately $1.8 billion per annum, representing an average of 18,500 new dwellings each year.
- In Perth, 35-40 new dwellings commence every day with, at any one time, as many as 6-7,000 dwellings under construction[4].
- This supports approximately 120,000 housing related jobs in Western Australia.
- An unpublished statement from the HIA suggests for every $1 spent directly on housing there is a further $1.40 spent elsewhere in the economy[5].

Housing is an important component of regional economies. The stability of a regional housing industry provides both continuity of local employment and affordability as local contractors do not incur the same set up costs as remote builders.

1.4.4 Housing Consumption

The physical and psychological consumption of housing affects the sustainability of the housing sector.

Since the 1970s, there has been a progressive decline in the proportion of first home buyers constructing first homes, with the majority (80%) preferring to purchase in the established housing market. The motivations are unclear, however affordability, accessibility and location are all indicated as influencing factors[6].

New construction is therefore heavily dependent on 'trade up buyers' who generally have more capital than first home buyers and can therefore afford to build better quality, larger homes.

In the 15 years from 1985 to 2000, the average floor area of new houses in WA increased by 22% from 188m^2 to 230m^2. The industry standard for single detached dwellings is now also the 4X2' (four bedroom, two bathroom dwelling) to the extent that it now represents 32% of the total dwelling stock in Western Australia, or 40% of all single residential dwellings. This compares with a national average of 23%.[7]

The increase in dwelling size and number of bedrooms is despite a decrease in the average household size. Between 1971-1996, average persons per dwelling fell from 3.68 to 2.8. This suggests the influence of changing lifestyles as additional bedrooms become used for study and hobby rooms, and home offices.

Smaller lot sizes and changes in building regulations such as zero boundary set backs have resulted in a preference for European style housing such as Tuscan and Mediterranean design in recent years. This form of housing is devoid of eaves, overhangs and verandahs, features that are considered desirable in climate sensible design. Such housing is also often two-storey, making them less accessible to a proportion of the population.

[4] Housing Strategy, Housing Sector Paper, November 2000, p11
[5] Housing Strategy, Housing Sector Paper, November 2000, p14
[6] Housing Strategy, Housing Sector Paper
[7] Housing Strategy, Existing Housing Stock Paper

These factors have contributed to an increase in energy demand for space heating and cooling. On average, an Australian home now consumes four times more energy than homes built a few decades ago[8].

Planning and development practices imposed by local governments or developers, such as the use of restrictive covenants specifying minimum house size or material selection influences consumption and therefore sustainability. This can effectively exclude parts of the population as it dictates a minimum level of investment at the expense of affordability.

1.4.5 Household Perceptions/Expectations

One influence that should not be overlooked is that of perceptions and expectations about housing. An appreciation of this factor can assist in an understanding of why certain types of housing form predominate, and can also inform strategies and education campaigns to increase the market preference for 'sustainable' housing.

In October 1998, the Australian Bureau of Statistics conducted the *Survey of Housing Motivations and Intentions*. The survey found in relation to Western Australia that:

- At the time of the survey, 79.8% of all households in private dwellings were living in a 'separate house' while 13% were in 'semi-detached/terrace houses'.
- Despite the recent trend towards smaller lot developments in Perth in recent years, the survey revealed that when selecting their next dwelling, the majority of people still expressed a preference for a 'separate house', 'larger residence' and 'larger block'[9]
- 81.6% of households intending to move within the next three years would prefer to live in a 'separate house' while 8.6% would prefer a 'semi-detached or terrace house' and 6.8% a 'flat, unit or apartment'.

These findings indicate that there is still a strong preference for single detached dwellings despite the move to increased housing density in Perth[10].

Encouragingly, there is an increasing awareness of energy efficiency. Of households intending to move to a new dwelling, 51.1% claimed that energy efficiency features will be factors affecting their choice of dwelling. This is in contrast with the choice of current dwellings where energy efficiency features were sought by only 14.3% of households. The most common energy efficiency features sought in future dwellings are 'natural gas access' (27.4%), 'solar hot water system' (26.0%), 'insulation' (5.3%) and a 'northern aspect' (4.4%).

As noted, one factor contributing to an increase in the average floor area of new housing is the predominance of the '4X2'. Interestingly, it is claimed to be an industry standard based on the belief that this is the 'preferred' housing type by buyers and consumers. It can be conjectured whether this is the case or to what degree the promotion of this type of housing by the industry, over other forms of housing, is influencing the market.

Another factor of note is the degree to which expectation and 'wants' can influence the housing industry. Rising aspirations combined with successful marketing of 'lifestyle' have resulted in households wanting to buy the best they can afford, rather than gradually upgrading as circumstances and incomes improved.

This has consequences for sustainability. The price of housing may be affected as people are prepared to pay for 'bigger and better housing' as a reflection of what is considered

[8] 'Energy Efficient housing design' www.abc.net.au/7.30/stories/s115196.htm
[9] (Future Perth, p46).
[10] For example, a survey of building approvals by the ABS found that nearly one quarter of new dwellings approved were medium density developments. Refer 1367.5 Western Australian Statistical Indicators, December Quarter 2001

desirable and socially acceptable housing. In turn, this can impact on the affordability of housing, thereby affecting those on low incomes[11]. To what degree rising aspirations and expectations may be contributing to debt over-commitment, housing stress and family breakdown also bears further understanding.

1.5 Other considerations for sustainability

1.5.1 Affordability

- Growth in property values particularly in Perth and falls in real incomes particularly for those in the lower two income quintiles has presented barriers to entry into home ownership.
- The Department for Planning and Infrastructure believes that the rapidly increasing price of land is the main cause of increases in housing costs. Between 1990 and 1998, land costs in Perth rose faster than established house prices, rising at 48.3% compared to 37.8% for the latter. Building material prices increased by 12% over the same period.
- The December 2001, median property prices across various centres in WA were:
    - Perth $171,800 (house) $128,300 (unit)
    - Mandurah $142,000
    - Bunbury $137,000
    - Albany $151,600
    - Kalgoorlie $141,000
    - Geraldton $119,000
    - Port Hedland $175,800
- A household on the median income of $972 per week (Dec. 2001) could borrow around $140,000 on a 25-year loan at a nominal 8.0% interest rate.
- A person on the award wage would only qualify for a loan of around $65,000
- Some 35% of households in the lowest 40% of the income distribution pay more than 25% of income to meet their housing costs.
- Low cost rental stock fell by 20% in Perth and 67% in the rest of the State between 1986 and 1996. Overall rental stock increased by 32.5% (Perth 44%).
- Real weekly rents in the lowest quartile rose by 10.7% compared with a 2.1% increase for the highest quartile. In non-metropolitan areas of Western Australia, the respective increases were 151.3% and 30.4%.
- Public housing has been increasingly targeted at people with high housing needs, needs that cannot be met by the private rental market. This has meant that households with a simple affordability problem have had to access housing in the private rental market.
- Funding for public housing has declined by 20% in real terms in the past decade.

1.5.2 Home Ownership

- Emerging evidence of a decline in home purchase rates among younger cohorts of the population.
- If the ownership rate declined progressively to 60% over the next 30 years, by 2030 the majority of housing being built will be for the rental sector.

1.5.3 Access and Equity

- Some 19% of the WA population has a disability – this figure is expected to increase to 30% by 2021 as the population ages.
- 13% of indigenous households in WA live in overcrowded accommodation.

[11] Andrew Burbidge, 'Housing and Families: Towards an Alternative View', presentation to a seminar at the Australian Institute of Family Studies, 19 October 2000

2 KEY ISSUES AND IMPORTANT QUESTIONS

2.1 Sustainability of Existing Housing Stock

The Western Australian housing stock at June 2000 was estimated to be around 780,000. Sixty percent of this stock was constructed in the past 30 years, coinciding with the emergence of the project home market promoting a range of standard designs. As previously noted, these designs have taken little account of environmental or social sustainability issues.

