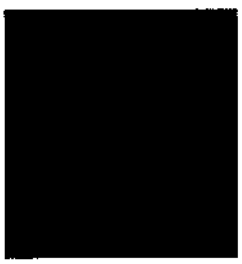

Planning
Institute
Australia

SUBMISSION TO SUSTAINABLE CITIES 2025

HOUSE OF REPRESENTATIVES STANDING COMMITTEE ON ENVIRONMENT AND HERITAGE

BY THE PLANNING INSTITUTE OF AUSTRALIA

October 2003

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Introduction

The House of Representatives Standing Committee on Environment and Heritage is undertaking an Inquiry into Sustainable Cities 2025. This Inquiry is timed to coincide with the Year of the Built Environment 2004.

The Planning Institute of Australia commissioned this report to the PIA National Council as a basis for its submission to the Inquiry. PIA determined that the following specific areas be addressed:

1. Preservation of bushland and urban green zones;

2. Ensuring equitable access to and efficient use of energy, including renewable energy resources;

3. Establishing integrated sustainable water and stormwater management systems addressing capture, consumption, treatment and re-use opportunities;

4. Developing sustainable transport networks, nodal complementarity and logistics;

5. Incorporating eco-efficiency principles into new buildings and housing; and

6. Providing urban plans that accommodate lifestyle and business opportunities.

The report seeks to provide background information and issues identification. Policy options and possible responses have been developed wherever possible, but have largely been excluded from this submission as they have yet to be considered in the context of the Planning Institute of Australia's current review of its National Policy Agenda – Liveable Communities which is due to be launched in February 2004 at the Institute's National Conference to be held in Hobart.

The report is submitted to the Committee as a series of papers on the major issues confronting planners in creating vibrant, sustainable Australian cities for future generations. Critical questions are flagged as well as the range of intellectual debate noted in some key areas. This is to highlight the fact that achieving 'sustainable cities' is a demanding and often complex process, which requires adaptable solutions to changing economic, social and natural environments.

Reflecting the current policy context in Australia, much of the discussions and facts are drawn from State Territory and Local governments. However, there is a strong theme throughout the report on the important role of Federal Government in achieving sustainable cities. This is consistent with the Planning Institute's call for a national framework for urban and regional development.

Management of urban growth is essential to achieve national objectives for sustainable development and will require the involvement and cooperation of all levels of government as well as the non -government sector and communities. The undertaking of this Inquiry into Sustainable Cities is an important step in this process.

The Planning Institute of Australia believes that settlement and land use patterns can have significant impact on a host of national aspirations for the environment, the economy and society and the sustainability of our communities, urban and regional. PIA's aim is to facilitate constructive debate within

governments at all levels, but particularly within the Australian government, and the community to produce a robust, bipartisan vision for city and regional development. This is not to say that the Australian government is neglecting key issues like salinity or the metropolitan/country divide, clearly, there are important initiatives underway in such areas. However, we lack the focus that an overarching policy framework can provide. There is a danger that individual responses will therefore have a lesser impact for want of coordination. PIA notes that Australia is somewhat out of step with many other OECD countries in this respect.

Finally, this report has been prepared with significant input from the Environment and Planning at RMIT University. PIA thanks RMIT for its contribution.

The PIA would also like to direct the Committee to the Institute's current National Policy Agenda – Liveable Communities - which, as stated previously, is currently under review. It can be found on the PIA website www.planning.org.au .

Recent Urban change in Australia

Since the late 1970s, ongoing processes of global economic restructuring have wrought major changes to the structural and spatial dynamics of Australia's large urban areas.

Such changes include:

- decline of traditional industrial activity (Fagan and Webber 1999; Beer and Forster 2001).
- increase in 'informational' employment sector (Brain 1999).
- heightened international links between firms and labour markets (Fagan and Webber 1999; O'Connor and Healy 2002)
- rapid urban growth, particularly on the fringe (Gwyther 2002; Dodson and Berry 2003).
- revalorisation of urban core (Brain 1999; O'Connor and Healy 2002).
- rise of new fringe 'suburbs of opportunity' (Gwyther 2002; Dodson and Berry 2003).
- increase in socio-spatial segregation and polarisation (Murphy and Watson 1995; Badcock 1997; Baum *et al.* 1999; Wulff and Reynolds 2000).
- shift in role of state from regulator to facilitator of capitalist development (Winter and Brooke 1993; Gleeson and Low 2000).

As part of these changes, three related socio-spatial processes have been apparent. The first is the reaffirmation of the urban core as a site of globalised business activity, combined with the residential gentrification of the inner city by workers who are predominantly associated with the global informational economy. This process has been ongoing since at least the mid-1970s and has been particularly prominent in the larger cities of Sydney and Melbourne (Beer and Forster 2001; O'Connor and Healy 2002).

A second key process has been the decline of suburbs with concentrations of industrial activity, as a result of the shifts in the location of global capital (Murphy and Watson 1995; Baum et al. 1999). Many firms have re-organised the spatial location and scale of their industrial operations, particularly manufacturing, by relocating overseas where labour markets offer greater returns per worker, or by rationalising existing operations to operate at higher capital to labour ratios. This phenomenon has been particularly marked in Melbourne where a high proportion of Australia's manufacturing has historically been located (Beer and Forster 2001). Suburbs such as Sunshine, and St Albans in the west of Melbourne, and Dandenong in the south east, have been particularly affected by these restructuring processes, with unemployment in these areas remaining much higher than the metropolitan average (Dodson and Berry 2003).

A third key spatial process is more recent and relates to the valorisation of the urban fringe as a location for new master-planned residential development (Gwyther 2002; Dodson and Berry 2003). Much of this new development is being undertaken by large private sector development corporations, which operate within national- and global-scale circuits of capital. The urban design of these estates tends to be of high quality and there is significant attention given over to the 'branding' and marketing of the estates, which highlights the quality of the development and the measures undertaken to fabricate a sense of 'community'. These development trends differ from the historic patterns of outer suburban developments populated by modest income earners (Burke and Hayward 2000). The residents of these new outer-suburban estates appear to be of medium- to high income and given the high degree of private sector involvement in the planning and development process, the households settling these estates appear to have a less overt attachment to public processes and institutions, which Burke and Hayward (Burke and Hayward 2000, p.82) have described as "large and unimaginatively laid out, with little reference to issues of environmental sustainability, landscaping, community facilities, or good design".

Each of the three processes described above have implications for Australia's economic, social and environmental outcomes and deserve attention from the Federal government. The enhanced global connectivity of the Australia's central and inner city areas places demands upon governments to ensure that these areas are attractive to global capital through investment and labour markets, both in terms of infrastructure provision, but also in terms of cultural vitality and environmental 'liveability' (Florida 1995). For Australia to continue to attract global investment capital and a workforce geared to the demands of the 21st Century 'informational economy', the good quality of Australian central urban environments must be maintained.

Likewise, in the declining industrial areas which have felt the brunt of Australia's adjustment to global economic change, there is strong evidence that the labour force in these areas has been unable to sufficiently adapt to these changed economic conditions, with the result that such areas remain as concentrations of high unemployment and relatively lower household incomes (Baum et al. 1999). This effect is being compounded by the concentration effects of housing markets (Wulff and Reynolds 2000; Dodson and Berry 2003), and the impact of immigration which is altering the historic socio-ethnic spatial patterns of Australia's suburbs (Birrell, O'Connor and Rapson 1999). That a significant proportion of the urban population is suffering this socio-spatial disadvantage through lack of access to employment opportunities, detracts from Federal objectives in a range of policy areas, such as, but not exclusively, welfare, employment, health, housing and education.

Finally, the economic and social policy challenges posed by new private fringe communities should be viewed as a major concern for Federal policy makers. There is some evidence that the dominance of the private sector in the development and economic organisation of these new suburbs has led to a decline in historic expectations regarding community engagement, the achievement of social cohesion, the formation of social capital, and the availability of sustainable forms of employment (Gwyther 2002). Added to this mix are concerns about the replication of unsustainable urban patterns, regarding the environmental effects of building and urban design, the availability of viable public transport and the timely provision of social and community services. Where state and/or local government agencies are unable to fill this policy void there is a clear role for the Federal government to provide policy leadership on issues of issues.

Wrapped around the three major empirical shifts described above are broader concerns, which relate to issues of environmental sustainability. These are clearly expressed in prominent debates about urban consolidation, provision of infrastructure, transport infrastructure and sustainable modal share, green open space, biodiversity, energy consumption and waste management, water consumption and conservation, the cultural vitality, social cohesion, locational disadvantage, and the role of governance arrangements in enabling these issues to be addressed. The complexity of these pressing urban issues is such that this submission can only attempt a cursory overview, however these are set out in the chapters that follow.

The basic empirical dimensions of contemporary change in Australia's metropolitan areas as set out above deserve much greater attention from the Federal government. There is a responsibility and clearer capacity at the Federal level which must be exercised to ensure that the nation's cities follow sustainable development paths over the coming decades, in order to achieve a prosperous national economy, which does not diminish the quality of the nation's environments nor contribute to issues of global environmental decline. There are historical examples of Federal involvement in urban policy issues, and contemporary Federal policies with current effects, which are strongly expressed in Australia's urban patterns. The following section sets out some of these past programs, and briefly discusses examples of current policies, which have strong urban impact.

Role of Federal Government in Urban Issues

The level of involvement by the Australian Federal Government in the planning of cities has varied significantly since Federation. During recent decades we have seen the shift from a strong Federal involvement in urban matters during the 1970s, with modest involvement under the Better Cities program

during the 1990's under the Deputy Prime Minister Brian Howe. The 1970s program of the Department of Urban and Regional Development placed significant emphasis on the urban and regional dimensions of national development and oversaw a substantial policy program. Better Cities, by comparison, was a much less interventionist mode of federal involvement in urban policy, and since its abandonment in the mid-1990s this has been an area of limited ongoing impact. Essentially, since the mid-1990s the Federal government has withdrawn from overt involvement in specifically urban issues.

Currently there are limited identifiable urban, spatial planning or infrastructure programs operated by the Federal Government. As a result, control and development of urban policies lies primarily with state governments, through housing, spatial planning, infrastructure, transport , and other policy areas and related service delivery mechanisms. This lack of involvement by the Federal government in developing and fostering coherent and sustainable urban policy at a national level is of major concern, given Australia's status as a highly urbanised nation. Much of Australia's economic activity occurs in and is dependent on a thriving, competitive urban context. The Federal Government plays a very significant role in setting the economic and non-urban policy frameworks for our cities. Fiscal policy, interest rates, taxation, housing, transport, environment, migration and other Federal government decisions all have a profound impact on spatial outcomes, without the benefit of an overall urban policy framework..

Two examples of Federal urban policy influence can be seen in the case of policies for housing and roads. The Federal government's 'First Home Owners Scheme' (FHOS) which provides demand assistance to home purchasers in part contributed to strong increases in housing prices in the early 2000s, which in turn put pressure on state government planning processes, particularly growth management, through increased new construction. The housing market effects of the FHOS were compounded by interest rates and monetary policy, which enabled households to obtain cheap credit for property investment purposes.

In roads policy the Federal Roads of National Importance (RONI) program may have contributed to a focus on freeway building to solve urban transport problems, rather than pursuing more sustainable alternatives such as public transport solutions. In Victoria, for example, in the case of the Mitcham-Frankston Freeway, the state government's decision to proceed with this road may at least in part have been influenced by the availability of Federal road funding, in contrast to a lack of Federal finance for more sustainable public transport alternatives. The debate around potential withdrawal of Federal funding from the Mitcham-Frankston project as a result of a state government decision to operate the road as a tollway, highlighted the lack of any mechanism for Federal funding to be re-directed into more sustainable transport infrastructure, such as public transport improvements.

Conversely, inadequacies in urban policy at the state government level can contribute to inequitable spatial distribution of opportunities which in turn have impacts on Federal policy programs. For example, the lack of state government investment in public transport infrastructure in outer-urban areas contributes to a high level of dependence on private motor vehicles, which in turn results in increased pressure on road infrastructure, and heightened demands from state governments for road funding, which also detracts from Federal environmental objectives, such as national greenhouse emissions. Federal leadership on urban policy could contribute to improved priority setting at the state level, with subsequent improvements to urban outcomes that are desirable to the Federal government, such as by favouring public transport alternatives to road-based transport solutions.

The ongoing lack of awareness and acknowledgement by the Federal Government to the strong urban spatial, social and environmental dimensions of its various policy programs is of great concern to PIA and is clearly regrettable, given the importance of Australia's urban areas to the nation's economic prosperity. Federal policy making appears trapped in a mode of analysis which fails to appreciate the broad national spatial and sustainability implications for our cities and towns of some its more significant policy settings and decisions. This perpetuates piecemeal urban solutions rather encouraging wider sustainable outcomes which would be possible with deeper engagement of the Federal government in urban issues or the setting of a national urban agenda.

The Planning Institute Agenda

The Planning Institute of Australia has long argued for an enhanced Federal involvement in urban policy. In its National Policy statement *Liveable Communities - a National Agenda* (2000) the Institute argued that:

> Settlement and land use patterns can have significant impact on a host of national aspirations for the environment, the economy and communities. Without an overarching policy framework there is a danger that these individual responses will have a lesser impact for want of coordination.

More recently, Marcus Spiller (President Elect Planning Institute of Australia) in his paper, *The Case for National Urban Policy* (2003) recommended that:

This overarching framework must:

- Conceptualise Australia's network of cities as a unified force in a global context; that is, the commonwealth should work with the Sates to identify the complimentary roles of the major cities based on the idea of centres of excellence;
- Provide the states with incentives to prepare metropolitan strategies which give fuller expression to these specialised roles;
- Provide the states with special infrastructure assistance in line with these defined roles, even if this means providing more favourable treatment to particular centres at particular points in time; and
- Oblige the Commonwealth to scrutinize its own programs for consistency with the national urban policy.

PIA's position on the need for an Australian Federal urban policy agenda and framework is also supported by industry groups. For example, the Property Council of Australia has called for an enhanced Federal input into urban issues, and avoid the 'accidental' approach to urban issues that has characterised recent Federal policy, such that:

> The Property Council believes that the Federal government has both the capacity, an the responsibility, in consultation with the States and local government, to plan for the long term with respect to industry and workforce development, the provision and maintenance of infrastructure and services, and environmental sustainability.

The PIA position is also reflected in recent international statements regarding the necessity for national governments to operate a strong urban policy. For example, the OECD report on the *Metropolitan Region of Melbourne, Australia - OECD Territorial Reviews 2003* (2003, p.52), concludes:

> Cities are key components in a territorial development strategy. A well rounded national economic strategy cannot ignore the spatial structure of the economy, or the qualities and characteristics of cities that affect economic performance, social cohesion and environmental condition. Whether a city is new or old, or growing slowly or rapidly, matters less than whether local and national governments are prepared to develop policies and guide investments appropriate to the needs and potential Not only must urban issues be given greater visibility and higher priority in national policy; new policies may be needed at national, regional and local levels, and governments at all levels must re-examine their roles and responsibilities.