On average, 18,000 new dwellings are added to WA's housing stock per annum. This represents an annual addition of only 2.25%. Most homebuyers will only ever buy an established property in their lifetime. The existing housing market has a far greater influence on the sustainability of the sector than new housing.

Therefore, it is very important that strategies aimed at increasing sustainability do not concentrate on new housing only. Strategies that encourage the retrofitting of existing homes are needed. The promotion of renewable energy technologies such as solar hot water and photovoltaic systems would also assist in lessening the demand for energy from the power grid.

Such strategies can also assist the sustainability of the industry. Official figures indicate that the alterations, additions and renovations market represents 10% of the value of the new housing sector although it is known to be substantially higher. Encouraging the retrofitting of existing homes to make them more sustainable would ensure ongoing work, thereby assisting to soften the effects of economic cyclical swings on the industry.

Questions

- How can government and industry encourage the implementation of environmental sustainability into existing homes?
- What are the potential economic gains from encouraging increased sustainability in housing?
- Is it desirable for government to implement strategies that address the under-utilisation of housing capacity?
- What are the future implications for sustainability of the under-utilisation of housing space

2.2 Urban form

Sustainable housing is reliant on a sustainable urban form. Large parts of urban areas in Western Australia are unsustainable in terms of solar orientation, ease of movement for residents, access to local employment and services, and the efficient provision of transport links and infrastructure.

Changing the existing urban form will be very difficult. Apart from the enormous expense involved in terms of amending infrastructure, street design, and resumption and rezoning of land use, it is also socially and economically disruptive for communities and businesses.

A recent example from Perth's northern suburbs illustrates this point. The suburbs of Woodvale, Kingsley, Greenwood and Warwick are typical of the type of unsustainable urban form of recent decades, characterised by low density, single dwellings, and a street layout

based on a hierarchical, curvilinear system ending in cul de sacs. However, a development proposal by the City of Joondalup that would have introduced more sustainable urban features into these suburbs (such as mixed density and better connection between streets) was met with fierce local resistance, based on a fear that this would destroy the character of these suburbs. This resulted in the backdown of the City of Joondalup and the abandonment of the development proposal.

Such responses present a major challenge to State and local government. The sheer scale and ecological impact of the existing unsustainable urban form represents a burden on current and future generations. Modification of the urban form will have numerous environmental, social and economic benefits to the community. The lesson from Joondalup is that these benefits need to be clearly and comprehensively explained and promoted, and that the community needs to be closely involved in the process so that they have a sense of ownership and control.

It is also critical that new developments and redevelopment of existing suburbs not replicate the mistakes of the past and incorporate sustainable principles from the start. While there are many encouraging examples where such principles are being incorporated into greenfield and redevelopment projects, this is not yet standard. The predominant type of development continues to be greenfield subdivisions on the urban fringe that are often not well integrated with transport, services or employment.

Consideration may need to be given to strategies to address the apparent mismatch or distribution of housing capacity demonstrated by the high level of excess bedrooms given the demographic changes occurring in the community.

Questions

- What is the role of local government in promoting the principles of sustainability in urban form within their communities and encouraging ownership of the process of change?
- What can the state government do to assist this process?
- What can the state government, local government and industry do to ensure greenfield development and redevelopment of suburbs incorporate sustainability principles?

2.3 Promotion of Sustainability

Anecdotal evidence from developers and sales agents indicate a lack of understanding by homebuyers of the benefits of sustainable features in housing. This discourages the industry from embracing sustainability for fear that such housing will not sell well.

This is in part the consequence of rising living standards. People expect thermal comfort and are conditioned to believe this can only be achieved with the assistance of air-conditioning and heaters. A house with these features is also favourably viewed when reselling, further enhancing the desirability for the implementation of these features.

These perceptions even influence the promotion of energy efficiency. For example, reverse cycle air conditioners are promoted to homeowners as being more energy efficient for heating in winter. While this may be the case, it shows how strategies have had to be targeted towards moderating people's use of energy for thermal comfort, rather than alternatives such as home modifications that would minimise the need for heating and cooling.

This lack of understanding of the benefits of sustainability extends to developers, builders and real estate agents. To some degree, this is being addressed through the HIA's GreenSmart environmental training program aimed at professionals in the building and construction industry. Such a program could be supported and extended to include all professionals (eg. real estate agents) and businesses working within the housing sector.

The challenge is to change these perceptions around and make sustainability a 'desirable' feature of housing, and therefore more marketable; e.g. by encouraging strategies that increases awareness and understanding of how these features assist thermal comfort, and provide substantial energy savings to the householder.

Questions

- How can sustainability be made 'desirable' to homebuyers?
- How can sustainability be incorporated as a key consideration for developers, builders and real estate agents when designing, developing and selling houses and land?

2.4 Sustainability 'costs' for housing

There is a perception that incorporating sustainability into housing involves higher costs in terms of construction and materials, which in turn impacts on affordability. Because of intense competition in the housing industry to minimise costs, this can act as a barrier to a more general acceptance of sustainability in the industry.

There has in fact been very little research done in terms of the real costs of more sustainable housing. Such research may well help to explode the 'myth' of much higher initial capital costs. There is little reason to assume for example, that ensuring a dwelling is correctly solar orientated on a block should add substantially to building costs yet doing so can have major sustainability benefits in terms of energy efficiency and reduced greenhouse gas emissions.

At present, homebuyers rarely specify 'environmentally friendly' or 'sustainable' features when buying or building, largely it is suspected due to a lack of knowledge about the potential benefits and contrary to the findings of the 1998 Survey of Motivations and Intentions. This can be overcome through the use of educational and marketing campaigns, especially in conjunction with the implementation of a voluntary or compulsory ratings system. Ironically, making sustainability desirable to homebuyers is potentially more likely to impact on affordability, particularly in the short to medium term, as the interaction of supply and demand could lead to these homes commanding higher prices.

Questions

- What are the real costs of incorporating sustainability into homes?
- How will these impact on affordability?
- What strategies can be implemented to address either the perception or the reality of higher costs?

2.5 Voluntary vs mandatory regulations

There is an increasing trend for mandatory standards relating to energy efficiency and sustainability to be legislated. Examples include:

- The incorporation of mandatory national minimum energy efficiency standards into the Building Code of Australia
- The mandatory requirement for new dwellings in Victoria, the ACT and South Australia to have a minimum star rating before receiving planning approval.
- The inclusion of generic guidelines regarding solar access and stormwater retention in the review of the R Codes.

Considerable thought needs to be given as to which approach better supports the move to sustainability in the housing sector. There are arguments for both positions. Experience has shown in the past that implementing legislation that enforces compliance with a set of mandatory requirements can help to overcome market inertia and precipitate cultural change. For example, the introduction of a mandatory requirement for all car occupants to wear seat belts in 1971, resulted in industry compliance (the fitting of seat belts in all cars) and behavioural acceptance (most people now do not question the benefit of wearing seat belts).

An approach based on voluntary regulations supported by educational campaigns, incentives and recognition (eg. through sponsorship of a major award) can also be effective as in the case of the ratings system in Victoria when it was first introduced.

A danger of the current moves to mandatory regulations is the piecemeal development of a framework of legislation at national, state and local level. Potentially, these pieces of legislation could be contradictory to each other. It also adds a further layer to an already complex planning regulatory environment.

The Housing Industry Association is concerned that compliance with these multiple acts could result in additional costs being imposed on the industry, thereby affecting affordability. As a consequence, they are advocating the development of nationally consistent guidelines, preferably through an instrument such as the Building Code of Australia.

Care should also be exercised to ensure that legislation is not so prescriptive as to prevent flexibility and innovation in the implementation of sustainability. It is not possible to entirely predict the type of technologies or building materials that may become available in the future that would assist sustainability in the housing sector. Further, industry requires the flexibility to implement the most cost effective option.