The short timeframe for submissions to this Inquiry have prevented this PIA submission from discussing the many international examples of federal and national governments which operate strong urban policies. We note, however, that governments such as that of the UK and the European Union have given significant levels of policy attention to ensuring that urban dimensions of policy programs across their multiple levels of government are designed and managed to ensure they meet achieve strong sustainable and equitable urban outcomes. Even the United States maintains a federal Department of Housing and

Urban Development which provides both the policy understanding and the means of program implementation to the Federal government on urban matters.

It is important for the Inquiry to be aware that PIA in its currently Liveable Communities document and in separate policy discussion papers separate to those attached to this submission been developing a range of ideas on issues that are related to planning and sustaninability.

Worthy of particular mention is a major policy project in the area of Climate Change being spearheaded by our Queensland Division. This project has the support of PIA nationally, the Environmental Protection Agency, Queensland and the Australian Greenhouse Office. It is a four stage project which began nearly two years ago. Stage 1, Scoping & Partnerships, has been completed, Stage 2 – Issues Papers are currently in progress with these papers expected to be launched at PIA's National Conference in Hobart in early 2004. Stages 3 and 4, Development of Planning Tools and Consultation & Initial Professional Development (PD) are dependent on future funding and have yet to commence. Ultimately, the project is intended to result in a legacy of on-going PD for planners and continuous renewal of education resources.

Climate Change is a real and immediate issue for planners. The Earth Policy Institute in Washington DC states that at least 35,000 people died as a result of the record heatwave which scorched Europe in August 2003 (19 times the number of people who died from SARS and this created world wide health alerts). The first reports are now emerging where some scientists are prepared to link these recent heat waves in both the US and Europe with climate change. During the same period British Rail was forced to shut down systems because of tracks buckling. Our near neighbours in the Pacific Islands are dealing with the realities of sea level rise in their countries. These are issues which must be addressed by spatial planning, urban designers and transport planners. It is the impacts, addressing them in planning and mitigation strategies, not the causes of Climate Change which are of concern to PIA and the profession. PIA is pleased to have Australian Greenhouse Office support for this project.

Options for a Renewed Federal Urban Agenda

A number of policy options are available to the Australian Federal Government in pursuing a renewed urban agenda. Below are four broad possible options which will be further refined and developed into the context of the PIA's current review of its National Urban Policy Agenda – Liveable Communities to be relaunched in early 2004.

A) AN FEDERAL GOVERNMENT DEPARTMENT OF URBAN DEVELOPMENT AND ENVIRONMENT

Under this option an Australian Federal Government Department would be established with a mandate to provide policy advice, research capacity, and program delivery in a range of urban policy matters. The department would draw together existing elements within the Federal Government bureaucracy which have a strong urban dimension. Such current agencies include the housing function within the Department of Family and Community Services, the transport function of the Department of Transport and Regional Services, as well as the environmental functions of Environment Australia.

This new Department would oversee a policy program which is designed to ensure the ongoing economic, social and environmental sustainability of Australia's urban centres. Funding would be attached to the Department for program purposes.

B) FURTHER EXERCISE OF CONSTITUTIONAL POWERS (SECTION 51)

The Australian Constitution provides the Federal government with powers to influence environmental policies and encompasses taxation, bounties and customs and excise (sections 51(ii), 51(iii), and 90 and 99), as well as specific purpose grants (section 96). Under section 51 the Federal Government may seek to encourage or discourage an activity which affects the environment by subsidising or taxing that activity.

Under section 96 the Federal government may impose conditions on the use of a grant made to a state or territory. An appropriate subsidy and taxation or sanction regime could be established to indicate Federal priorities in urban issues, and to provide incentives to businesses, households and governments to achieve these objectives.

C) A NATIONAL SPATIAL PLAN

A national spatial plan is a further means of achieving coherent and strategic Federal government involvement in policies affecting urban Australia. A national spatial plan would provide policy programs and solutions to urban, suburban and regional Australian cities' problems. Construction of the plan would draw together and include review of current policy programs operated by Federal agencies. This plan would serve as a means of establishing policy priorities, and would have a funding program attached to it to provide incentives to state and local governments to recast their policies in light of the national priorities and the means of expressing these priorities spatially, as determined by the national spatial plan.

D) USE OF EXISTING INTERGOVERNMENTAL PROCESSES

The Council of Australian Governments could be used to establish an agreed upon national urban policy between all jurisdictions on the model of competition policy. This would require a commitment to a common policy and implementation arrangements, timetable for implementation and penalties for non-compliance with the agreed positions. Responsibility for the oversight and coordination of the policy formulation process would rest with Environment Australia. A cross jurisdictional and cross sectoral policy approach would be taken so that ongoing commitments would be made at all levels of participating governments. Primary responsibility for this program at the Federal level would reside with Environment Australia.

Specific policy areas addressed by this submission

The remainder of this submission sets out a series of policy issues which PIA considers to be of most pressing relevance to this Inquiry in the form of discussion papers and policy options.

Each chapter is written in the form of a brief discussion paper to provoke the Inquiry's thinking on the issue. It sets out what the relevant dimensions of the particular policy problem with reference to relevant research and proposes potential avenues for improvement to the way in which the Federal government currently engages in or addresses these issues.

While highlighting possible solutions in each policy area to the Inquiry, these are presented as options for consideration and are not necessarily all be endorsed by PIA.

PIA's final policy proposals will be outlined in its National Urban Policy Agenda – Liveable Communities to be launched later in 2004.

Chapter 1 Preserve bushland and urban green zones

Background and current practice

Biodiversity encompasses the variety of life at the gene, species and ecosystem levels. Australia has a rich and diverse range of native flora and fauna, comprising approximately 450,000 species. Because of its size, age and geological and evolutionary isolation of Australia, some 80 percent of these species are endemic or unique to this continent (Williams *et al.* 2001), and for this reason, the continent is recognised as a region of global biodiversity significance (Major 1988). It is recognised that the protection of biodiversity must consider all of the levels of biodiversity and management strategies should aim to conserve species across a broad range of climatic regions and to conserve all races, variants and subspecies (Williams *et al.* 2001).

Consistent with a worldwide trend, the size of Australian cities has increased dramatically over the last 100 years (Global Urban Observatory and Statistics Unit 1999). Increasing numbers of people are choosing to live in urban environments, with nearly 75% of Australians living in the metropolitan areas of capital or smaller cities and this is projected to increase to 90% by the year 2011 (Newman *et al.* 2001). The growth of urban areas has resulted in the loss of natural habitats and fragmentation of the landscape, and urbanisation is now considered one of the greatest current threats to Australia's biodiversity (Williams *et al.* 2001). The biodiversity value of remnant areas is considered nationally and internationally significant, with over 40% of nationally listed threatened ecological communities occurring in urban fringe areas (Newman *et al.* 2001). Aside from the ecological significance, conservation of native plants, animals and ecological communities increases the quality of life in cities, and provides a number of important ecosystem services (Binning *et al.* 2001).

The pattern of human settlement in Australia is characterised by particularly high rates of urbanisation, low-density cities, and the concentration of the population within 50 kilometres of the coast (Newman *et al.* 2001). Protection of habitat for biodiversity in urban and periurban areas involves tradeoffs between a complex range of land uses including housing development, agricultural production and conservation. Intensification of agriculture at the urban fringe and reduction in property sizes is also a potential threat due to clearing and degradation of native vegetation, increases in introduced predators and weeds, and changes in hydrological, fire and grazing regimes (Dorrough *et al.* in press). In these modified landscapes, significant funding is available for restoration and revegetation projects, but decisions regarding the location and types of plantings are relatively ad-hoc.

Without adequate planning, future development has the potential to further impinge on remaining habitat and substantially reduce the biodiversity value of periurban areas (Lowe *et al.* in review). The importance of managing urban areas in an ecologically sustainability manner is recognised through all levels of government. Establishing legislation to protect biodiversity values in urban areas represents a significant step towards ensuring the ecological sustainability of these regions. However, it is important that ecological knowledge is incorporated into decision-making processes (Wilson & Lowe 2003). Currently,

the design of natural areas in many urban and periurban landscapes is not assessed in terms of the comprehensiveness or adequacy for the protection of biodiversity. There is an opportunity to improve the planning process through a sound, scientific understanding of landscape patterns, species requirements and environmental pressures. To this end, PIA will be establishing an Environmental Planning Chapter in 2004 recognising this as a professional sub-discipline and an area in which the profession will become progressively more active in the years to come.

Data and trends

DECLINE IN BIODIVERSITY

The most recent State of the Environment Report (Williams *et al.* 2001) states that "*the most important cause of changes in threat status that are not the result of new work or taxonomic revision over the last five years has been land clearance for urban and agricultural development.*" Urbanisation has affected and continues to affect biodiversity principally through the spread of exotic species, pollution and the destruction of natural habitat (Yencken & Wilkinson 2000). It is also important to consider that the impact of urban settlements extends far beyond Australia's cities, since large parts of Australia are used for primary production to feed and clothe those living in these urban centres (Yencken & Wilkinson 2000).

The development of Australian cities has modified habitats along much of the coastal fringe of Australia. This has led to loss of many species, a reduction in the variety of flora and fauna and the decline of habitat and landscape amenity. The threat posed by urban development is comparable to many of the other key processes that threaten Australia's biodiversity. This is illustrated in Table 1 using birds as an example.

Table 1 Threats to Australian birds. Threats are divided into those that are continuing and those that no longer occur, either because the taxa are extinct or because the process has ceased and is no longer affecting the surviving birds.

	Current Threats		Former Threats		
Clearance and fragmentation of habitat	Confirmed	Speculative	Confirmed	Speculative	Total
Agriculture	32	4	22	9	67
Mineral extraction	2	4	3	-	9
Softwood plantation	2	1	2	-	5
Urban development	4	3	1	-	8
Forestry operations	3	14	-	-	17
Total	43	26	28	9	106

Source: Williams *et al.* (2001)

Urban areas in Australia are located within regions of regular rainfall and fertile soil, which are generally also areas of high biodiversity (Yencken & Wilkinson 1996). It is estimated that more than 50 percent of threatened or rare plants, mammals, birds, reptiles and freshwater fish are distributed in and around our major cities or in other population growth areas. Table 2 presents the distribution of species of conservation concern within population growth areas.

Table 2. Species of conservation concern occurring in population growth areas

Growth Area	Plants no.	Mammals no.	Birds no.	Reptiles no.	Fish no.
New South Wales	518	4	29	28	12
▪ Greater Sydney	113	0	12	10	4
▪ South-east	-	-	-	-	-
▪ North coast	-	1	18	15	3
Victoria	815	6	30	12	10
▪ Greater Melbourne	92	1	16	8	3
Queensland	1197	18	34	75	20
▪ South-east	186	2	17	21	6
▪ Cairns/Townsville	528	2	12	21	5
▪ Rockhampton	29	1	7	16	5
South Australia	185	8	33	17	5
▪ Greater Adelaide	95	0	11	9	0
Western Australia	1372	20	33	33	23
▪ Perth and the SW	582	5	17	7	3

Source: Australian Bureau of Statistics (1996). Australians and the environment, Australian Bureau of Statistics, Canberra (based on Crome, Foran and Moore unpublished).

In Sydney, only a few percent of the original vegetation remains and about 400 of the 900 native plant species in Western Sydney are considered endangered (SOEAC 1996). The original blue gum high forest and turpentine ironbark forest of Greater Sydney once covered 46,000 hectares. Less than 1 percent and 0.5 percent, respectively, remains (Department of Housing and Regional Development 1995). Additionally, only about 3 percent of each of the original 19,000 hectares of river flat forest and 8000 hectares of eastern suburbs banksia scrub are left and of the Cumberland Plains woodland, only 6 percent of the former 107,000 hectares remains (Benson & Howell 1990).

Around Brisbane only 600 of the original 6000 hectares of rainforest and only 450 hectares of the original 13 000 hectares of melaleuca forest remain (SOEAC 1996). The loss of bushland has been directly linked to the localised extinction of many species, including 11 birds and a number of terrestrial fauna (Ritchie 1993). Significant clearance has also occurred in Perth metropolitan area. Seventy percent of the original wetlands have been destroyed and the remaining 30 percent have been affected to some extent by drainage, filling or mining (Government of Western Australia 1993).

A recent report on the state of Melbourne's environment (City of Melbourne 2003) stated that less than one-third of Melbourne's original vegetation remains and that most of this is forest in the outer water catchment areas. Over the past decade, 68 animals have been recorded as threatened, including five mammals, 47 birds, six reptiles, two frogs and six fish. Seventy-nine plants are also under threat of extinction. The condition of streams in Melbourne was found to have declined over this century, reflected by a decrease in the diversity of stream macroinvertebrates. On a positive note, Melbourne has over 470 community groups actively involved with councils and state and federal governments to restore remnant vegetation and protect threatened species.

The transformation of watercourses and water bodies in urban environments has been another threat to biodiversity (Yencken & Wilkinson 2000). As an example, only 5 percent of shallow freshwater marsh, 2

percent of deep freshwater marsh and 18 percent of permanent saline wetlands remain of those found in the Melbourne region prior to European settlement (Department of Conservation and Environment Victoria 1999).

Urbanisation has also caused significant impacts on Australia's marine environment around coastal cities. Significant losses of saltmarch and mangroves have occurred near urban areas through reclamation, drainage and other developments. These developments have contributed significantly to estimates that over 60 percent of coastal wetlands in southern and eastern Australia have been lost (CSIRO 1990). In addition, there have been localised losses of sea grass beds; for example the majority of sea grass in Victoria's Western Port Bay has been lost (DEST 1995).

Issue identification

The on-going expansion of urban and rural housing development has important implications for biodiversity. This expansion will lead to large areas of land, previously under native vegetation or agricultural use subsumed by housing, road networks and associated infrastructure.

Ecological impacts associated with urban expansion and rural residential development include:

- clearing of remnant native vegetation and native animal habitat for residential development and for new fire breaks
- increased predation by domestic cats and dogs on native fauna, and resultant loss of animal species
- further introduction of environmental weeds and other 'garden escapees' into native vegetation
- problems associated with disposal of putrescible and non-degradable waste;
- sewerage treatment and disposal problems affecting streams and land;
- increased road traffic, road construction and pressure for road improvements;
- increased recreational use of environment and associated disruption of flora and fauna
- altered drainage and increased stormwater;
- segmentation of streams between retarding basins;
- impact on estuaries,
- salinisation arising from excessive clearance of recharge areas,
- degradation of freshwater ecosystems;
- climate change, and
- impacts on other parts of Australia that are used for primary production to support those living in urban centres.

CLEARING NATIVE VEGETATION

Over the past 150 years, extensive vegetation clearance has occurred around Australia's metropolitan areas for grazing, cropping and residential occupation. The impacts have included loss of native plants and animals, slowly rising water-tables and salinisation of land and streams. Increased run-off from the cleared land has increased stream flows and led to significant erosion both of the land, streambanks and streambeds.

The size of the remnant area of native vegetation is a key determinant of its viability and value as habitat. Its size influences the botanical complexity of the fragment and the diversity of native animal and bird species that can survive in it over time. Studies show that the smaller the fragment, the fewer species that

can depend upon it for survival (Bennett 1998). In addition, studies of islands of native vegetation indicate that if the remnant is small, slow deterioration occurs over time with the incursion of weeds (edge effects) or the loss of influences necessary for natural plant reproduction, such as fires - or protection from frequent burning. If the fragment is small and isolated, or has been significantly modified (for example, through the clearing of understorey species), its faunal species are less likely to be able to maintain sufficient genetic diversity or find sufficient food and habitat to reproduce and survive (Bennett 1998).

Despite native vegetation retention controls, clearing of native vegetation continues across metropolitan regions of Australia, for agricultural land, for residential development, to assist in road works and to increase access for certain utilities. Ecological impacts of clearing of native vegetation include:

- immediate loss of native plants
- immediate threat to biodiversity through loss of habitat for native animal and bird species
- increased fragmentation of remaining vegetation and edge effects, resulting in the further decline in presence and abundance of native plant and animal species over time
- increased water erosion, water-logging, raised groundwater tables depending on the replacement groundcover
- increased occurrence of landslips
- increased surface water run-off and non-point source pollution (i.e. nutrient run-off from fertiliser use or domesticated animals) of streams
- increased streamflow, accelerated streambank erosion, siltation of streambeds and loss of in-stream environmental values including habitat for fish and organisms which remove pollution.

INTRODUCED SPECIES

Exotic organisms have been identified as a major threat to biodiversity (Williams *et al.* 2001). 'Sleeper' weeds (species that have established, but are yet to become a widespread problem) are now recognised to be of major concern, as are exotic organisms that might find their way through Australia's quarantine barriers as a result of trade, tourism and other human activities. The effects of genetically modified organisms (GMOs) on biodiversity could also be significant.

Several introduced animal species - cats, foxes and dogs - prey upon native wildlife, contributing to the decline in populations of small and medium sized mammals, birds and reptiles. Weeds have a major impact on native vegetation communities, and are an increasing problem for remnant vegetation throughout metropolitan regions. Disturbance or clearing of understorey vegetation, slashing, vehicle use and fire can provide opportunities for invasion. Grazing of domestic stock and recreational use can assist the dispersal of seeds into bushland. Small fragmented remnant vegetation is more vulnerable to infestation by pest plants and animals due to the pressures from surrounding land use. Many environmental weeds that cause significant damage are common in suburban gardens.

Ecological problems associated with pest plant and animal infestations may include:

- modification of the floristic composition and ecological resilience of nature reserves, bushland and wetlands, threatening viability of native flora and reducing natural diversity
- degradation of riparian conditions where thickets of environmental weeds take hold on stream and river banks, leading to loss of habitat for terrestrial plant and animal species, loss of shading and nutrient input for aquatic species
- chemical contamination of native plants, animals, soils and streams where spraying with herbicides is used to reduce pest plant infestation
- erosion where removal of large numbers of weeds is not followed by adequate planting

- impeded access and reduced habitat and food plants for native fauna
- reduction in populations of native plants and animal species through predation, competition for resources and introduction of disease
- prevention of regeneration, soil disturbance, soil erosion, and weed dispersal
- reduction of nesting and breeding sites for native wildlife
- loss of species or diversity in a local or regional context

AGRICULTURE

Agricultural activity in urban areas across Australia is highly diversified with the dominant activities being grazing, intensive agriculture (horticultural), cropping, and mixed and hobby farming.

While farming methods are being developed which are more sustainable and early adopters are paving the way to reduce damaging environmental effects, there are many ecological problems associated with current agricultural activity which may include:

- increased nutrient run-off and contamination of surface water run-off from pastures and cropping land, where the riparian zone has been disturbed, degraded or destroyed by clearing and/or grazing
- accelerated soil erosion, soil slumping and compaction
- degradation of riparian ecosystems where grazing and stock watering is permitted along stream and river banks - leading to loss of habitat for terrestrial species, and stream bank erosion and degradation of water quality and habitat for aquatic species
- long term native vegetation and native bird habitat loss in paddocks where isolated native trees or clumps of vegetation fail to regenerate because of grazing in the understorey or through repeated removal by cropping
- chemical contamination and toxic impacts on the health of native fauna, and
- increasing pressure for clearing native vegetation to keep farms viable

FIRE MANAGEMENT

Indigenous peoples of Australia have valued and utilised components of biodiversity for at least 60 000 years (Thorne *et al.* 1999) and the use of fire by indigenous Australians helped shape the terrestrial environment. Fires help create and modify the mosaic of landscape and biological patterns within their sphere of influence and may increase the susceptibility of some areas to erosion. The influence of fire on native ecosystems is profound, and much is still to be learnt about the long-term effects of both single and repeated fires on natural ecosystems.

The impact of altered fire regimes was listed on the 2001 State of the Environment Report as a key threatening process (Williams *et al.* 2001).

"*Altered fire regimes have been implicated in local extinctions of several vascular plant species across Australia ... and inappropriate fire regimes have been associated with 19 plant species threatened with extinction at the state or Commonwealth level.... The changes in habitat structure that come with the decline and elimination of woody plant species under frequent fire regimes have demonstrable implications for the persistence of other groups of biota*" (Williams *et al.* 2001).

In an urban setting, fragmented ecosystems reliant on fire for key ecological processes are at risk from fire suppression, where as upland forest vegetation close to urban developments are at risk from too frequent prescribed burns, grazing and/or slashing to reduce fuel loads.

TOURISM AND RECREATION

The pressures placed on the open space network by the high and increasing demand that recreational users and visitors place on the natural environment The impact of tourism and recreation in urban areas may include disturbance to wildlife breeding sites, vegetation trampling, erosion and increased litter. Additional impacts may include soil compaction, weed invasion, disturbance and removal of native vegetation and increased fire risk.

TRANSPORT AND ROAD CONSTRUCTION

The environmental implications of road improvements and widening can be significant. Native vegetation beside road reserves and railway lines may have high conservation and landscape value. This is frequently the case in agricultural areas where vegetation is extensively cleared for production. Such linear corridors of vegetation allow native fauna to travel between larger areas of bushland and improves the genetic viability of populations of particular species and allows populations to disperse after breeding or relocate to new habitat after fire or, possibly, in response to the greenhouse effect. Public authorities and local councils should consider factors such as the blending of roadway alignments with surrounding landforms, maintenance and enhancement of rail and road-side vegetation, and the rehabilitation and revegetation of rail and road-sides after construction work, including the use of plants grown from locally collected seed. Ongoing maintenance of roads and rail lines also has an impact on remnants.

CLIMATE CHANGE

By 2030, average annual temperatures in Australia will be between 0.4 – 2.0°C higher than in 1990, and by 2070 it will be between 1 – 6°C warmer (CSIRO 2001). These are dramatic changes, and they are predicted to occur within our lifetimes. While some Australian animals and plants are adapted to withstand dramatic seasonal changes in climate each year, many species have quite limited ranges of long-term average climate. Temperature ranges in the order of 1 – 2°C and 20 percent variation in rainfall mean that Australian animals and plants are vulnerable to long term climate change (CSIRO 2003). Climate change could have a greater impact on species than all human interventions to date.

Earlier in this submission, PIA's major policy project on Climate Change is mentioned.. It has support from the Environmental Protection Agency, Queensland, and the Australian Greenhouse Office. Stage 1, Scoping & Partnerships, has been completed, Stage 2 – Issues Papers are currently in progress with these papers expected to be launched at PIA's National Conference in Hobart in early 2004. Stages 3 and 4, Development of Planning Tools and Consultation & Initial Professional Development (PD) are dependent on future funding.

This Climate Change project is wider than this discussion paper topic which addresses bushland and urban green zones. Climate Change is a real issue for planners not in the future, but right now. The Earth Policy Institute in Washington DC states that at least 35,000 people died as a result of the record heatwave which scorched Europe in August 2003 (19 times the number of people who died from SARS and this created world wide health alerts). The first reports are now emerging where some scientists are prepared to link these recent heat waves in both the US and Europe with climate change. During the same period British Rail was forced to shut down systems because of tracks buckling. Our near neighbours in the Pacific Islands are dealing with the realities of sea level rise in their countries. These are issues which must be addressed by spatial planning, urban designers and transport planners. It is the impacts, addressing them in planning and mitigation strategies, not the causes of Climate Change which are of concern to PIA and the profession.

Returning to the issue which is the focus of this discussion paper, climate change affects ecosystems and wildlife in several key ways (taken from CSIRO 2003):

- Inability to keep pace with changing conditions;

- Barriers to movement (This is a particularly important issue in urban environments as species that might otherwise be able to adapt to climate change will be threatened because the natural environment is now fragmented by human settlement);
- Climate change suits some species and not others;
- Effects on physiology, and
- Effects on relationships and behaviors.

The 2001 State of the Environment Report states that "*climate change remains a key issue confronting Australia. The response of the Australian government to the Kyoto Protocol has significantly changed the way climate change is viewed and the amount of resources directed to this issue. In terms of the climate change policy of the present Commonwealth government, emphasis has been placed on the mitigation of greenhouse gases emissions through processes such as the Greenhouse Challenge, with the direct and indirect effects of climate change on biodiversity receiving much less attention. This situation must change if the potential impacts of climate change on terrestrial and marine biodiversity are to be adequately researched, better understood and managed. The important role of native vegetation in carbon sequestration and the mitigation of climate change is well known. Despite this, some Australian jurisdictions continue to permit high rates of land clearance*" (Williams *et al.* 2001).

DEGRADATION OF FRESHWATER AQUATIC ECOSYSTEMS

The continued degradation of freshwater aquatic ecosystems is also of major concern. Declines in several species of frog, aquatic tortoise and lizard continue and are primarily the result of continuing declines in wetlands, riverine systems and water quality (Williams *et al.* 2001).

Best practice

The principles underlying biodiversity protection are:

- protect key sites of biodiversity
- maintain the viability of populations and increase the diversity of species within remnants
- ensure movement of migratory species
- reduce susceptibility of species to disease and threats such as weed invasion and predation from pest animals (Bennett 1998)

Some examples of policies and practices that have incorporated these principles are described below.

HABITAT PROTECTION, RESTORATION AND COMMUNITY INVOLVEMENT:

The Growing a Green Web project, by the City of Casey in partnership with Greening Australia Victoria, is engaging broad cross cultural community involvement to restore vegetation in an urban area with limited remaining natural vegetation, at the same time building understanding and commitment to the environment.

The on-going re-establishment of vegetation and wildlife corridors along the lower reaches of the Yarra River linking the disjunct sections of the Yarra Valley parklands provides an important case study in habitat restoration for migratory and threatened species as well as valuable recreational corridors. In addition, the development of a fish ladder at Dights Falls, has restored access to a significant length of the Yarra for five native fish species.

The Merri Creek Management Committee, a body dedicated to the restoration and conservation of a major creek system in Metropolitan Melbourne, has achieved impressive results through its coordination

of four local councils, Melbourne Water, local industry and residents. Strategic long-term planning, sound financial management and community participation have been key factors in the Committee's success.

The management of the Evans Street grasslands in Sunbury, by a Committee of Management highlights the important role communities can play to protect pockets of biodiversity. This dedicated community group voluntarily undertakes weeding and propagation for replanting of native species, and arranges a regular control burn by the CFA. The group's ability to focus on a single area contrasts markedly with larger agencies responsible for the management of many small reserves that can be faced with conflicting priorities.

INFRASTRUCTURE

Installation of telephone lines in Cape Tribulation National Park in north Queensland departed from the norm of cutting a 5 metre easement in vegetation beside the road. Instead, the line was installed under the table drain along the roadside and in some sections, by using hand held machinery through the vegetation. This resulted in no clearing of easements and no tree removal.

INTRODUCED SPECIES

The introduction of by-laws in the Shire of Eltham (now Nillumbik) to control the sale and distribution of environmental weeds through nurseries and inform the community of the risks associated with introduced common garden plants is an important step in reducing weed invasion into remnant vegetation.

The establishment of dog training programs by Parks Victoria to improve responsible pet ownership is an innovative method to increase awareness of the impacts of pets on native vegetation, streamsides and water quality.

COMMUNITY EDUCATION

Many measures to protect biodiversity involve increasing awareness and understanding of the biodiversity values by the general public. Protection of the endangered Hooded Plover, which nests along sections of Victoria's coastline including Mornington Peninsula and Point Cook, can be enhanced by keeping people off the beach during the plovers' short nesting season. Signs, temporary fencing and efforts to raise community interest in the plover have been used effectively to retain breeding success of known colonies.

Councils responsible for coastal management in and around Sydney beaches have established a program to protect the fragile intertidal zone. Local residents have undertaken basic training and act as volunteers explaining the importance of conserving the zone from risks such as uncontrolled shellfish collection, trampling and rubbish dumping. Coupled with signs in a variety of languages this educative rather than enforcement approach to coastal protection has proved highly effective.

PLANNING FOR BIODIVERSITY VALUES (TAKEN FROM WILLIAMS *ET AL.* 2001)

Redland Shire, to the south-east of the main Brisbane city area, contains a mixture of urban and non-urban land uses and has the range of environmental and biodiversity issues typical of such an area. It is a high-population growth area with many pressures for development and significant remnant native vegetation areas. Among other specific issues, some vegetation in the Shire is habitat for the Koala (*Phascolarctos cinereus*) and is subject to the Queensland Government's State Planning Policy (SPP) 1/97 *Conservation of koalas in the Koala Coast.* Redland Shire Council's gazetted Strategic Plan of 1998 incorporates detailed provisions for environmental protection and ESD, including habitat protection and the implementation of SPP 1/97 (Strategic plan S3.1.1c). Redland reflects a wider trend in local government to extend traditional 'tree preservation orders', that concentrated on urban trees and their visual amenity, toward more broadly based vegetation protection policies including a range of biodiversity values. In Redland Shire *Local Law No. 6: Protection of Vegetation* (No. 1 of 1998), the Shire sets out the process for permission to remove or damage vegetation, assessment procedures, possibilities for removing protection orders, and so on. The definition of 'significant vegetation' in the Law covers a wide range of

values, including Indigenous cultural significance, role as wildlife habitat or wildlife corridor, rare or threatened species status, educational or recreational use, aesthetic appeal, and importance to 'maintaining life-supporting capacities of ecological systems for present and future generations'. While, as with all recent policies and laws, implementation of this measure cannot be assessed as yet, this is an example of some of the key definitions and intents of the Convention for Biodiversity being translated into practical local contexts in a relatively short time.

Policy options

The protection of extensive tracts of wild land, free of development is critical for the conservation of Australia's unique biodiversity. However, these alone will not be sufficient, as many species exist primarily on private land or in areas subject to human disturbance. Additionally, the protection of biodiversity should aim to conserve species across a broad range of climatic regions and to conserve all races, variants and subspecies (Williams *et al.* 2001). For these reasons, it is critical to find ways to inhabit and use lands in urban environments in a manner compatible with biodiversity conservation.