Key Questions

- Should sustainability in housing be a mandatory or voluntary requirement? Which approach is more likely to achieve industry and cultural change and acceptance?

2.6 Rating systems

Current rating systems are limited in their application to sustainability in housing by their emphasis on energy efficiency. There are however difficulties in developing a more comprehensive system, that is still simple, practical and unambiguous to use. Further, such systems are only concerned with the physical building itself. They do not rate elements such as affordability, accessibility, location or safety. Nevertheless, they can have a real impact on sustainability by making a star rating a desirable feature for those building or buying a house.

To date, no rating system for housing has been officially adopted in Western Australia, although a number of accredited house energy assessors use the FirstRate House Energy

Rating Software to assess housing designs. This software is also being promoted to industry by the Sustainable Energy Development Office.

The adoption of any ratings system must ensure it takes account of the range of climatic conditions in Western Australia, from temperate in the south to tropical in the north. While rating systems such as FirstRate and the Nationwide House Energy Rating Scheme (natHERS) incorporate a number of climate zones in their assessment, they do not as yet include zones for the tropical/north west zones.

Key Questions

- How can a rating system be best used to promote sustainable housing?
- Should it be a mandatory or voluntary requirement to have a house rated?
- Should a national rating system (eg. NABERS) be used or should a WA specific system be developed?
- Without a rating system, can new stock be truly sustainable?

3 POLICY OPTIONS AND RECOMMENDATIONS

3.1 Promoting Sustainability

Government

- The appropriate inclusion of sustainability principles in the Government's decision-making processes for urban development and housing.
- Ensure triple bottom line accounting is a standard reporting requirement for all government agencies involved in urban development and housing.
- Support the implementation of an approved rating system, appropriate to WA conditions, for all new construction and existing homes being sold. Preferably, this should not initially be mandatory but promoted via agencies such as SEDO and the HIA's GreenSmart program. The starting point could be the requirement to have all project home standard designs rated to a minimum standard (eg. 4 star rating). The rating system could be supported with a recognition program (eg. state sponsored award).
- Investigate and implement financial and taxation measures that can help to offset the additional 'sustainability' costs
- Government agencies (Department of Housing and Works, LandCorp) could be used to demonstrate best practice in the implementation of sustainability within the housing sector. For example, a Keystart loan product with a lower interest rate should be developed that encourages sustainability features such as energy efficiency.
- Well-located surplus government sites should be used as demonstration projects for sustainable housing.
- Sustainability should be given more focus in all land development, redevelopment and construction programs carried out by government agencies.

Industry

Significant progress in sustainability within the housing sector cannot occur without the support of industry. Governments can set the framework, however industry must take the lead.

- Government should work closely with industry to raise levels of awareness about sustainability issues (through joint sponsorship of seminars, awards, competitions, programs).
- Support education and training programs aimed at all stakeholders, such as builders, developers, architects, real estate agents, contractors, small business owners, government employees, to assist a cultural shift to sustainability.
- Industry should liaise with financial institutions to ensure more widespread availability of 'sustainability' housing loan products. These loans can be modelled on the HIA's GreenSmart Home Loan and Bendigo Bank's discounted personal 'Green Loans'.[12]
- Support the development of a rating system suitable to WA and assist in its promotion through voluntary rating of all project home plans.

[12] Bendigo Bank's Green Loans assist customers to purchase "environmentally friendly products" such as solar hot water systems, insulation, water tanks, greywater treatment systems and renewable energy systems. It is also in the process of developing a green home loan product.

3.2 Existing Housing Stock

- State and local government needs to instigate community consultation strategies to promote and raise awareness of the benefits of retrofitting the urban form to make it more sustainable.
- Instruments should be developed that encourage the retrofitting of existing houses to make them more sustainable. For example, the application of a rating system to existing houses being placed on the market can help to promote sustainability as a selling point. In conjunction with educational/promotional campaigns, this can help to make these features more desirable. A rating system or some other assessment measure of sustainability also needs to be applied to all approvals for additions or alterations.
- Financial incentives are important. Government grants or low interest loans for householders to implement environmentally sustainable features such as renewable energy technology or insulation can be effective and should be more widely promoted and supported.
- Government can assist by sponsoring design competitions and major housing awards to promote the 'sustainable' renovation of houses.

3.3 Planning and Development Framework

- All building and planning codes should be reviewed to ensure that they support sustainability:
  - Where possible, these codes should be performance based in order to permit innovation in design and materials, and to allow for any technological advances not anticipated by these codes.
  - The codes need to go beyond environmental issues to consider social and economic sustainability.
  - The codes need to consider the full life cycle impact of housing, for example embodied energy.
- The planning framework needs to be rationalised to remove excessive layers of regulation and areas of duplication.
- More effective use of existing instruments such as the Metropolitan Development Program (MDP). The MDP could be used to ensure land releases are coordinated with the efficient provision of infrastructure.
- It is important that there not be a single approach only to the design, maintenance or refit of housing. Principles such as Liveable Neighbourhoods and Universal Housing Design should be considered as tools only, not the solution to the issue of sustainability.

3.4 Research

Research is required to investigate and better inform both government and industry about the implementation and promotion of sustainability within the housing sector:

- Research and development in sustainable building materials, and sustainable practices in construction and waste disposal.
- Research into the role of perceptions and expectations in the housing sector and strategies to address those that present a barrier to sustainability.
- Research into the effectiveness and cost of various design elements (for example universal design or climate sensible design) on the basic price of a house. This information can then be used by government and industry in education or marketing promotions that 'sell' the benefits of sustainability.
- Research to measure and quantify the embodied energy in residential housing in WA, identify financial measures to reduce the level of embodied energy.

4 Appendix – Supporting Material

4.1 Global/National context

4.1.1 Agenda 21

The concept of sustainability was put forward in the late 1980's in response to the perceived dichotomy between protecting the environment and economic development. In 1987, 'sustainable development' was proposed by the United Nation's World Commission on Environment and Development as the means to ensure "the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future."[13]

Agenda 21 was adopted at the United Nations 'Earth Summit' at Rio in 1992 as the official global strategy for the implementation of sustainability at the global, national and local level. It is principally promoted via Local Agenda 21 (LA21). LA21 recognises that local government and communities are lead agencies in the promotion and implementation of sustainability through the integration of environmental, social and economic goals at the local level.

4.1.2 Ecologically Sustainable Development

The term 'ecologically sustainable development' was adopted by the Commonwealth Government as part of the development of a national strategy for the implementation of sustainability in Australia. In 1992, the Government endorsed the *National Strategy for Ecologically Sustainable Development*, subject to budgetary priorities and constraints in individual jurisdictions.

4.1.3 Greenhouse gas emissions

Over the past decade, evidence has been mounting that human actions are increasing the concentration of greenhouse gases in the atmosphere, potentially resulting in devastating global climate change. The largest source of human created greenhouse gases is carbon dioxide released from the burning of fossil fuels.

The National Greenhouse Strategy, which was endorsed by the Commonwealth and all State and Territory governments in 1998, provides a national framework for action on climate change. The Australian Greenhouse Office (AGO) has been established with responsibility for cutting Australia's greenhouse gas emissions.

Because of the link between energy and the emission of carbon dioxide, the majority of initiatives to date have been directed towards improving energy efficiency with a lesser emphasis on the move to alternative, renewable energy sources.

Examples of such initiatives include the AGO's Greenhouse Challenge and Cool Communities (to encourage action by industry and the community), Cities for Climate Protection (a program for local government), the development of rating systems such as natHERS, and the establishment of sustainable energy development agencies in several states.

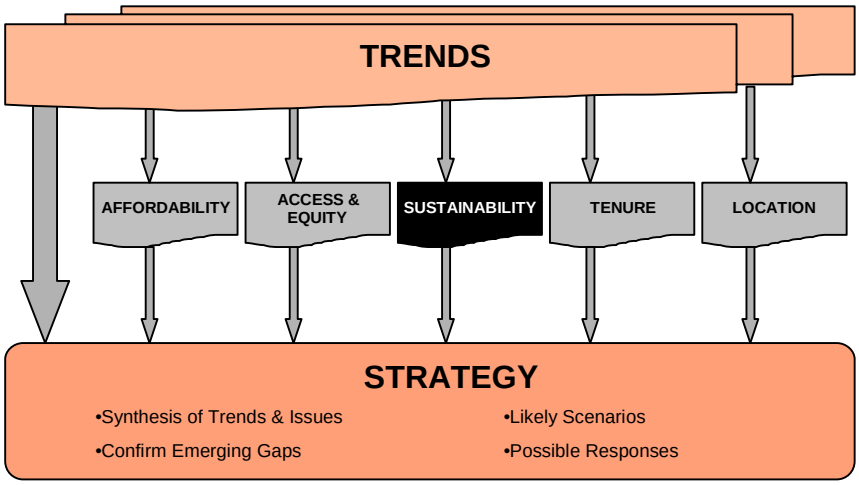
[13] Preamble, Agenda 21, United Nations Environment Programme

4.2 State Context

4.2.1 State Housing Strategy

The Sustainability Issues paper is part of the third stage trends and issues phase of the State Housing Strategy process and one of a series of issues papers covering the five themes adopted by the Strategy as indicated on Figure 1.

Figure 1 – State Housing Strategy – Trends and Issues



4.2.2 State Planning Strategy

The *State Planning Strategy*, released in 1997, was formulated to provide a vision and a strategic guide for land use planning for Western Australia and its regions to the year 2029. It is aimed at assisting the State to achieve a number of key goals, including generating wealth, conserving and enhancing the environment, and building vibrant and safe communities. The Strategy acknowledges the need to achieve a balance between environmental, social and economic goals in order to ensure the sustainable development of the State for the benefit of current and future generations[14].

4.2.3 Future Perth

The Future Perth project is proposed to provide a new strategic plan for the development of Perth within the next 30 years. It will replace METROPLAN, the strategic land use vision for the Perth Metropolitan region released a decade ago. Sustainable cities, in terms of environmental and resource protection, employment, transport, land requirements and quality of life, are a strong focus of the preparation of Future Perth.

Future Perth complements the *State Planning Strategy*. It is specific to the Perth Metropolitan Region and all adjacent local government areas, the Peel Region and Greater Bunbury. These areas have been identified as facing major issues of growth management and planning[15].

[14] State Planning Strategy, Final Report, December 1997, Western Australian Planning Commission
[15] Future Perth Indicators, June 1999, Western Australian Planning Commission

4.2.4 WAste 2020

The WAste 2020 strategy was released by the State Government in August 2000. The strategy advocates a broad-scale shift from waste disposal to resource recovery in order to achieve zero waste to landfill by the year 2020. This is expected to be achieved by reducing waste production in Western Australia and greatly increasing re-use and recycling initiatives.

Construction and demolition waste is the main source for the waste stream going to landfill. Consequently, waste reduction and recycling within the housing construction industry is a key component of this strategy.

4.2.4 State Greenhouse Strategy

A Greenhouse Management Taskforce has been established with the task of developing a State Greenhouse Strategy. The Taskforce is chaired by Fran Logan, member for Cockburn and comprises representatives from the Departments of Environmental Protection, Conservation and Land Management, Housing and Works, Planning and Infrastructure, Agriculture, and Industry and Technology, WA Office of Energy, Forest Products Commission and Murdoch University.

Three subgroups are being established to deal with the following areas:

- Stationery energy
- Agriculture
- Housing, planning and transport

The intent is for each subgroup to engage with key groups within the community who are involved in these areas. The housing sector will have an important role in providing comments and feedback via the subgroup to the Taskforce, thereby assisting the development of the Strategy.

4.2.5 State Industry Policy

The preparation of a State Industry Policy was foreshadowed by the Minister for State Development in his *Building WA: A Strategic Partnership* statement. The Industry Policy will identify a number of high level outcomes that express the Government's economic development goals for the whole economy and, by extension, the whole-of-Government and the wider needs and aspirations of the Western Australian community. A key outcome is the promotion of sustainable development to ensure that economic development is achieved in a way that does not compromise the Government's commitment to sustainability and the triple-bottom line.

It is intended that the Policy will be supported by a series of sub-strategies specific to particular industry sectors or economic development issues. One of these may relate to the housing industry sector.

4.3 Key References and Strategies

4.3.1 Urban Form

4.3.1.1 Liveable Neighbourhoods

The *Liveable Neighbourhoods* Community Design Code was developed by the Western Australian Planning Commission and released in 1997. It was prepared as a tool to assist the implementation of the sustainability objectives of the State Planning Strategy that aims to guide development in Western Australia to 2029.

The principles underlying *Liveable Neighbourhoods* are those of New Urbanism. New Urbanism promotes the creation and restoration of diverse, walkable, compact, mixed-use urban environments that encourage sustainable communities in terms of employment, services, community safety and social interaction.

4.3.1.2 Metropolitan Development Program

The Metropolitan Development Program (MDP) is prepared annually by the Department for Planning and Infrastructure to assist in the orderly planning for the provision of physical and community infrastructure. The MDP covers the Perth Metropolitan Region and Peel Sector (Mandurah and Murray local government areas).

The MDP was intended to be an urban management tool to provide a "more effective co-ordination of public investment and urban land release in the metropolitan region"[16]. It is therefore potentially a powerful tool for government to influence urban form and sustainable policy objectives. However, the MDP has not reached its full potential and is currently limited to providing information on current residential activity and identified trends in likely residential type land release over a five-year period. This has meant that infrastructure has tended to 'follow' land releases rather than direct where they occur, resulting in inefficiencies in service provision that affect the economic and social sustainability of communities.

4.3.2 Building Design

4.3.2.1 Building Code of Australia

The Building Code of Australia (BCA) is intended to provide a framework for nationally consistent building regulatory systems that are efficient, cost-effective and meet community, industry and national needs.

In its current form, the BCA is performance-based, rather than prescriptive in its approach to building regulation. This has an advantage from a sustainability point of view as it allows for flexibility in the use of materials and forms of construction or design, provided that the intent of the BCA is met. This can assist not only the incorporation of environmental criteria into housing design and construction but can also result in cost savings in building construction, thereby assisting affordability.

The BCA is currently being amended to incorporate mandatory national minimum energy efficiency standards in all new homes from 1 January 2003.

[16] Planning for the future of the Perth Metropolitan Region, Report of the Review Group to the State Planning Commission of Western Australia, November 1987, p147

The BCA does not however have any legislative pre-eminence over State or Local Government planning legislation[17]. Rather, States and Territories have been implementing their own planning regulations across a range of urban and housing planning issues. This has resulted in a complex network of planning regulations, frustrating to designers and developers, and allowing local authorities to circumvent the application of the BCA.[18]

4.3.2.2 Planning Policies – R Codes

The Residential Planning Codes 1991 (R Codes) control residential development in Western Australia in terms of built form and housing density. These codes are largely given effect through their incorporation into town planning schemes.

It is intended to replace these codes with the Residential Design Codes. In contrast to the prescriptive approach of the 1991 Codes, the new codes have a performance orientation and "deemed to comply" standards. This approach encourages "innovative design solutions" and "the widest possible range of dwelling types, to meet community desires"[19].

The revised Codes have also introduced several additional generic elements, including design for climate. This provides guidelines principally in relation to solar access but also to the containment of stormwater on site.

4.3.2.3 Universal Housing Design

It is intended that housing based on universal design is to be accessible to all users, regardless of physical ability, and is able to meet the changing needs of users over time, without the need for adaptation or specialised design. Examples of the features of a universally designed home include:

- undercover car parking that provides easy access into the house;
- step free entry, door handles that are easy to operate;
- an internal layout to assist easy access and circulation; and
- bathrooms and kitchens that can be used by a wide range of people.