Effective conservation of biodiversity will require changes to current approaches to land use practices, pollution control, resource consumption, waste and recycling, valuation of natural resources and the role of the community and individuals in protecting the environment. Good government policy is fundamental to implementing the changes needed. However, history has shown that policies relating to biodiversity conservation are not commonly matched by effective policy implementation and good biodiversity outcomes. During the 1990s, Australia's biodiversity has experienced continued degradation and decline (Williams *et al.* 2001). Ecologically sustainable development in Australia's urban areas will not be possible unless many more financial and human resources are directed to support improved understanding and management.

The key measures outlined below are recommended to promote the conservation of biodiversity in urban areas. The Federal Government has an important role to play in implementing these measures, particularly through coordinating federal, state and local efforts.

FINANCING THE PRESERVATION OF THE NATURAL VALUES OF URBAN AREAS

The recently released *Coordinating Catchment Management* report, from the bipartisan House of Representatives Standing Committee on Environment and Heritage, recommended that a National Environment Levy be put in place for the next 25 years to help fund programs to address the need for funding to promote the conservation of biodiversity (Williams *et al.* 2001). Additional mechanisms may be required to ensure that the funding is adequate, and comprehensive in its coverage of ecosystems and biota. Background to this issue and some suggestions and case studies are presented here.

A research project conducted by PhD student Nick Williams at Melbourne University quantified and determined the causes of native grassland loss in the western and northern suburbs of Melbourne. Native grassland is a threatened vegetation community that is protected under State and Commonwealth legislation. Its conservation values have been recognised by government for at least two decades, leading to the implementation of a range of policies designed to protect it. Williams' research shows that these have largely been ineffective in an urban landscape and close to 50% of the extremely small amount of native grassland present in 1985 has since been lost to development and weed invasion. This is due to a number of factors that have relevance to the preservation of open space, biodiversity and native ecosystems in all Australian cities.

The research results highlight that private landholders cannot be relied upon to preserve bushland, urban green zones or open space in urban areas due to the high opportunity cost of not developing their land. In rural areas, the amount of money forgone by retaining or protecting native vegetation is relatively small compared to urban areas and the landholder may receive other benefits by preserving habitat such as protection from the wind or natural pest control. In an urban setting these benefits are small relative to

the potential large financial gain accrued by selling property to a developer. Consequently, in urban areas and those on the outskirts of Australian cities it will be up to the various levels of government to acquire and protect bushland and open space.

There are a number of models that have been successfully used to finance the preservation the natural values of urban areas.

- Brisbane City Council has a bushland preservation levy which uses a proportion of residents' rates to buy areas of environmentally significant bushland.
- The City of Boulder, Colorado had a successful open space preservation scheme that has operated for over 60 years. A small sales tax increase has been used to buy property on the periphery of the city to prevent urban sprawl. Some of the areas bought have environmental values while others are maintained as farmland with the City leasing them to interested farmers.
- Funding ecosystem services through water or biodiversity trusts
- Another potential source of income is that a small percentage of the stamp duty payable on all property transactions be made available to preserve bushland and open space. Using this method the amount of money collected for bushland purchase is tied to the level of housing development.

An excellent review of the options available to government to preserve native vegetation is provided by (Binning and Young, 1999; Binning *et al.*, 1999).

Changes to policies regarding the sale of government owned land will also contribute to the preservation of bushland and open space in urban areas. Currently government departments at both state and federal levels dispose of land surplus to their requirements through public sale. This land often has features of conservation value but unless these values trigger legislation the current financial management paradigm treats these lands as property rather than public assets and encourages realisation of their real estate values (Adam 2001). Consequently, large areas of public land have been bought by developers and many conservation values have been lost.

LONGER TERM CONSERVATION PLANNING BASED ON A SOUND, SCIENTIFIC UNDERSTANDING OF LANDSCAPE PATTERNS, SPECIES REQUIREMENTS AND ENVIRONMENTAL PRESSURES.

It is important that ecological knowledge is incorporated into conservation planning and decision-making processes. Currently, the design of natural areas in many urban and periurban landscapes is not assessed in terms of the comprehensiveness or adequacy for the protection of biodiversity. There is a need to improve the planning process through a sound, scientific understanding of landscape patterns, species requirements and environmental pressures.

Conservation planning needs a long-term perspective, rather than reacting to threats as they arise. Because areas of remnant bushland and open space are much more likely to be lost if they are in close proximity to cities and major roads, it is essential that conservation planners work in concert with town planners and those responsible for major infrastructure projects. Using this approach any plans for freeways, highways or subdivisions can be situated to avoid significant native vegetation. Just as importantly, areas of high biodiversity significance can be targeted for purchase by conservation management agencies early in the planning process before the inflationary pressure of the development impacts on land prices. There are many instances where state and local governments have been unable to purchase highly significant sites in peri-urban areas for preservation due to price of the land, which becomes prohibitive once the land in question is located close to infrastructure, but was much lower prior to the development project being announced.

NATIVE VEGETATION AND HABITAT RETENTION & REHABILITATION

Retaining stands of natural vegetation in urban regions is of paramount importance and should be recognised at a Federal level. Maintaining and establishing wildlife corridors and re-establishing connections between fragmented patches of remnant vegetation are also important, particularly in the

light of evidence of human induced climate change. All efforts should be made to protect and properly manage any remaining areas of remnant vegetation, particularly where identified as sites of significance.

Consideration of the establishment of biodiversity offsetting mechanisms as a condition of future developments should be investigated to meet the commitment to no net loss of biodiversity. This is in the process of being implemented in several states of Australia and has the potential to be implemented at a national level. This concept has intuitive appeal, but we cannot afford to be naïve about the difficulties with implementation. A transparent method is required, based on sound science and a thorough understanding of the tradeoffs involved.

Permits for clearing of native vegetation on agricultural and residential land should be reviewed to ensure they are not issued where the native vegetation to be cleared contributes to an existing or proposed wildlife or vegetation corridor or refugia, and if cleared, would not diminish the viability or value of any remaining associated area of native vegetation or habitat.

Finally, financial commitment is required to support professional management of urban reserves, reducing reliance on volunteerism. While volunteer work is valued, there is a danger in mismanagement through inexperience and lack of formal training.

URBAN AND INDUSTRIAL EXPANSION AND RURAL RESIDENTIAL DEVELOPMENT

- Promote and facilitate further urban consolidation in areas other than those identified as having significance for biodiversity
- Establish stronger controls to limit broad hectare subdivisions where remnant vegetation or threatened species habitat is located.
- Prevent loss of habitat from future infrastructure installation such as gas and water pipelines, telephone and power lines through the development of ecological codes of conduct with service providers to ensure:
  - alignments are over cleared land rather than remnant vegetation wherever possible.
  - the method of installation is the least damaging.

  Note: Utilities often prefer roadside reserves because use of public land is administratively easier, less expensive and access along a road makes it easier to install and service equipment. As reserves are managed by a number of authorities this can lead to no single body taking responsibility for vegetation protection.
- Establish stricter conditions on land development permits to improve the requirement for open space or off-sets in lieu of open space as a means of restoring and protecting important habitat such as remnant vegetation and riparian zones. This is particularly relevant for industrial estate developments.
- Increase the provision of accessible strategic advice, such as the new format planning schemes being developed under the new format planning schemes, to local government planning processes to promote development in the least sensitive areas and to protect and promote corridor areas (such as the green wedges in greater Melbourne)
- Enhance current information management systems so that information about biodiversity values for any particular area can be easily accessed early in the planning cycle by local government, developers, and conservation groups.

WETLANDS & RIPARIAN (STREAMSIDE) VEGETATION

- Strong and effective planning provisions to protect remnant wetlands, and restrictions on developments in floodplain areas should be incorporated across the region through local planning controls.

- The development of habitat links for the ongoing viability of the remaining vegetation fragments, particularly along creek and waterways should be developed.
- No clearing of riparian native vegetation should be permitted, irrespective of its condition. Planting of inappropriate species should also be discouraged.
- No agricultural or residential use of riparian zone land should be allowed, and restoration of native vegetation buffers should be made a priority. Rate incentives should be investigated as a means of encouraging rapid response by landholders.
- Fencing to protect the riparian zone and stream banks from grazing should be implemented, with rate incentives provided to assist meeting costs.
- Continued cooperation between municipalities and agencies in projects such as catchment planning and stream improvement works.

INTRODUCED SPECIES

- Development of an integrated approach to weed eradication among all agencies and the community to target and control problem areas is required.
- Strong regulations, backed up by on-going community education programs is required to control domestic pets, in an effort to protect native wildlife and water quality. Responsible pet ownership programs should be continued and broadened.
- Feral animal eradication programs – particularly of foxes and cats - should be introduced or expanded.

FIRE MANAGEMENT AND BIODIVERSITY

- Many of the areas of remnant vegetation in urban areas will require active management for fire to ensure the maintenance of suitable habitat for endangered and threatened species of plants and animals.
- In outer urban and rural areas, local government should play a lead role in adoption of an ecological code of practices for roadside management, which addresses fire management among other issues.

TOURISM AND RECREATION

- Recreational pressures should be monitored annually to assess environmental impacts in the region. Assessment should include information and assessments of visitor numbers, demands and impacts of tourists on specific parks and other natural sites, studies on traffic flows, associated pollution problems, and environmental impacts and constraints. The strategy should seek to 'rest' and 'rotate' recreational areas to protect them and assist their regeneration; identify and provide resources for restoration works to repair the inevitable damage which intensive use creates to infrastructure, paths and the bush, and incorporate community activity in these restoration and protective programs.
- Major expansion of the open space network to diffuse increasing recreational pressures should occur in accordance with the original intent of the strategic open space purchase program

TRANSPORT AND ROAD CONSTRUCTION

- Effective traffic management such as speed restrictions and safe passage via under-road tunnels for wildlife where required should be investigated.
- Any further freeway development / expansion should in the first instance be assessed in the light of alternative transport policies, should not be constructed along native vegetation and waterway corridors, and should be planned to minimise impacts on biodiversity.
- Conservation of roadside reserves should be a priority when realigning or upgrading roads.

COMMUNITY INVOLVEMENT

- Promote and facilitate urban community involvement in the stewardship of biodiversity values;

- In the urban fringe encourage landholder involvement in schemes such as Landcare and Land for Wildlife.
- Promote community group projects that assist in restoring and rehabilitating flora and fauna habitats

Chapter 2 Ensure equitable access to and efficient use of energy, including renewable energy sources

Background and current practices, trends and data

Energy supply and use is associated with many environmental, social and economic consequences. When considering urban areas, a large proportion of these impacts may occur elsewhere, as energy is used to produce food, fibre and materials for use in the cities. And often energy resources outside cities are mined and processed for delivery to the city to satisfy its operating energy needs.

We are often told that energy is an essential for civilised life. But, while it is true that we need some energy, the question is whether we need the enormous amounts of energy now consumed by cities and the people in them. The perception of our dependence on continuous and ever-growing supply of energy as an essential is, to a great extent, an outcome of our past choices as to the energy supply systems and the energy using technologies. For example, we can compare food supply and energy supply. We supply our food from diverse sources, and most households have significant stores of food. So an interruption in the supply of, say, chicken, does not threaten the functioning of our society. However, one failure in our complex electricity supply system can severely impact on the lives of thousands, or even millions, of people. Since two-thirds of the world's oil is in the Middle East, a few countries exert enormous influence over the ability of the developed world to continue its car-based lifestyle.

While our large, hierarchical energy supply systems have made sense over the past 60 years, as society has developed rapidly using crude and inefficient technologies (which use energy very wastefully), we now know that the impacts of our present fossil fuel-based, centralised energy supply systems are unsustainable. We need to rethink the way we supply and use energy: and, since most of our energy use is either in or for cities, they must be a key focus of attention.

A cubic metre of natural gas is not much use without a stove or heater. People and businesses do not want energy: they want the services that are provided by energy combined with technology. Only when we understand this, and focus on the sustainable delivery of services, not energy, will we be able to achieve equity and economic success. This also means paying attention to reliability and total cost of delivery of services that involve energy.

A fundamental problem is that we generally ask the wrong questions when we are developing energy policy. For example, policy debate often focuses on the cost per unit of energy generated at the power station or gas well-head. The reality is that it's the total real cost of delivering energy services that matters. This includes a number of elements:

- The total cost of energy equals the cost per unit multiplied by the number of units – so improving efficiency can offset higher prices. It is perfectly feasible to offset the possible higher unit costs of environmentally preferred energy (where they really do cost more) by using less of it. Indeed, many businesses and households are already doing this.
- The cost of energy consuming equipment is also a component of an energy service. Oversized equipment is often more costly up-front as well as being less efficient when operating outside its optimum conditions
- The price of energy includes many subsidies, such as failure to include a price for greenhouse gas emissions. There are numerous additional subsidies, worth billions of dollars, to fossil fuel use (see Riedy, 2003). Peak energy demand is often subsidised due to limitations of metering and political sensitivities: for example a recent Sydney study estimated the real cost of supplying summer peak electricity demand at more than $3.80/kilowatt-hour, compared with a price of 12 cents. Then there are the subsidies for rural energy consumers... ..
- The price of energy should include the cost of delivering it to the consumer. But the present energy market arrangements blur transmission and distribution costs, and fail to give full credit to local energy sources that reduce the need for investment in supply infrastructure.

So most debates about the relative generation cost of coal, gas or renewable energy miss most of the real point – and the real costs and benefits. What's more, when we debate the potential of new energy solutions, we compare emerging cottage industries and small scale production solutions with mature technologies that have been built over the past century with massive community input – or what some might now call subsidies.

When we look at the overall economics, there are more arguments to re-think how we satisfy our energy requirements.

The energy supply sector has, in the past, been able to capture political and economic power by painting itself as the 'engine of economic development'. Given the technologies we have chosen to apply, and the types of industries we have chosen to base our economic development on, this has been true. But recent evidence shows that shifting investment from energy supply to improving the efficiency of energy use benefits the economy – see for example the Allen Consulting study of Victoria's 5-star energy rating for housing (Allen 2002). This is because the conventional energy supply sector employs few people (48,000 in 2000-01, a fifth as many jobs per unit of Value Added as the average business (ABS 2002)), absorbs enormous amounts of capital, and delivers low returns on investment. Alternative ways of satisfying our energy service needs such as energy efficiency create more employment and can be less capital intensive. To illustrate this, the return on net worth of the electricity, gas and water sector in 2000-01 was less than half the average for all Australian business, excluding agriculture forestry & fishing (ABS, 2002). In contrast, the Australian Government's appliance energy efficiency program is delivering millions of tonnes of greenhouse abatement at a net cost of -$30 per tonne – a negative cost (NAEEEC, 2001). And lower energy bills free up money for investment in other activities that deliver bigger economic returns than conventional energy supply – such as even more investment in energy efficiency improvement or renewable energy.