An important principle underlying universal design is that it assists equity of access to housing for people with disabilities and the aged. In addition, because its design allows for the future incorporation of assistance aids, existing occupants can remain in their home despite increasing frailty or the onset of a physical disability. Universal design can be applied in multi storey dwellings.

Because dwellings built to universal design require more space than ordinary dwellings, this can add to costs. It has been estimated that the floor space of a standard design can be increased by an average of 14m^2, adding up to $11,575 per dwelling in construction costs. In response, proponents argue that this additional cost is recouped over time due to the reduced need for future modifications to the dwelling. There is also an indirect benefit to government and the community due to the reduced need for people to move into institutional care.[20]

Universal housing design is currently being applied by the Western Australian Department of Housing and Works, Queensland Department of Housing, and Housing Tasmania in their public housing programs. Its principles are also evident in publications such as the ACT Master Builder's Association's (ACT) guide 'Housing for Life'.

[17] With the exception of Tasmania
[18] Better Living Environments, Housing Industry Association, www.hia.asn.au
[19] Residential Design Codes of Western Australia, draft for public comment, Western Australian Planning Commission, Oct 2000
[20] 'Universal Housing Design', Queensland Department of Housing, Occasional Paper 5

4.3.2.4 Climate Sensible Design

Climate Sensible Design (CSD) takes account of local climatic conditions in housing design to create dwellings that are thermally comfortable all year round. CSD is associated with passive solar design principles.

By using natural forces, such as the sun and wind, to maintain internal comfortable thermal conditions CSD homes require little additional heating or cooling. They are therefore also energy efficient, resulting in minimal energy running costs for the occupant, and reduced fossil fuel use and greenhouse gas emissions.

Key features associated with CSD are solar orientation, zoning of living and sleeping areas, the use of thermal mass to regulate internal temperatures, insulation, natural ventilation, window placement, and the use of landscaping for shade and cooling.

4.3.2.5 Security

Housing and urban design can both have an important influence on the potential for an individual dwelling to be at risk from crime. Burglary patterns for example, have been found to be affected by street layout, height of boundary walls and the inter-visibility of buildings[21].

In terms of housing, security can be improved by increasing the level of 'natural surveillance'. For example, it is recommended that houses face the street, and that fences, walls and vegetation not hinder surveillance of the street or the front of the house.

These design principles are a key element of the City of Gosnells *SafeCity* Urban Design Strategy and are a feature of planning documents such as *Liveable Neighbourhoods*.

A challenge for designers is to minimise the potential conflict between design principles. For example, facing a house to the street may not assist its solar orientation, or using vegetation to shade and cool a house could compromise its level of security by providing hiding places for burglars.

4.3.2.6 Rating systems

A number of building rating systems have been developed and implemented nationally and at state level in order to measure the environmental performance of a building. Dwellings get a star rating (0 – 5) according to their potential for low energy use to maintain comfort. Star ratings compare houses' modelled annual heating and cooling loads per square metre of floor area under standard operating conditions.

As the impetus for the development of these systems has largely been in response to the concerns about global warming, they are mainly concerned with rating the energy efficiency of a dwelling[22]. Examples of such systems currently in use include the National Home Energy Rating System (natHERS), and First-Rate[23].

These systems are being used in the ACT, Victoria, NSW and South Australia to rate the energy efficiency of new and existing homes. New homes are required to achieve a 3.5 to 4 star energy rating in order to receive building approval. In the ACT, existing home-owners wishing to sell their properties are also required to have their home rated, and to include this rating in any advertisement for its sale.

[21] Safe City Urban Design Strategy, City of Gosnells, 2001
[22] David Beyers, Building and Construction Policy Initiatives and Rating Systems, February 2002
[23] natHERS was developed by the CSIRO, and First-Rate by the Sustainable Energy Authority Victoria.

A new rating tool, the National Building Environmental Rating Scheme (NABERS) is currently being developed by Environment Australia. NABERS aims to go beyond the current systems and intends to rate the overall environmental impact of a building including its energy and water efficiency, site conservation and biodiversity, indoor air quality, and efficiency of resource use.

4.3.2.7 HIA GreenSmart

The GreenSmart program is the practical implementation of the Housing Industry Association's Partnership Advancing the Housing Environment (PATHE) national environment strategy. PATHE and GreenSmart have been developed in conjunction with the Commonwealth Government. It has been operating since 1998.

The GreenSmart program aims to instil sustainability principles into the culture of the housing industry via a range of actions:

- Environmental training and accreditation for building and construction industry professionals. The course incorporates training in regard to waste management, stormwater management, energy management and insulation. It is based on the 'Your Home' design guide, published by the Australian Greenhouse Office.
- Demonstration of sustainable principles and practices via showcase GreenSmart Villages.
- The provision of the GreenSmart Home Loan for consumers who build with accredited GreenSmart professionals. The GreenSmart Home Loan has a rate 0.25% less than the standard variable home loan rate offered by HIA Home Loans. The lower rate assists to offset the higher up front costs involved in incorporating sustainable features in a dwelling.
- The development of partnerships with companies, State and Local governments to advance the goals of GreenSmart.
- Recognising initiatives in environmental design and construction through GreenSmart Awards.

4.3.2.8 Smart House Technologies

Smart Houses are designed to incorporate current and emerging technologies that can either function automatically or be remotely controlled by a mobile user. Also marketed as home automation systems, it involves the house being 'smart wired' using copper pair wiring, cabling and Internet connectivity to allow home-owners to control a totally linked home network using keypad codes, phones, televisions or the computer.

The market for these systems is expected to be strong. In Australia, about 135,000 new homes built this year will incorporate smart wiring for telecommunications and lighting.[24]

Smart House technologies can assist energy efficiency, for example by allowing appliances such as washing machine and dishwashers to turn themselves on when electricity is at off-peak rates. Potentially, they could also assist sustainable houses to monitor and operate waste treatment and renewable energy systems.

Home automation can also help people with disabilities or the frail aged to live independently by permitting them to control devices in any part of the house from a central point. The degree of automation is however determined by cost. Incorporation of smart wiring is most cost effective at construction (representing approximately 0.5% of the cost of the dwelling),

[24] 'Wired for house of the future', The Real Estate Report, South Australia, 2002

while retrofitting an existing dwelling is currently prohibitively expensive[25]. This raises an issue of equity of access to these technologies for those on a low income if the house is not pre-wired.

4.3.3 Housing Construction

4.3.3.1 Cleaner production

The residential housing industry is a significant producer of large volumes of waste, mostly solid waste left over from the construction of housing. Much of this finds its way to landfill. In Victoria for example, construction industry waste accounts for 44% of total landfill[26].

One approach to the issue of construction waste is that of Cleaner Production. Cleaner Production refers to the application of an "integrated preventative environmental strategy" to increase eco-efficiency in the use of materials and reduce waste[27]. Strategies to achieve this in the building construction industry include input substitution of less polluting materials, changes in operational procedures and management to eliminate waste, and on-site recycling and reuse of building materials.

Cleaner production directly addresses the triple bottom line by linking environmental measures with economic strategies aimed at the more efficient use of resources.

For industry, the reuse and recycling of building materials can result in large cost savings in waste disposal and the transportation of materials to site. However, a number of barriers have been identified including the cost of reusing/recycling waste relative to disposal in landfill, attitudes to using recycled materials, and lack of information about potential markets and customers for recycled goods. It also requires local government to be flexible in regard to regulations on the use, or reuse, of building materials within an area.

The potential benefits to consumers come from reduced building costs due to savings made by industry. This could aid affordability or at least offset some of the potential additional costs from the incorporation of sustainable features into a dwelling.

A national Cleaner Production strategy was launched in December 1998 and is promoted via Environment Australia. This strategy mandates that states and territories implement Cleaner Production policies and strategies, and report on progress annually. In Western Australia, Cleaner Production has been adopted as part of the Government's waste policy for industrial waste[28]. A Centre of Excellence in Cleaner Production has also been established at the Curtin University of Technology in Perth.

4.3.3.2 WasteWise Construction Program

WasteWise is a program coordinated by Environment Australia with the aim of reducing the amount of construction waste going to landfill.

In the first phase of the WasteWise program, five leading Australian construction companies volunteered to work with the Australian and New Zealand Environment and Conservation Council (ANZECC) to develop waste reduction best practice. The companies had to find the best way to reuse, recycle and reduce the waste resulting from their day to day operations.

[25] 'Securing a Home's Future', Building Product News, www.hometoys.com/htinews/feb01/articles/hpm/hpm.htm
[26] 'Waste Minimisation in the Construction Industry – Fletcher Construction Australia', Cleaner Production Case Study
[27] Cleaner Production Opportunities for Small to Medium sized Enterprises, Prof Rene Van Berkel, Waste & Recycle Convention, 5-6 August 1999
[28] Cleaner Production Opportunities for Small to Medium sized Enterprises, Prof Rene Van Berkel, Waste & Recycle Convention, 5-6 August 1999

Their experience demonstrated the capacity for significant reduction and reuse opportunities for construction waste. As a consequence, broader industry participation was attracted in the second phase of the program commenced in 1998.

The HIA is pursuing its WasteWise commitment through the PATHE program and has released a Waste Management Guide for Residential Building. The Guide seeks to create an awareness of the waste problem and to identify cost-effective waste minimisation solutions for the normal range of circumstances found on most building sites. The HIA is incorporating waste management training in its training and education seminars to help facilitate the shift towards effective waste management in the housing industry.

4.3.3.3 Embodied energy

Embodied energy is the energy used by all the processes associated with building a house including the extraction of the natural resources, manufacturing of materials and equipment, transport and administrative functions.

The question of embodied energy is often overlooked when considering the energy consumed by the residential housing sector. However, the amount of energy involved is significant. It is estimated that the energy embodied in existing building stock in Australia is equivalent to ten years of the total energy consumption for the nation[29].

The choice of building materials can have a major influence on the embodied energy of a building. Wood and concrete typically have low embodied energy while stainless steel and aluminium have quite high energy content. The amount of embodied energy in building materials can however be recaptured to a large extent through reuse and recycling. The reuse of building materials can save about 95% of embodied energy, while recycling can save between 20-95% dependent on the material[30]. As noted above under Cleaner Production, construction waste reuse/recycling can result in significant cost savings.

Because of the connection between energy and greenhouse gas emissions, it is inevitable that embodied energy will become a higher profile issue. However, the question of how to address the issue of embodied energy in housing is not necessarily straightforward. For example, building dwellings that are more energy efficient usually means (at present) increasing the embodied energy content. This may be acceptable if the life of the building is extended to offset the increase in energy. Another consideration is the amount of materials used (for example, wood and concrete are generally used in larger quantities in a dwelling than steel).

With the development of, and increasing use of rating systems, another matter to consider is whether, or how, embodied energy can be incorporated into considerations of the 'energy efficiency' rating given to a building.

Further work is clearly required into the issue of embodied energy and housing as follows:

- to measure and quantify the embodied energy in terms of residential housing. This has implications for greenhouse gas emissions measurement.
- explore financial or other incentives to encourage home owners and builders to consider reducing the amount of embodied energy in the houses.
- encourage policy makers and private industry to consider total life cycle energy use (operational and embodied energy) in the construction of residential buildings.

[29] 'Embodied energy' CSIRO Built Environment Online Brochure, www.dbce.csiro.au/ind-serv/brochures/embodied/embodied.htm
[30] Tracey Mumma, 'Reducing the Embodied Energy of Buildings', Home Energy Magazine Online, January/February 1995, www.homeenergy.org/archive/hem.dis.anl.gov/eehem/95/950109.htm

4.3.4 Housing Consumption

4.3.4.1 Sustainable Energy Development Office

The Sustainable Energy Development Office (SEDO) was established in November 2001, as part of the Office of Energy, in order to deliver the State Government's sustainable energy policy.

SEDO's interim strategic plan lists as its objectives the increased uptake of energy efficient products, practices and renewable energy by WA households, the encouragement of best practice energy management in the business sector, and the support of an efficient and sustainable energy supply industry.

Initiatives undertaken by SEDO in support of its objectives are:

- Funding initiatives such as the solar hot water subsidy and the Photovoltaic Rebate Program (PVRP) and the Renewable Remote Power Generation Program (RRPGP).
- Provides information to the public on energy efficiency measures via the Home Energy Line, the SEDO website, brochures and promotional campaigns.
- Implementation of the nationally developed *Reach for the Stars* program to promote the sale of high efficiency household appliances.
- The establishment of the FirstRate training course in conjunction with Central TAFE.
- Development of policies to promote and encourage growth in the sustainable energy industry.

4.4 WESTERN AUSTRALIAN CONTEXT

4.4.1 Characteristics of the housing construction market

The housing construction market is dominated by project home companies that produce the majority of new single residential and small multi-residential group housing projects. Project home companies operate on small margins and rely on sales volume to generate economies of scale through bulk purchase of materials from suppliers and continuity of sub-contractor labour.

This makes the industry vulnerable to economic fluctuations and cyclical investment in the housing sector. The volatility of housing activity has significant flow-on effects to the economy and society. For example, a downturn in housing construction can affect the supply of local labour, in terms of unemployment and the loss of skilled tradesman from the industry. This in turn can result in a shortage of labour during an upturn leading to increased labour costs, which can impact on the affordability of housing for those on low incomes.

The raw materials used in housing construction are sand, limestone, lime sand, clay, hard rock and gravel. The market value of the basic raw materials industry in Perth was assessed at $768 million in 1994 and was directly responsible for 4127 jobs[31].

The extraction and transport of these materials contribute significantly to the ecological footprint of the housing industry. The sources for these materials are drawn from sites close to Perth and throughout the southwest from Geraldton to Albany.

WA has traditionally met all its housing timber needs through native forest hardwoods, and more recently plantation softwoods. With pressure on local natural resources, particularly for the preservation of hardwood, imported timber from South East Asia has been flowing into the local industry primarily for roofing timber[32].

There are no figures available for the amount of embodied energy used in the WA residential sector. However, it is worth noting that manufacturing utilised the largest share of the state's final energy use (36%). Most of this was used in the processing of alumina, nickel and iron. Transport represents a further 32% of final energy use[33].

The proximity of the sources of raw materials close to point of use assists affordability in the housing industry. However, depletion of these resources will have a significant impact on the cost of housing and construction. For example, an increase of 25 kilometres in haulage of hardrock would add approximately $550 to an average residence and associated infrastructure[34].

4.4.2 Characteristics of resource use in the housing sector

People living in dwellings use energy and water, and produce solid and liquid waste. The level of consumption is affected by a number of factors. These include the design and building materials used in construction, attitudes towards the use of resources, government policies regarding waste disposal or its reuse/recycling, the existence and effectiveness of public campaigns and financial incentives to improve energy efficiency and water conservation, and behavioural patterns of consumption.

[31] WA Regional Forest Agreements, South West Forest Region, www.rfa.gov.au/rfa/wa/raa/cra1, p95
[32] Housing Strategy Housing Sector paper, November 2000, p19
[33] Energy 2001, Office of Energy Western Australia
[34] WA Regional Forest Agreements, South West Forest Region, www.rfa.gov.au/rfa/wa/raa/cra1, p95

Energy

Households account for 8% of the state's final energy use. Since 1974/75, residential energy use has almost doubled from 19 petajoules (PJ) in to 33 PJ in 1999/2000. In 1974/75, wood was the main source of energy. It has now been replaced by electricity as the largest source of energy (38%), while gas provides a further 26%. This is a reflection of the increasing use of electrical appliances within the home, and changing lifestyles. As virtually all electricity is produced in fossil fuel fired plants, this has significant implications for the state's greenhouse gas emissions.