The focus of energy market reform has been on minimising the price per unit of energy for large electricity customers, not the total cost for all customers, so it has not necessarily reduced energy costs for many businesses and the community, as growth in total consumption has continued. Indeed, ABS (2002) shows that total income of the electricity, gas and water sector rose by 29% over the five years to 2001, well above the rate of inflation – although this figure may be distorted by the dramatic structural changes in the industry over that period. Further, since non-transport energy is only around 2% of expenses for most businesses, but the cost of blackouts and power surges is high, due to their impact on production, it

could be argued that excessive emphasis on energy prices at the expense of reliability and quality of supply and encouragement of energy efficiency and demand management, may well have an overall negative impact on the economy and our society – and it has certainly increased greenhouse gas emissions (see Allen Consulting 1999).

The challenge we face is to break out of the mind-set that using more fossil fuels is good for the economy, and create new ways of satisfying our energy service needs that are better for the economy, the environment and society.

To do this, Australia, like many countries (including both developed and developing countries) must find a cheap alternative source of energy (such as hydrogen technologies which have yet to be researched and developed) or find ways in which to 'decouple' fossil fuel-sourced energy growth from economic growth (WRI, 1998). This decoupling can be achieved in a number of ways, including:

- Utilising more energy efficient technologies and systems in both energy use and energy conversion
- Replacing physical activities with electronic alternatives
- Shifting from material to service based economies (for example, replacing paper-based commerce with electronic commerce, production and use of virgin metals with recycling)
- Re-using and recycling materials, using materials more efficiently and shifting to less energy-intensive materials (on a lifecycle basis)
- Utilising renewable energy resources and materials
- Building low energy and greenhouse intensity export and import replacement industries – already the lower energy intensity services and manufacturing sectors are growing their share of exports (ABARE, 2000), but we need to address import replacement and further develop exports in these sectors

This list highlights the importance of using modern technologies and systems to reduce reliance on the Earth's natural capital, and to utilise both the existing stocks of materials already extracted, and to use renewable resources (within their limits). This will involve strategies such as:

- ongoing development of strategies to extract useful materials and energy from wastes, and even mining of landfills
- development of materials that do more with less, such as foamed metals and carbon fibre composites, and utilisation of recycled and renewable feedstocks and energy for production of metals and plastics
- design of buildings and equipment for materials and energy efficiency, to utilise environmentally preferable materials, as well as recovery of materials at the end of life

Australia's conventional energy use has grown steadily over the long term, as shown in Figure 1. Of this total, 5.4% was from renewable sources in 2001 (ABARE, 2003).

Figure 1. Trend in Australian primary energy consumption (DRE 1987, ABARE 2002)

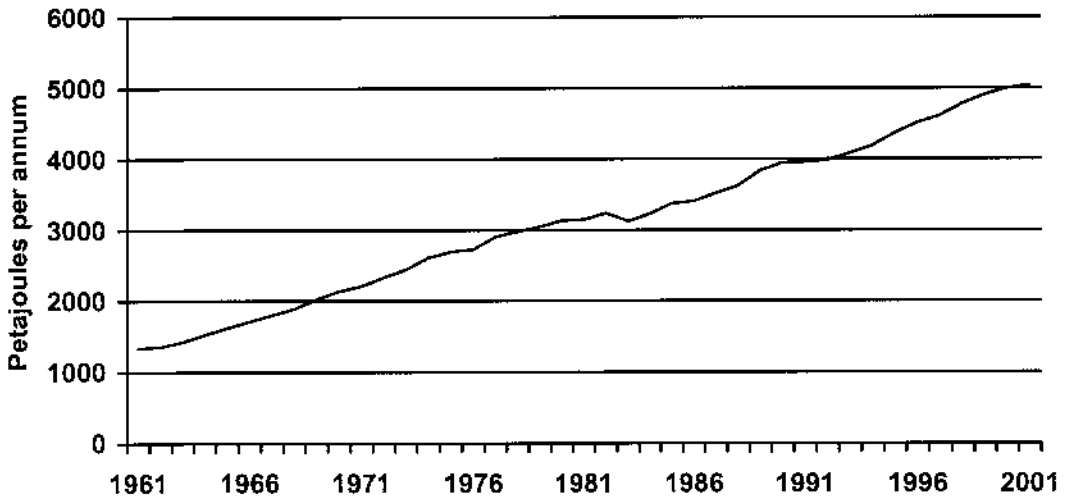
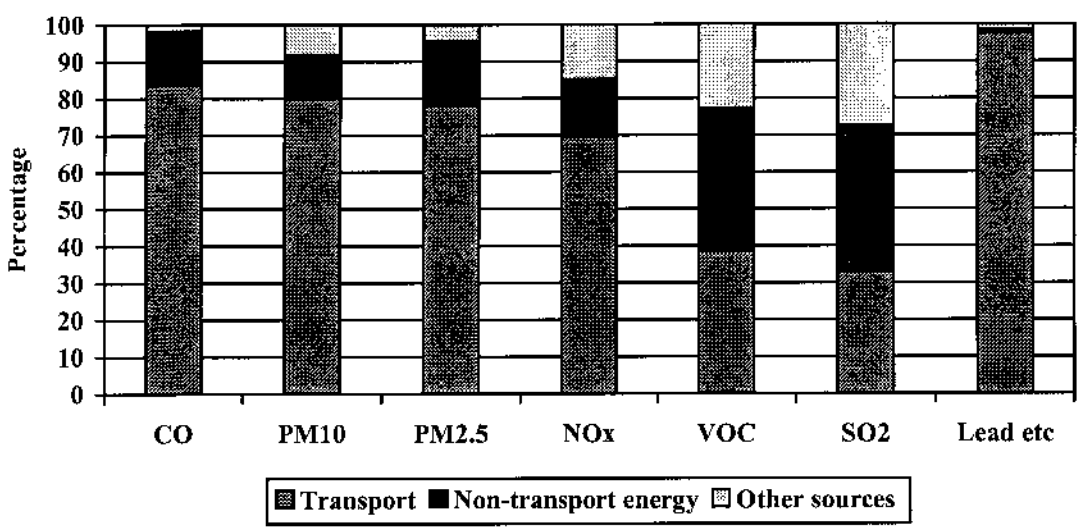


Figure 2. Contributors to air pollution in Melbourne, 1995 (EPA Vic, 1998)

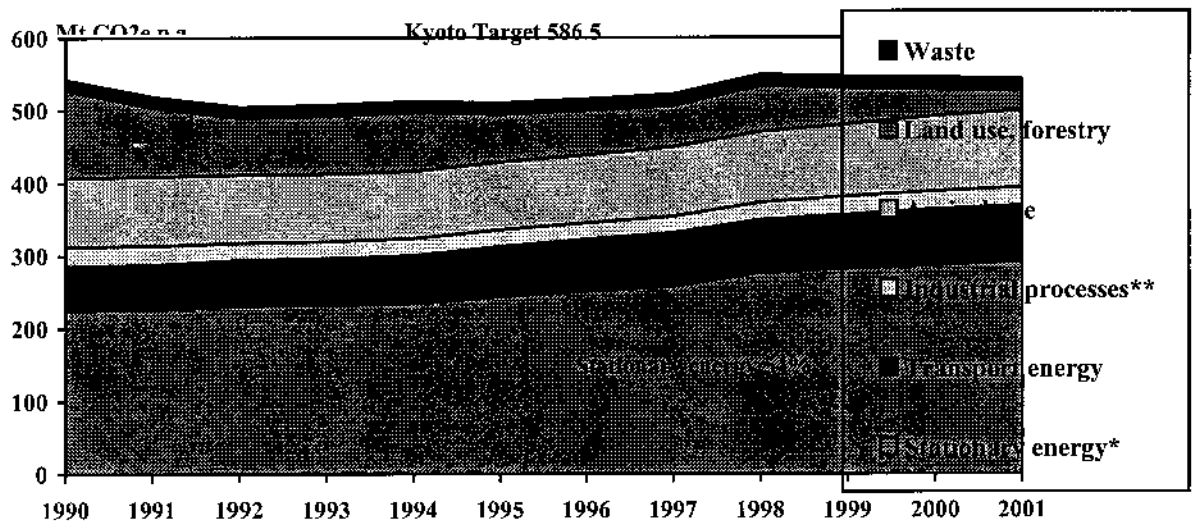


Our use of fossil fuels has implications for many aspects of sustainability. For example, Figure 2 shows that energy-related activities are major contributors to urban air pollution in Australian cities. Fossil fuel use is also the dominant contributor to Australia's greenhouse gas emissions, as shown in Figure 3. Coal-fired power stations also have major environmental impacts, for example the 2000 MW brown coal-fired Loy Yang A power station significant quantities of particulates, oxides of nitrogen, sulphur dioxide and heavy metals (RCG/Hagler Bailly, SRC, 1993). The cost to households and business of owning and maintaining energy-consuming equipment is substantial: for example, in 1999, car ownership and use cost Australian households around 13% of household expenditure on goods and services (ABS 2000).

A relatively recent environmental issue of global significance is the greenhouse effect, or global warming. Fossil fuel use, particularly over the past 50 years, combined with land clearing over the past century have increased the concentration of carbon dioxide, the major greenhouse gas, to above the highest level known for at least 400,000 years and possibly 20 million years, and this change has occurred at what seems to be an unprecedented rate (IPCC, 2001). Globally, emissions must be reduced by at least 60% this

century, and preferably by much more, to stabilise the warming and its associated impacts, such as more frequent and violent storms, drought, spread of tropical disease, and loss of biodiversity.

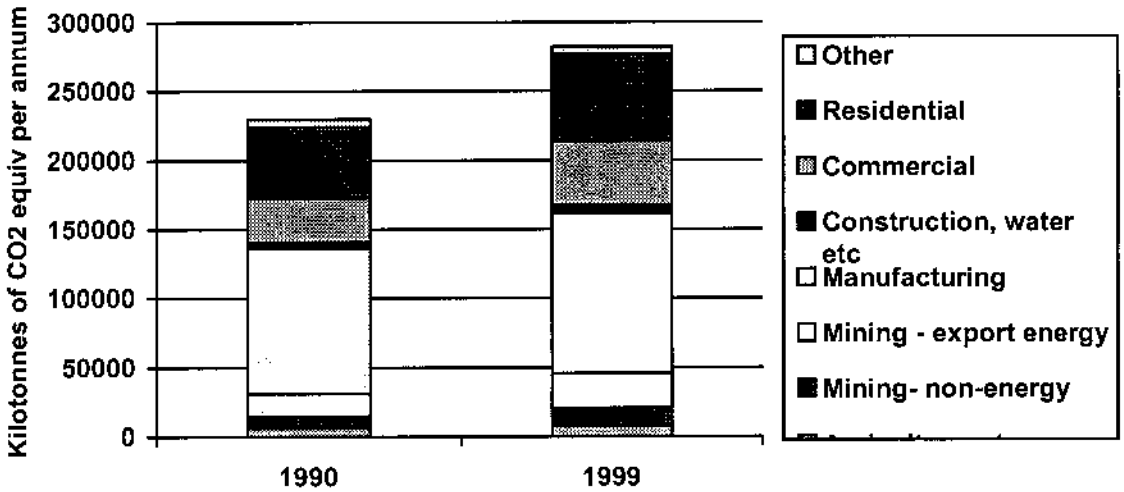
Figure 3. Australia's greenhouse gas emissions (Kyoto accounting method), 1990 to 2001 (NGGI, 2003)



Australia's greenhouse gas emissions since 1990, the base year for the Kyoto Protocol, are shown in Figure 3. Stationary and transport energy emissions from burning fossil fuels comprise over two-thirds of Australia's emissions, and are rising steadily.

The way we look at energy use shapes the possibilities we see for change. For example, the National Greenhouse Gas Inventory allocates emissions according to the point of combustion, so 85% of household greenhouse gas emissions and almost 90% of commercial sector emissions are not allocated to these sectors. Instead, they are allocated to the electricity generation sector, because they result from use of electricity in these sectors. So the NGGI does not reflect the significance of energy using activities in these sectors. Figure 4 shows a breakdown of stationary energy-related greenhouse gas emissions by end-use sector – over 40% of these emissions are generated by the residential and commercial sectors. Further, the residential and particularly the commercial (services) sectors have shown strong growth in emissions over the past decade, with emissions growth of 23% and 45% compared with an average growth in energy emissions of 23% (Wilkenfeld and Energy Strategies, 2002).

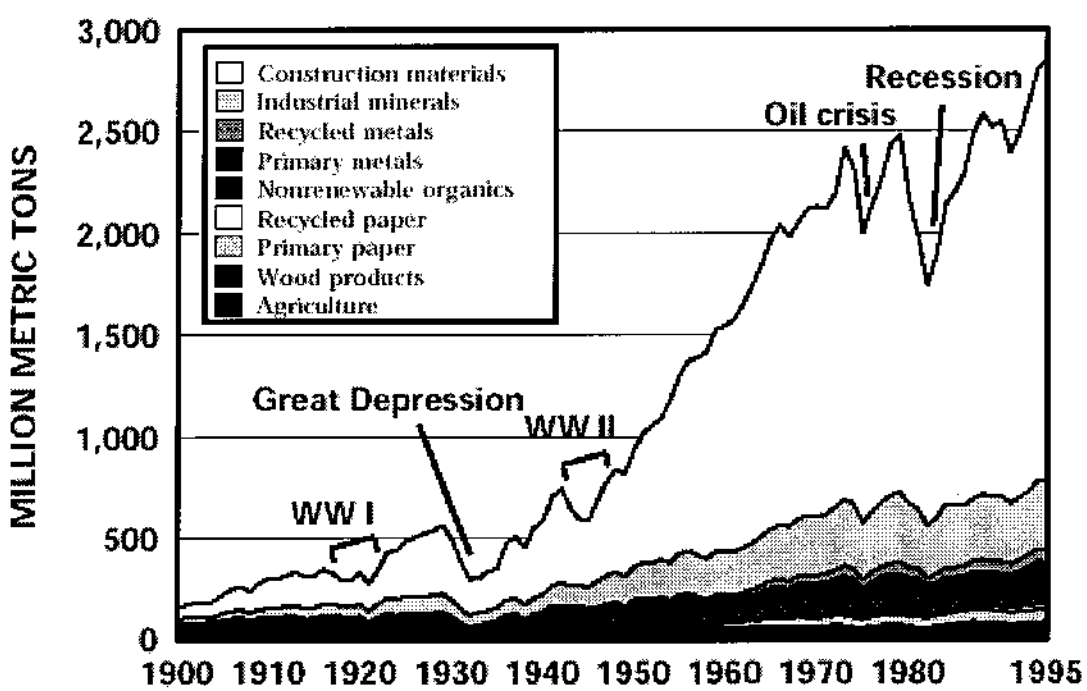
Figure 4. Breakdown of Australian stationary energy-related greenhouse gas emissions, 1990 and 1999 by energy use sector (Wilkenfeld and Energy Strategies, 2002).