There has been considerable focus on the promotion of energy efficiency in the residential housing sector. As previously noted, the Sustainable Energy Development Office has recently been established in Western Australia to assist the adoption of energy efficient practices by individuals and business. Another initiative is the Australian Greenhouse Office sponsored initiative "Cool Communities", which aims to highlight and moderate energy use behaviour in the home in order to reduce greenhouse gas emissions.

Greenhouse gas emissions

On average, households in Western Australia produce 6 tonnes of greenhouse gas emissions per year, excluding transport and wastes (landfill) emissions. In Western Australia, the residential sector is responsible for 10% of the state's total greenhouse gas emissions[35].

A report commissioned by the Australian Greenhouse Office into greenhouse gas emissions by the residential building sector has found that 15% of emissions can be attributed to the need by residents to heat and cool their homes. They report that the amount of energy used for this purpose is affected by factors such as design, housing materials and other factors determined at the time of construction, and modification in the behaviour of energy users[36].

Hot water heating contributed a further 28% to greenhouse emissions from this sector. The largest contribution of 52% was from electrical appliances.

Not included in the above calculations are greenhouse gases emitted from the extraction of raw materials, manufacture and transport of building materials, or construction on site (embodied energy). This is a significant omission in understanding the full impact of the housing sector on greenhouse gas emissions.

Water

Residential water consumption constitutes over 50% of the overall demand for water in urban centres. The overall water consumption per residential customer largely depends on climate, household size and outdoor consumption requirements (eg. gardens). The South West of the state has the lowest water consumption levels while per capita consumption increases towards the North and inland.

The average Perth household consumes about 920 litres of water per day. Virtually, all of this water is supplied from surface dams and underground aquifers and delivered to households via an extensive network of infrastructure pipes.

[35] Information provided by SEDO, 15 March 2002
[36] Australian Residential Building Sector Greenhouse Gas Emissions 1990-2010, Australian Greenhouse Office, Executive Summary report 1999

It is estimated that by the year 2031, due to population growth, Perth will require an extra 150 gigalitres of water per annum. At the same time, there has been a significant reduction in winter rainfall in the past 25 years, a trend expected to be exacerbated by global warming[37].

Pressure on water supplies can be significantly reduced through the development of water efficiency programs and the recycling of wastewater. The average person in Perth produces 200 litres of wastewater per day[38]. Housing design can be influential in this area in terms of incorporating water efficient appliances, the capacity to capture and use rainwater and the reuse of wastewater onsite.

There appear however to be several obstacles at present to the widespread implementation of recycling/reuse water management initiatives. Council and public health regulations can be a barrier to the greater application of water efficiency measures in housing design. For example, greywater recycling is prohibited at present by the Health Department, on public health grounds, unless specific approval is granted (although using washing machine water on gardens is a common practice). The Water Corporation has indicated that it is keen to develop wastewater options, however states that the relatively cheap scheme water and local groundwater alternatives present obstacles to a greater takeup of this option. A significant decrease in greywater moving through the sewerage system could also affect its efficiency[39].

Waste

The largest single source of landfilled waste in WA is materials and soils from construction and demolition (C & D) activity. For the Perth metropolitan area in the year 2000, it has been estimated that 1,500,000 tonnes of C & D waste was generated accounting for almost 55% of the waste stream by weight.

The largest contribution to C & D waste is soil that has to be removed from a site for health reasons or to facilitate construction. Other sources include waste materials from interim and post-construction cleanups, and waste materials from the demolition of old buildings.

There is little information available about the level of recycling in the C & D industry although some high value materials such as timber beams, steel, aluminium, baths, toilets and copper piping are reused or recycled. The value of these salvaged materials is estimated at $10 million per annum.

The implementation of a resource exchange for soil removed from construction sites could assist in creating a market for it, and divert this material from landfill.

A large amount of C & D waste is illegally tipped every year and has been identified as a substantial environmental problem. Illegal tipping has severely compromised some areas of bushland and forest, requiring clean-ups that could cost millions of dollars and would lead unavoidably to further destruction of bushland[40].

The second highest proportion to the waste stream is municipal solid waste. In 2000, the municipal waste stream in Perth was 800,000 tonnes. Typically, the major component of the domestic waste stream is organic, with green and food wastes accounting for 60-70% of a household's total solid waste. This organic waste could be composted or shredded for mulch. Another 20% is recyclable materials (paper, cardboard, mixed plastics, metals and

[37] Planning for Perth's water needs, Water Corporation, November 2001
[38] http://www.watercorporation.com.au/environment/content-wastewater.asp
[39] Water Corporation of Western Australia, Submission to the Senate Inquiry into Australia's Urban Water Management, July 2001
[40] 'Construction and Demolition Waste Sector Actions', WAste 2020 TaskForce Report and Recommendations, 1 Jan 2001

glass). Therefore, potentially over 80% of the waste generated by residential housing could be diverted from landfill through reuse and recycling[41].

4.5 National and International Comparisons

4.5.1 SMART Housing/GETSmart Housing

Smart Housing and GETSmart Housing are programs run by the State Housing departments in Queensland and Tasmania respectively. Both programs have the objective of promoting sustainable housing that is "flexible, efficient, safe and affordable over time"[42]. The principles underlying both programs are universal housing design and climate sensible design.

In support of its program, the Queensland Department of Housing has produced a residential design manual for designers and builders providing public housing, co-sponsored a Smart Housing Design Award with the HIA and have built demonstration Smart Houses in Brisbane, Townsville and Cairns that "showcase environmentally and economically sustainable design principles."

As in Queensland, Housing Tasmania has incorporated GETSmart principles into the construction of public housing. It has also initiated a number of partnerships with designers and builders in order to make GETSmart Homes the normal standard for construction and renovation of houses throughout Tasmania.

4.5.2 Olympic Village Newington

The Olympic Athletes Village and the wider suburb of Newington were designed as a demonstration of the commitment to 'green' principles by the 2000 Olympic Games in Sydney. Key features include:

- Permanent houses designed to achieve a 50% reduction in energy requirements and greenhouse gas emissions compared to conventional dwellings.
- 665 permanent dwellings fitted with rooftop photvoltaic cells sufficient to generate household energy demands, making it the largest solar powered suburb in the world.
- 50% reduction in potable water usage as compared to conventional dwellings through water saving devices and use of reclaimed waters.
- PVC use reduced by at least 40%.
- The recycling of 92% of construction waste.
- Housing in Newington has been designed to incorporate passive solar design while responding to the need for street frontage and privacy.

The successful tenderer, the Mirvac Lend Lease Village Consortium, was awarded the project as a consequence of their commitment to Ecologically Sustainable Development. A challenge for the developers was to balance the incorporation of innovative and green design ideas with mainstream marketing needs. There was in recognition that the market was more open to environmental design if it promotes the thermal comforts, lifestyle improvements and energy cost savings it can bring.

Important design lessons from Newington put forward by the developer are:

[41] 'Municipal Solid Waste', WAste 2020 TaskForce Report and Recommendations, 1 Jan 2001
[42] 'What is Smart Housing', Smart Housing brochure, Queensland Department of Housing, www.housing.qld.gov.au/org/smart_hsing.htm

- Passive energy efficient aspects of the design are the easiest and most cost effective to employ. However, active energy efficient aspects such as PV cells, while more expensive, are more visible to purchasers.
- Apart from solar hot water, the general public do not have a good understanding of the benefit of active energy efficient aspects. There is a need for greater branding of these products together with education campaigns.
- Government grants should be more progressive. Providing subsidies to owner-occupiers only, limits the incorporation of energy efficient technology (eg PV cells) into building design. Without a similar incentive, developers are reticent to include energy efficient technologies into large projects for fear that they may not be understood by future purchasers, thereby affecting sales[43].