At the same time, a significant proportion of emissions from mining and industry result from our (and other countries') voracious appetite for materials to build urban infrastructure, equipment and buildings. Around two-thirds of the manufacturing sector's greenhouse gas emissions are generated by the industries that process materials and chemicals for equipment and urban infrastructure, although much of this production is exported. Figure 5 shows the trends in material use in the USA over the past century, which highlights the enormous quantities of materials now consumed. A large proportion of the materials consumed relate to urban infrastructure.

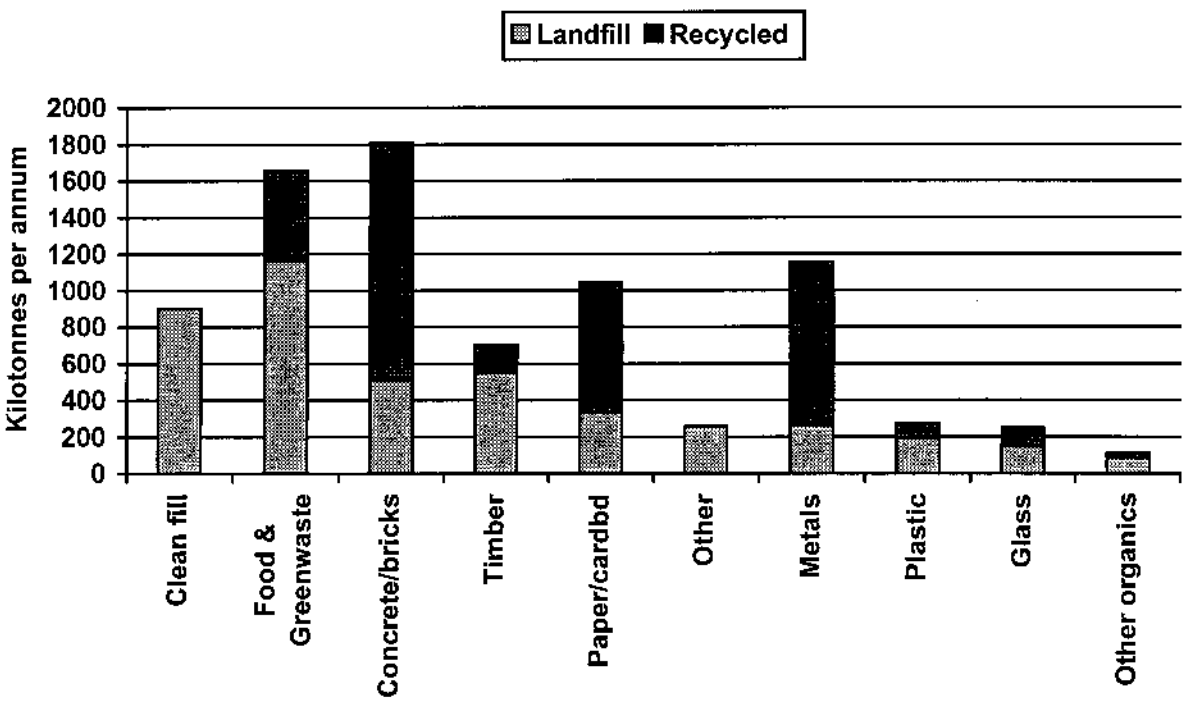
Figure 6 shows Melbourne's waste stream for 2000. This shows the untapped potential for recovery of materials and conversion of wastes into energy.

Figure 5. US Consumption of materials (Matos and Wagner, 1998)



The use of energy varies widely within sectors. For example, 5% of Australian households consume 15% of household electricity (Pears, 1998). Among office buildings, around 10% of offices use more than double the median level of energy use (Lumb et al, 2000). By identifying these high consumers, programs can be targeted to achieve large savings where they are likely to be most cost-effective.

Figure 6. Victorian wastes 2000-01 (Ecorecycle 2002)



Issue identification

The key energy issues for urban development include:

- development of a culture that makes energy waste an unacceptable activity (as is being done with water), and focuses attention on improving the productivity of energy use
- dramatic improvements in the efficiency with which energy and non-renewable materials are used, for both new and existing infrastructure and buildings
- a shift from traditional centralised fossil fuel-based energy systems to diversified systems including renewable energy, cogeneration and energy efficiency improvement
- restructuring of energy markets so that they make it more profitable for electricity retailers to save energy or sell renewables than to sell conventional fossil fuel-sourced energy, and to provide clearer signals to energy consumers of the costs and impacts of using fossil fuel-sourced energy wastefully while ensuring equitable outcomes
- ensuring all new urban infrastructure, buildings and business expansion are compatible with a low greenhouse impact future, either through low emissions when built, or through flexible design so that low emissions solutions can be easily added as they become more cost-effective. This might include, for example, installation of hydrogen gas pipes to all houses in new developments

- utilisation of local renewable energy resources (including wastes) and waste materials to replace non-renewables
- development of targeted energy strategies, such as management of peak energy loads, identification of high energy users, etc
- assisting low income households (many of whom rent or live in caravans or portable housing) to reduce energy costs while improving comfort
- tools are needed to help identify energy waste in buildings and infrastructure, and to help set priorities for improvement. For example, rating schemes such as the Australian Building Greenhouse Rating facilitate benchmarking and targeting of high energy users, while the Australian Government's annual reporting of energy use by agencies (DITR, 2002) facilitates strategic energy management within the public sector, and could be applied more broadly.

Policy options

The nature of many decisions related to urban development is that their implications are long term, and their impacts are widespread. Experience with market solutions over the past decade has highlighted that, while they can allocate resources efficiently, the detailed structure of the markets and the extent to which they reflect long-term costs and limit the application of market power by entrenched interests strongly influences their effectiveness as policy tools.

While greenhouse emissions trading is widely proposed as a greenhouse response strategy, it should be noted that the main proposals would limit trading to large emitters – probably the largest 250 or so emitters in Australia. This means most energy consumers in an urban area would not be involved in trading, and would simply experience the flow-on price increases passed on by the upstream emitters such as power stations. In this sense, emissions trading for the vast majority of urban households and businesses would be no different from a greenhouse levy or tax. The key issue here would be that it is how the revenue from the emissions tax or emissions trading is allocated (eg to fund incentives for sustainable energy) that will be more significant than the relatively small price effect.

It has also been found that regulation can be accepted in situations where allocation of costs is difficult. For example, the building industry has worked constructively with regulators to introduce energy efficiency requirements into the Building Code of Australia over the past few years, after resisting such action for decades. It has also been recognised that market mechanisms must operate within a regulatory framework anyway, so the dichotomy between market solutions and regulation has been found to be a matter of degree.

For energy, the key issue is that most decisions made that impact on energy use are made in a context where the energy implications are a minor component of the criteria. Reasons for this include the small cost of energy as a proportion of total costs, heavy discounting of future costs, split incentives where the decision maker does not pay the energy bills, and distortions of energy prices. Ignorance of the potential for energy savings is also a barrier, as is the early stage of development of the sustainable energy industry.

Given these barriers, there are no simple paths to sustainable energy in urban development. A comprehensive strategy is required that includes:

- education and promotion in relation to the benefits of sustainable energy
- incentives for sustainable energy (which could include changes to energy markets, taxation, rebates, etc)
- funding of pilot projects, for example application of energy efficiency and distributed generation to a new mixed use development

- guidelines (evolving towards mandatory requirements) for incorporation of sustainable energy into new developments – for example, a greenhouse budget for all new buildings
- development of evaluation and rating tools, and their use to assess eligibility for incentives and/or application of mandated measures
- supporting research of hydrogen and related technologies as an alternative to fossil fuel dependency

Scenarios and responses

QUESTIONS FOR CONSIDERATION

How might we implement a shift from the existing large-scale energy generation and distribution infrastructure towards an alternative model? (and do we want to?)

A fundamental problem we face in driving a transition is that all of the regulatory and policy frameworks are still structured around traditional energy solutions. To drive a shift we need to:

- carry out modelling projects to help understand better how distributed systems might work, and what infrastructure they could benefit from (eg local energy storage, advanced meters/voltage control/load management systems in homes and businesses, etc)
- plan several new developments (preferably mixed used) from the ground up as energy efficient, distributed generation pilot projects, the build them and learn from experience
- in parallel with the above, provide incentives and assistance to implement alternative models in targeted existing areas

How can the uptake of renewable energy for residential and commercial properties be promoted?

This question is somewhat linked to other questions in this section. Ideally, packages are needed that combine energy efficiency improvement and renewable energy so that overall costs are reduced. However, capital cost may then be an issue, particularly where split incentives exist (i.e. the decision maker does not benefit from future savings) so schemes that bring lifecycle costs to the point of decision making and/or allow the cost to be paid off via energy bills or mortgage payments are needed. It will be important to underwrite the risk so that individuals can feel confident to act.

Along with such schemes is needed a strong innovation/efficiency improvement program for products and equipment used throughout the commercial and household sector, not just a mandatory standards program. There are simply too many different kinds of products and equipment to be able to address each of them via standards within a reasonable timeframe. Training of designers and engineers to carry out quick assessments of energy efficiency potential of things from coffee makers to pizza ovens to cold rooms is urgently needed, so that they can get on with designing better solutions.

It will also be important to ensure that investments in conventional energy infrastructure support future adoption of sustainable energy options. For example, it is quite feasible to introduce tougher energy standards for hot water services, to make them compatible with solar boosting. Then, solar pre-heaters can be added to such systems at any time during their lives at minimum cost. At present, the solar systems must be installed up-front, when there is often a shortage of capital or a split incentive situation. Of course, mandating solar hot water provides another path.

What are the impediments to utilising renewable energy sources in residential, commercial and industrial areas and how might these be addressed?

First, this question misses a critical dimension of the challenge. The aim should be to encourage adoption of a mix of sustainable energy options, including renewable energy, energy efficiency and demand management. For example, a household that uses less hot water through water-efficient showerheads,

taps and appliances, needs a smaller solar HWS than one that uses water wastefully. A recent study for the NSW Government (Allen Consulting 2003) shows how a mix of such approaches can deliver economically attractive outcomes. Books have been written on this subject. Brief overviews of some of the issues are covered in Watt and Outhred (1999) and Greene and Pears (2003). Key factors include:

- energy is a relatively small cost for most people and businesses (in fact gas and electricity are, on average, less than 1.5% of business input costs), and therefore does not attract much attention
- most decisions that impact on energy use are actually not understood to be energy-related by the decision makers: businesses upgrade a photocopier because they want a higher speed model or new features, and rarely realise that this could impact on their energy use. Even where energy performance is a factor, it generally rates well below other criteria such as price, aesthetics, status, reputation for reliability, etc
- split incentives such as the landlord-tenant problem mean that often those who have to pay for energy efficiency don't get the benefits
    - markets are heavily stacked against energy efficiency. Energy markets are an obvious example, as we now have many highly resourced marketing groups working for energy suppliers whose job it is to steal market share from their competitors: the overall effect of this marketing effort is an increase in energy use. Further, for energy suppliers, there is much more profit at the margin from selling one extra unit of energy than from saving it, because a large proportion of their costs are sunk capital, which they have to pay for whether it is used or not. Also, appliance and equipment markets are biased in favour of energy waste. For example, a salesperson selling boiling water units for an office kitchenette has a vested interest in selling a bigger model because it provides more profit for the same effort: but it is also less efficient. Similar pressures encourage sale of bigger refrigerators and heating units and even houses. Lastly, most markets are structured to sell single products rather than packages. For example, people go to a bulk store to buy an air conditioner, not to buy a package that includes analysis of their house, draught sealing, insulation, shading and, possibly, a small air conditioner. Also, appliance stores are no longer geared for trade-ins, because they want to minimise labour and complexity, so buyers of new appliances are left with their old ones, which they put in the laundry or garage and leave running.

Dealing with these barriers will require strong policy action, technology development, strong incentives to do things differently, as well as an education and cultural change program that makes it clear that using energy wastefully is not only silly, but is antisocial. At present, for example, up to 10% of Melbourne's streetlights are on during daytime. Electricity distributors pay a fine if a light is reported that is not working at night, but there are no fines if a light keeps running during daytime. Nor are there any advertising campaigns to encourage people to notify authorities if they see a streetlight running in daylight, or to 'dob in' office buildings that have left lots of lights on at night. And do we really need all those lights shining on buildings after, say, midnight?

Should renewable energy generation be promoted at the single dwelling level or across city regions?

Again, this question should relate to all aspects of sustainable energy, not just renewables. They should be promoted across a range of levels for good reasons:

First, different technologies apply at different scales. Solar cells can be useful running small appliances, while wind generators capture economies of scale by being large and located at site with high winds. Solar hot water systems make sense for individual homes. Further, according to the Alternative Technology Association, many householders who install solar cell systems become much more aware of energy waste, and begin to pursue energy efficiency as they come to appreciate the high cost of supplying energy.

Are there economic, and hence social, implications of a city increasing its use of green power and developing new complexes which are predominantly self-sufficient in terms of energy generation?

Yes. Where an optimised combination of energy efficiency, demand management and green energy is used, often total lifecycle costs of delivering energy related services are reduced and other benefits such as increased employment accrue (see, for example, Allen Consulting 2003). In regional and rural areas, the extent of community subsidies can decline while total costs for the user can also be reduced. But often there are up-front costs that are offset over time. And because many of these solutions are far from being mass-produced mature technologies, there is a need to support commercialisation and roll-out.

Should higher efficiency standards be mandated for all new dwellings, appliances and business operations?

Yes, but higher standards are not enough. The time delays and negotiations involved always mean that standards are lower than best practice. For example, it will be 2005 before Australia adopts refrigerator energy efficiency standards introduced in the US in 2001, and even these standards are well below best practice energy efficiency. While strong standards are important, they must be seen as part of a package with other features (such as incentives) that encourage ongoing improvement at the leading edge.

There are also some challenges with establishing appropriate benchmarks for standards, particularly in the business sector. For example, in the non-residential sector, the only recognised benchmarks at present apply to office buildings, and were developed for the Australian Building Greenhouse Rating Scheme. Getting the detail of assessment systems is also challenging. For example, the House Energy Rating Scheme assesses only the design phase, and looks only at thermal energy flows through the building fabric. Further, its metric of energy use per square metre of floor area creates a bias in favour of larger houses, which have a smaller surface area per unit of floor area than do smaller dwellings, the reverse of the incentive we should be creating. Recent changes to the *FirstRate* software used in Victoria correct for this bias, but a case can be argued that larger dwelling should have to meet tougher standards than smaller ones.

How can residential and commercial developments incorporate renewable energy generation into planning and construction?

Targets for overall levels of greenhouse gas emissions for new developments could provide one mechanism to encourage developers to apply a mix of sustainable energy solutions into their projects. Governments could also require a building developer to submit a specified number of Renewable Energy Certificates which are created under the Mandatory Renewable Energy target legislation, or NSW Greenhouse Abatement Certificates (which cover a range of greenhouse emission reduction measures) or similar schemes could be developed. This would allow developers flexibility in responding to requirements.