While Newington has been praised for its innovation and demonstration of environmentally sustainable housing features, there are also concerns that it does not provide for low cost housing. In Stage 1 of the project, house prices for three bedroom houses started at $355,000, while a two-bedroom apartment was selling for $265,000. Indications are that properties in Stage 2 are exceeding these amounts.

4.5.3 Effect of rating system – Victorian experience

The First Rate House Energy Rating System has been available in Victoria since 1994. Active promotion by the Sustainable Energy Authority Victoria and Insulation Solutions (formerly ACI Insulation) in conjunction with the State's major housing awards have helped to raise awareness of the benefits of a house energy rating. This resulted in hundreds of new house designs from leading builders being rated voluntarily.

Research in 1998 found a 14% increase in the average energy efficiency of new homes since the inception of the ratings system. As a consequence, 38% of new homes had a rating of four or five stars[44].

Victoria has now legislated to ensure that planning permits for multiple dwellings on a lot are subject to each dwelling achieving a four star rating. Interestingly, this legislation does not apply to single dwellings or residential buildings (such as hostels, backpacker accommodations, motels).

4.5.4 Social Housing in Victoria

The Victorian government is supporting sustainability principles in social housing through a number of initiatives.

- The development of social housing projects in Windsor, Kensington, Port Melbourne, Richmond and Carlton that will be energy efficient. The Windsor project, awarded last year via a competition for the best environmentally sustainable design, will feature the use of renewable energy only, a 50% reduction in water use and be built to last 200 years.
- Funding for 600 solar hot water systems to social housing projects over a three-year period.
- The voluntary introduction of a minimum 4 star rating for all new social housing construction.
- Energy efficiency training of Office of Housing staff by the Sustainable Energy Authority.
- The provision of rainwater tanks in homes in regional Victoria.

[43] 'Newington Master Plan', www.netspeed.com.au/abeccs/newington/newington%20design.htm
[44] ''New Homes Go Green In Victoria', November 1998, www.aie.org.au/pubs/greenvic.htm

4.5.5 United Kingdom

In the United Kingdom, all new housing is assessed against the Environmental Standard Award. This sets out a range of criteria covering aspects such as carbon dioxide emissions, use of environmentally friendly materials, use of recycled materials, water conservation and minimisation of ecological damage to the site. Those housing developments meeting a necessary number of criteria are awarded the Environmental Standard Award.

A number of organisations, such as Sustainable Homes and the Somerset Trust for Sustainable Development, have been established to promote sustainability in housing. They promote awareness of sustainable development issues and good practices through seminars, conferences, newsletters, funding assistance, and the development of partnerships with organisations such as housing associations.

One example is Millenium Homes, Tewkesbury. Fifteen two and three bedroom rental houses were developed by the Gloucestershire Housing Association for low-income families. The properties feature a number of sustainable features including solar passive design, low embodied energy, environmentally friendly materials, solar hot water, and water conservation measures. They also incorporate universal housing design principles to ensure the flexibility, adaptability and accessibility of the houses to meet the changing needs of families over their lifetimes[45].

4.5.6 Amersfoort solar housing

The building of a new quarter in the City of Amersfoort in the Netherlands provided an opportunity for innovative policy in the incorporation of photovoltaics into the urban form. The Utrecht Electricity Corporation (REMU) has, in partnership with developers, the Amersfoort Housing Corporation and owner occupiers, installed an average of twenty square meters of solar panels on the roofs of about 500 houses amounting to 1 MW of capacity. This is fed into the grid with residents receiving a credit equivalent to the normal domestic consumer tariff. In addition, a further 1150 houses were equipped with solar collectors.

4.6 Western Australian Examples

4.6.1 East Perth/Subiaco Redevelopments

The reurbanisation of the inner city suburbs of East Perth and Subiaco has to a large degree successfully demonstrated the principles of New Urbanism that underpin documents such as Liveable Neighbourhoods. Both developments feature a compact, walkable urban form, mixed use development, public transport links, and natural surveillance of streets and parks for increased safety.

These developments have been very popular with housing selling strongly and recording solid and consistent price growth. They demonstrate that well designed, higher density developments can be marketed successfully. The December 2001 median price for a dwelling in East Perth was $289,000 while Subiaco was $395,800, while the overall median for Perth was $171,800.

Since the establishment of both redevelopment authorities in the early 1990s, a number of sustainable housing issues have gained prominence such as: solar orientation, access and affordability and adaptability.

[45] Sustainable Homes Case Study, Gloucestershire Housing Association, www.sustainablehomes.co.uk/case_studies/gloucs.htm

Planning policy made provision for passive solar design but were 'desirable' only and encouraged "so long as it is consistent with good design and market acceptability"[46]. There were possibly missed opportunities for the use of renewable energy such as solar hot water heating or photovoltaic panels.

High density small lot development whilst efficient in terms of land and infrastructure requires multi-storey construction which may have a long term downside in terms of meeting the whole of life housing requirements of current occupants as they age.

A criticism that has been leveled at both developments is the low proportion of affordable housing. However, affordability was not a key driver in the original charter of these estates. Indications are that the new Northbridge and Eastern Gateway project areas of EPRA will incorporate affordable housing projects.

4.6.2 Department of Housing and Works

The Department of Housing and Works has a significant role in the housing sector. The agency has responsibility for the provision of public rental and community housing, aboriginal housing and infrastructure, land development and home ownership finance.

The Department has implemented a number of sustainability initiatives:

- The Department is an inaugural partner in the HIA PATHE program
- The principles of Liveable Neighbourhoods have been adopted as an underlying principle in its land development and redevelopment programs.
- The 'mainstreaming' of universal housing design in the construction of seniors and special purpose housing.
- Where appropriate, the incorporation of solar passive and water sensitive design in mainstream construction of public housing.
- The Department has been a partner in demonstration projects:
  - The trial of greywater recycling for toilet flushing and garden watering at six seniors units in Palmyra.
  - The construction of an energy efficient house in Stratton featuring solar passive design and active solar technologies such as roof mounted photovoltaic cells and gas boosted solar hot water system.
  - The Department has assisted the preparation of guidelines for minimisation of construction waste, in conjunction with the Centre of Excellence in Cleaner Production, interested builders, and the Waste Management and Recycling Fund.
- The Department's range of programs to assist Aboriginal people with their housing and infrastructure needs, promotes sustainability within Indigenous communities in several ways. Programs such as the Management Support Program and Remote Area Essential Services Program aim to develop skills within communities in management, repairs and maintenance of housing and infrastructure through training and employment opportunities. Communities are also encouraged to have a major input into the design and siting of housing to ensure they are culturally and climatically appropriate.
- The New Living program, Western Australia's largest urban renewal project, aims to rejuvenate older public housing estates to create more functional and attractive living environments, reduce the Department's presence and encourage home ownership. This ensures a greater mix of household and tenure types, and the availability of affordable housing close to services, employment and amenities.

[46] General Planning Policies, East Perth Redevelopment Authority, http://www.epra.wa.gov.au/_extranet/planpol2.pdf

4.6.3 Ellenbrook Solar Housing

The Coolamon Village, a subdivision of Ellenbrook, has been designed to encourage the construction of solar efficient housing. The subdivision has been designed incorporating the principles of Liveable Neighbourhoods and has a permeable grid system with two thirds of the roads having a north/south axis permitting solar passive housing to be constructed. Housing Packages have also been designed to encourage energy efficiency. If homebuyers meet six of ten environmental criteria, they are eligible to receive free ceiling insulation.

4.6.4 Atwell South (HIA GreenSmart)

This new neighbourhood will be developed by LandCorp in close consultation with the community and in co-operation with the City of Cockburn and environmental agencies. The Minister for Planning and Infrastructure has indicated that LandCorp was working closely with the Housing Industry Association on the GreenSmart Village concept and 12 builders had already committed to a display centre of 14 houses built to environmentally sustainable guidelines.

Attachment 1

Membership of the Sustainability Issues Paper Reference Group

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