To what extent should public transport systems seek to change to renewable energy sources?

Again, this question addresses only part of the issue. There is enormous scope to improve the energy efficiency of public transport through use of lightweight materials, high efficiency lighting, motors and other equipment, and increased efficiency of regenerative braking to recover energy. Public transport buildings and facilities could also improve efficiency. Since public transport vehicles have long lives, and stop and start frequently, they are ideal targets for aggressive energy efficiency improvement. A study of Melbourne trains in the early 1990s showed that an empty train weighed almost 270 tonnes, while a full load of passengers adds only 45 tonnes.

There is a case for public transport to aim for 100% adoption of greenhouse neutral energy sources, possibly including use of offset schemes such as the Australian Greenhouse Office's *Greenhouse Friendly* offset scheme. For example, at a price premium of 3 cents per kilowatt-hour for green electricity, rail travellers would have to pay around 1 cent per passenger-kilometre for renewable energy powered trains and trams. It would be even cheaper (as low as 0.2 cents) if greenhouse offset schemes were used – and

high efficiency public transport and increased patronage would substantially reduce this cost. A shift to renewable energy would mean that debates about the relative greenhouse impact of public transport and cars could be clearly resolved.

Chapter 3 Establish an integrated sustainable water and stormwater management system addressing capture, consumption, treatment and re-use opportunities

Background, data and trends

Until recently, planning for water supply has been based on the assumptions of a stable and consistent climate, and predictable water flows. These assumptions can no longer be made. The Commonwealth Scientific and Industrial Research Organization's (CSIRO, 2001) climate change forecasts for Australia suggest that global warming is expected to reduce total water resources and increase the variability of rainfall in the future. Water flows, storage levels and discharges from reservoirs have fallen in recent years in many areas of Australia. Yet total net water consumption in Australia is rising, increasing by 19 percent between 1993-94 and 1996-97, from 18,575 GL to 22,186 GL. These factors highlight the need for proactive adaptive strategies which will lead to more assertive efforts to reduce water consumption, including in major urban and regional centres.

A number of issues and strategies were highlighted by the Wentworth group in early 2003. In addition to this discussion paper, PIA is supportive of the work of that group and has also commissioned a further policy paper in relation to planning and water which can be made available to the Inquiry on request.

GLOBAL WATER USE

The majority of water on the earth is not available for human use: saline oceans make up 97.5 percent of Earth's water and the majority of the remaining 2.5 percent is captured in the frozen polar icecaps, glaciers and snow cover. Perry and Vanderklein (1996).

Note that if all the Earths water's were "equivalent to 100 litres, fresh water would comprise only 3 litres of the total and available fresh water would amount to only half a teaspoon".

The global utilization of freshwater is increasing dramatically. The 'Living Planet Report 1998' indicates that global freshwater withdrawals have nearly doubled since 1960. It is estimated that nearly half of all accessible freshwater run-off has now been commandeered for human use, reducing natural flows available to ecosystems by half, which is having a serve detrimental effect. The global water cycle "seems unlikely to be able to cope with the expected demands in the coming decades" (Yencken & Wilkinson 2000;25,26). The utilization of water is of global significance.

WATER USE IN AUSTRALIA

In Australia, water problems are urgent, widespread and recurrent. " (Pigram 1986;3). Water use in Australia is rising. Figure 1 shows that in 1996-97 Australia's net water consumption[1] was 22,186 GL. "The majority of water consumption occurred in NSW/ACT (39 percent), Victoria (30 percent) and Queensland (17 percent)" (ABS 2002).

Figure 1 Supply, Use and Consumption of Water in Australia 1996–97

Sector	Self Extracted Use (ML)	Mains Supply (ML)	Mains Use (ML)	In-stream discharge (ML)	Net Water Consumption (ML) (a)
Agriculture	7,156,488	–	8,346,485	–	15,502,973
Services to Agriculture; hunting and trapping; Forestry and Fishing	13,164	–	14,420	8,589	18,815
Mining	544,706	4,905	30,376	–	570,217
Manufacturing	216,666	511,071	–	–	727,737
Electricity and Gas	47,771,365	12,869	58,387	46,509,049	1,307,834
Water Supply; sewerage and drainage	12,864,431	11,507,477	349,691	–	1,706,645
Other	103,588	282	419,207	–	522,513
Household	32,923	–	1,796,076	–	1,828,999
TOTAL	68,703,371	11,525,533	11,525,533	46,517,638	22,185,733

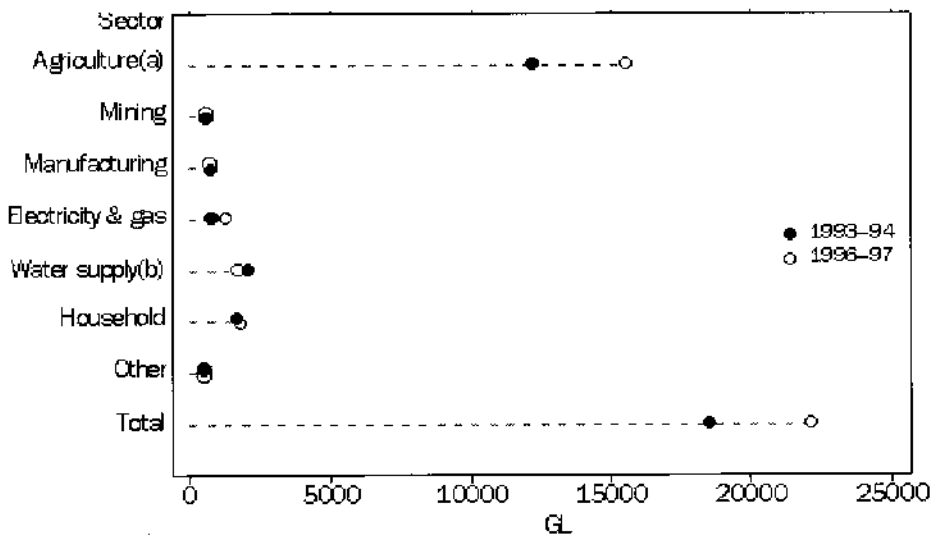
Net Water Consumption = Self Extracted Use + Mains Use - Mains Supply - In-stream Discharge

Source: Australian Bureau of Statistics (2002)

[1] the amount of water used and not discharged back to existing water bodies

Figure 2 illustrates total net water consumption by sector for the period 1993-94 to 1996-97. Total net water consumption roles 19 percent, from 18,575 GL to 22,186 GL.

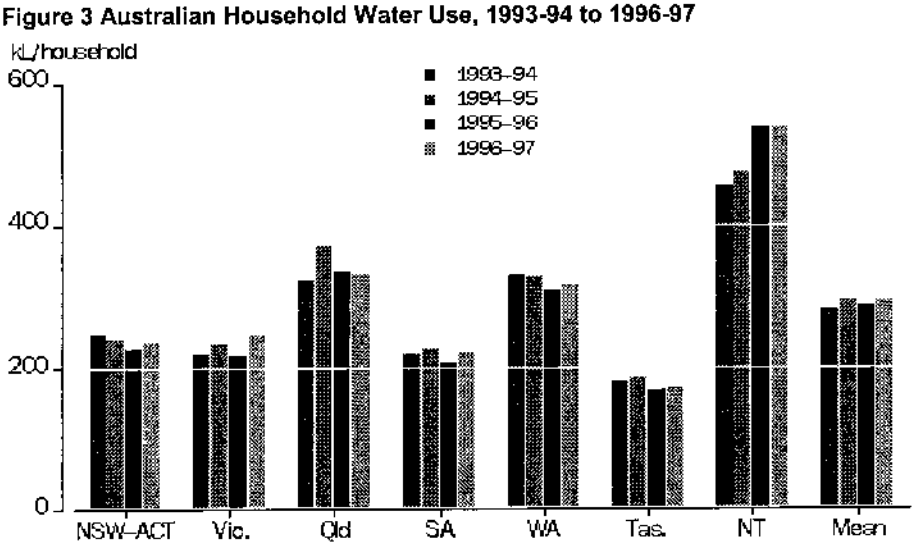
Figure 2 Australian Net Water Consumption - By Sector 1993-94 and 1996-97



Source: Australian Bureau of Statistics (2002)

Across Australia between 1993-94 and 1996-97 mean household water use increased, from 282 kL/year to 294 kL/year. In 1996-97 household water consumption totalled 1,829 GL, or 8 percent.

Figure 3 Australian Household Water Use, 1993-94 to 1996-97



Source: Australian Bureau of Statistics 2002

Australia has three distinctive urban water supply characteristics. First, Australia is the driest inhabited continent. Second, Australia's water consumption levels per capita are amongst the highest in the world. Of total use per person, "Australians are still among the most water-greedy people in the world, only Americans use more water than Australians. We use about twice, per capita, the water that France, Germany and the United Kingdom use, and 10 times what the World Health Organization says each

human needs" (Fyfe, 2003). Figure 4 illustrates that Australia has experienced extreme growth in water usage; with a 370 percent increase between 1950 and 1990, and 24 percent between 1990 and 2000.

Figure 4: Annual Water Usage (km^3/yr)

				Average Annual Water Usage				*% Increase*	
Continent	1940* (km^3/yr)	1950 (km^3/yr)	1960 (km^3/yr)	1970 (km^3/yr)	1980 (km^3/yr)	1990 (km^3/yr)	2000** (km^3/yr)	1950-90	1990-2000
Australia & Oceania	<10	10	17	23	29	38	47	370	23.7
Total^	1050	1360	1982	2594	3316	4138	5189	282	25.4

* figures for 1940 are approximate only

** projected figures

^ Total figures for Europe, Asia, Africa, North America, South America, Australia & Oceania, Antarctica.

Source: Extract from Maybeck, M., Chapman, D. & Helmer, R. as cited in Aplin 1999;131

Thirdly, Australia requires a high storage capacity. This is attributed to Australia having "the lowest percentage of rainfall as run-off, the lowest amount of run-off, and the smallest area of permanent wetlands... it is also attributed to high levels evapotranspiration, through which some 87 percent of the average annual rainfall is lost" (Aplin et al 1999;145). High water use for public and private gardens and low density cities are also attributed to Australia requiring high storage capacity (Yencken and Wilkinson 2000;130). Sydney stores "930 cubic metres per head compared to 250 cubic metres in New York and 18.2 cubic metres in London" (Yencken and Wilkinson 2000;130).

It is evident that Australia is a 'water poor' country, and water availability is falling; all these characteristics are a persuasive case for minimization of water use. Much of Australia's agricultural water use is in fact to provide food, fibre and materials for people in urban areas. So people living in urban centres have some responsibility for managing it and helping farmers to cut water usage.

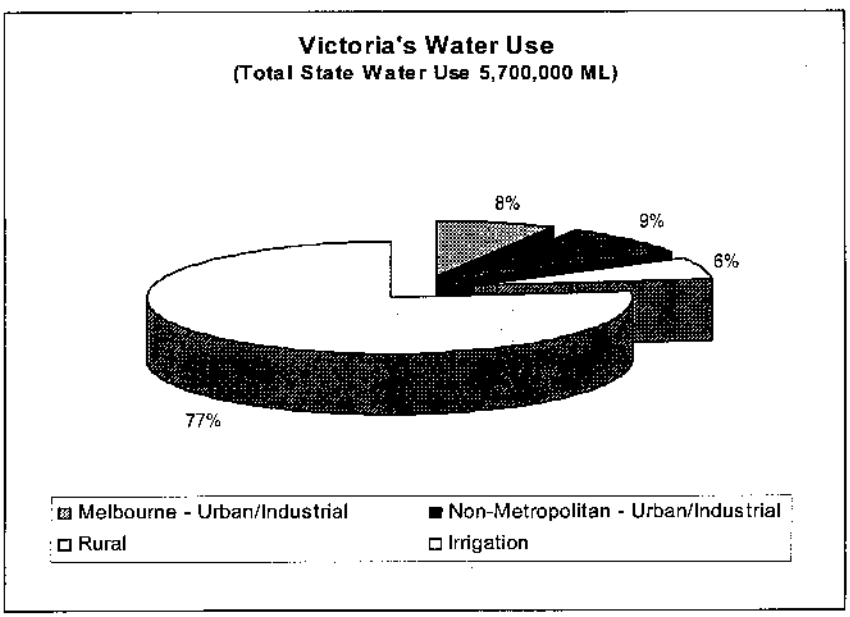
METROPOLITAN AREAS

The water resources of most Australian major metropolitan and regional catchments are heavily committed. Sources of water supply, and the required size of water storages vary between cities. The breakdown of water use in Victoria provides a generic picture more or less applicable to most Australian urban areas, and will be used as a case study.

The National Land and Water Resource Audit (NLWRA), conducted on behalf of the National Heritage Trust in 2001, revealed that "Victoria's water resources are heavily committed" (Water Resources Strategy Committee for the Melbourne Area 2002:10). Figure 5 illustrates the NLWRA finding that of the State's total average water use (5,700,000 ML) 8 percent is used for metropolitan Melbourne's urban and

industrial use. While irrigation is the largest sector utilizing water supplies (77 percent), it is linked to the needs of the metropolis, for example for food production.

Figure 5: Victoria's Water Use, by Sector

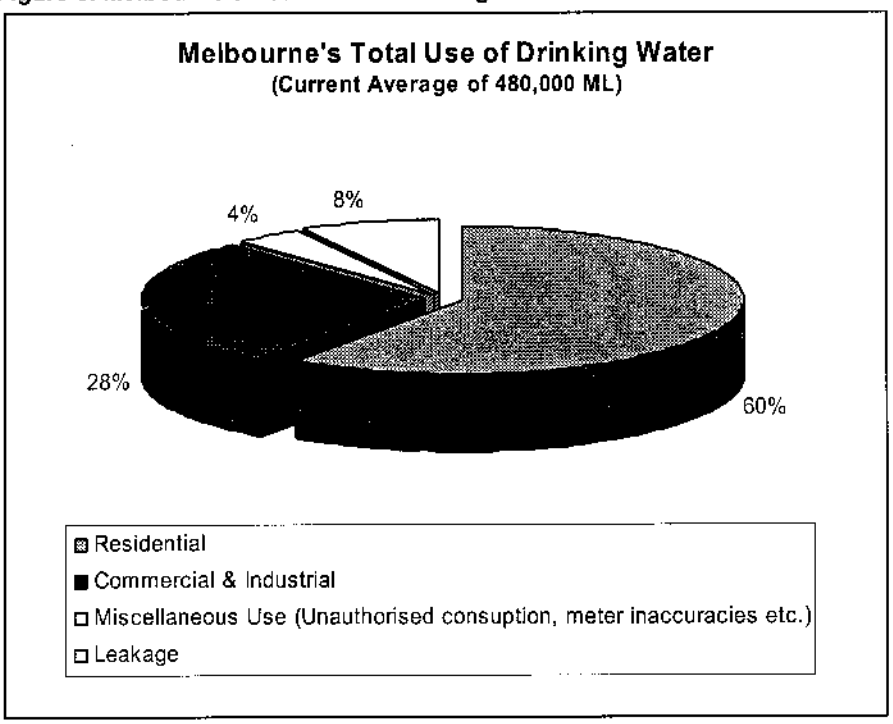


Source: Australian Water Resource Assessment 2000, National Land and Water Resource Audit, as cited in Water Resources Strategy Committee for the Melbourne Area (2002) 21st Century Melbourne: A WaterSmart City – Final Report, Victorian government Publications, Melbourne, October 2002, page 10.

The current average annual total amount of water consumed by Melbourne is around 480,000 ML. Melbourne's water use in comparison the volume consumed by irrigation is relatively minor however the efficiency of residential development remains an important consideration particularly because of the impact of cities on the health of supply rivers and their immediate and related catchments which may cover considerable areas.

Figure 6 demonstrates that the residential sector is the largest consumer of Melbourne's drinkable water, consuming 60 percent (288,000 ML) with industrial and commercial use accounting for 28 percent (134,000 ML).

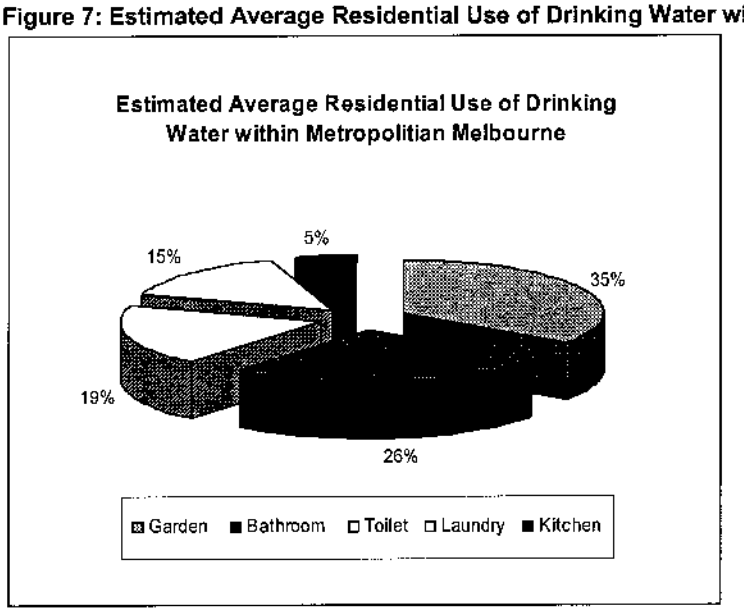
Figure 6: Melbourne's Total use of Drinking Water



Source: Water Resources Strategy Committee for the Melbourne Area (2002) 21st Century Melbourne: A WaterSmart City – Final Report, Victorian government Publications, Melbourne, October 2002, page 17.

Figure 7 is an estimated break down of the distribution of water use within the home. The garden is the greatest consumer of water (35 percent), followed by the bathroom (26 percent) and toilet (19 percent).

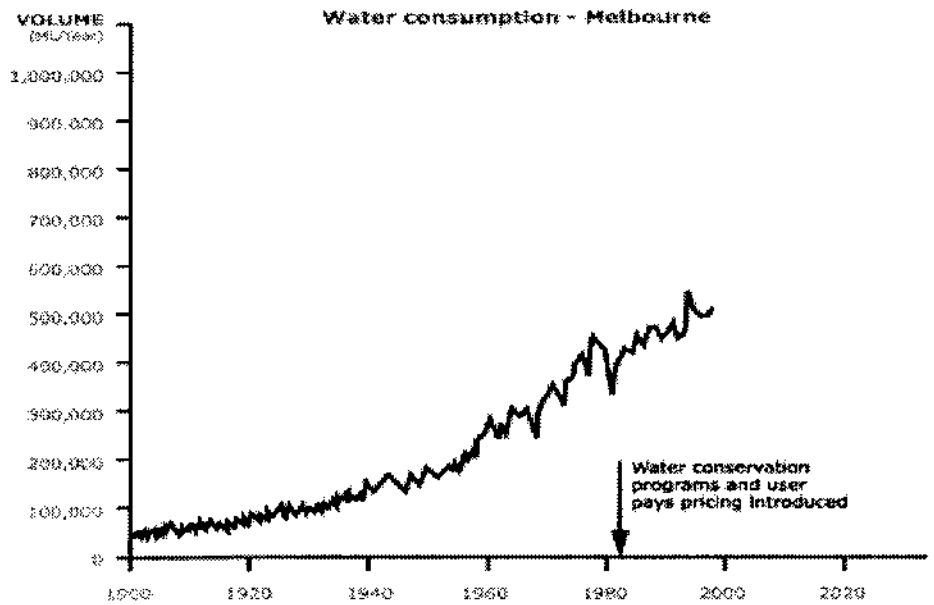
Figure 7: Estimated Average Residential Use of Drinking Water within Metropolitan Melbourne



Source: Water Resources Strategy Committee for the Melbourne Area (2002) 21st Century Melbourne: A WaterSmart City – Final Report, Victorian government Publications, Melbourne, October 2002, page 17.

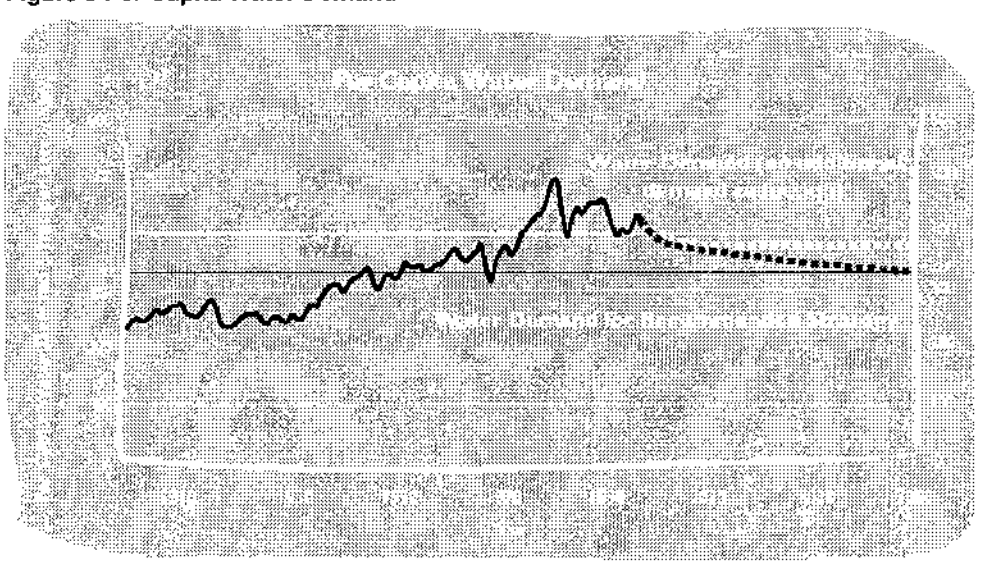
Rates of growth in water use vary between major capital cities, with some recording a decline in growth. Figure 8 demonstrates that Melbourne reflects national trends in water use having experienced significant growth.

Figure 8 Water Consumption in Melbourne, 1900 to Present



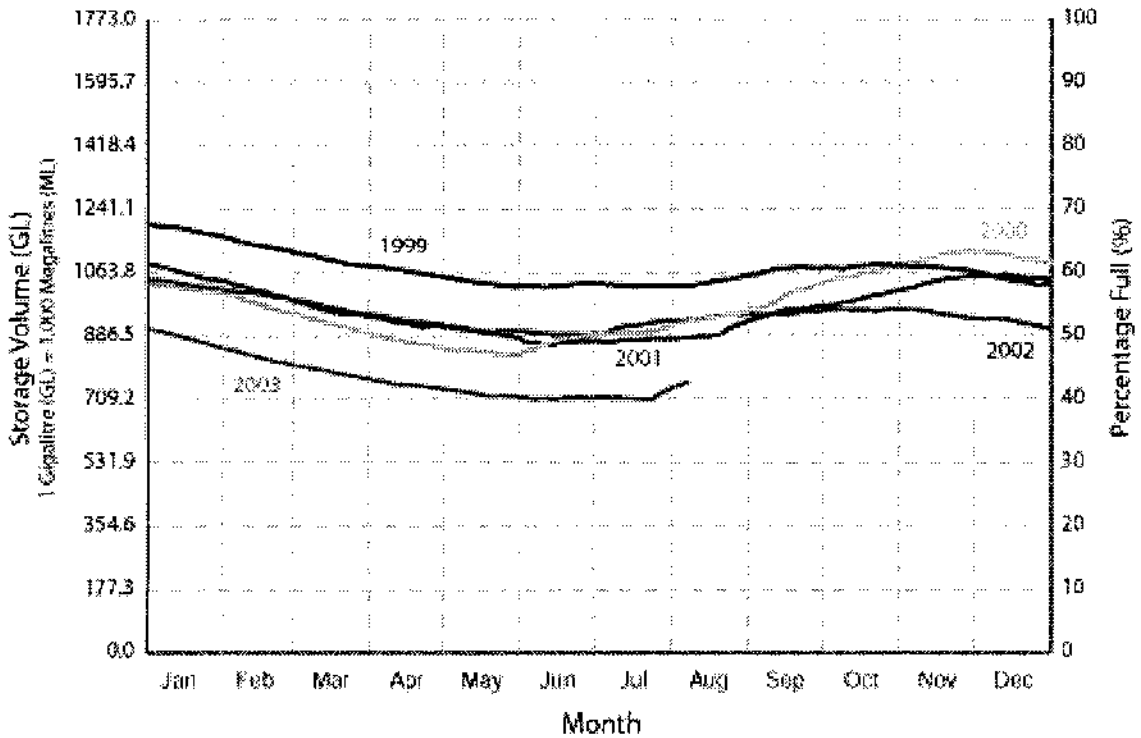
Source: Melbourne Waters Drought Website, Website 6

Figure 9 Per Capita Water Demand



Source: Water Resources Strategy Committee for the Melbourne Area (2002) 21st Century Melbourne: A WaterSmart City – Final Report, Victorian government Publications, Melbourne, October 2002, page 69.

Figure 10 Melbourne Water Storage Levels, January 1999- August 2003



Source: Melbourne Water 2003

Figure 9 illustrates the water per-capita demand if water consumption were to remain constant and the impact of change. The average demand per person per day over the period 1990-1999 was 423 litres. Under the recommended strategy the projected demand per person per day: by 2010 is 371 litres, a 12 percent reduction from the nineties rate of consumption; and 327 litres by 2050, a 23 percent reduction from the nineties rate of consumption (Water Resource Strategy Committee for the Melbourne Area 2002; 68). Figure 10 illustrates the reduction in storage levels.

Issue identification

Traditionally the urban water system views the urban hydrological cycle in two ways, 'water supply' and 'water/waste disposal', and this is reflected in the institutional arrangements for their management. Large scale water supply projects have been provided from few sources; stormwater has been collected and discharged to receiving waters through pipes, and sewage has also been collected and discharged after treatment (Mouritz and Newman, 1997).

Serious environmental results have resulted. These include habitat destruction, reduced downstream flows and increased peak volumes, concentration of pollutants, urban litter transfer to waterways, high organic and nutrient loads. Increased demands are being made for improved control of the environmental quality of stormwater and wastewater (Mouritz and Newman, 1997). Other issues include the increasing costs of a growing and ageing water infrastructure (Troy 1999), and the wasted resources represented by stormwater and sewage which cannot be replaced as additional sources of supply are no longer available. Cities will have to live within the available water supply systems.

Water quality will therefore need to be improved, water use minimized, water runoff from sites reduced, and water reused through recycling systems. And also efforts made to mimic to some extent the pre-development water flow regimes.

The Australian Urban and Regional Development Review (1995) pointed to the failure of institutional arrangements, market failures, weaknesses in implementation methods, and lack of funding in the urban water sector. It argued that institutional arrangements established to deal with draining and stormwater in many jurisdictions were separated from those with responsibility for environmental quality. Agencies with primary engineering responsibilities were therefore not properly integrated on a policy or institutional basis with environmental agencies. Institutional arrangements are complicated where integrated agencies such as the Melbourne and Metropolitan Board of Works were broken up and water supply and drainage responsibilities separated from Catchment Management agencies and large multi-functional Government agencies.

The Australian Urban and Regional Development Review (1995;120) also argued that inadequate storm water and sewage disposal was an example of market failure in that the market has failed to reconcile the environmental costs with the financial savings made in the cost of treatment. Markets are failing in other ways also. With few exceptions, most greenfields and infill urban developments pay little or no attention to reducing water use, relying on traditional pipe and disposal engineering. Voluntary and market based measures will be unable to achieve the required scale and rate of change in the desired time frames because of the conservatism of the building industry and its reluctance to initiate change on a sufficiently widespread scale. A more interventionist role by governments through increased regulation using land use planning and building regulations and law, and greater cooperation between the commonwealth and the states will be required if change is to be achieved.

Best practice

Water Sensitive Urban Design (WSUD) is an approach to urban design and development which aims to integrate the management of the urban water cycle into urban development. The four key principles which underpin WSUD are:

1. Minimize water use though design.
2. Minimize off site run off.
3. Maximize water use and reuse on site.
4. Improve the quality of the water leaving the site.

The First National Conference on WSUD was held in 2000 in Melbourne and was entitled 'WSUD in the Australian Context'. Four major issues were identified to be addressed in order to advance the WSUD paradigm (Lloyd, 2001);

1. The *'regulatory framework'* (planning policy, local development standards, standards and approval);
2. *'Technology and design'* (multi-disciplinary teams, performance measures, design tools, operation and maintenance, maintenance costs);
3. *'Assessment and costing'* (standards and approvals, securing funding, institutional costs, externalities); and
4. *'Marketing and acceptance'* (community education, integrated urban design).

WSUD also achieved prominence in Australia during the process of a research project supported by the West Australian Water Resources Council. The research project was undertaken by Whelans[2] and Halpern Glick Maunsell[3] in association with Thomas Palmer[4] and the Institute for Science and Technology Policy of Murdoch University. Central to their discussion was the acknowledgment of another water use cycle, resulting from the influence of urbanization on the hydrological cycle (Wallis & Robinson 1991;31).

It is within this wide context of sustainable development that the WSUD paradigm can provide a significant contribution to urban sustainability, through cities being less exploitive of their resources.

WSUD ELEMENTS

1. Minimize water use through design;

Water conservation can be encouraged through design on both a small and large scale. The garden is the largest component of residential homes average water consumption, consuming 35 percent. Thus, higher density developments generally consume less water, as smaller gardens consume less water. Therefore from an institutional perspective the encouragement of higher density development can reduce domestic water consumption.

The '21st Century Melbourne: A WaterSmart City' (2002) report identifies the compulsory introduction of AAA shower roses, in 2005, and AAAA washing machines, in 2010, as a major contribution to domestic water reduction. The predicted combined impact is annual water savings of 47,000 ML by 2050. The report cites the compulsory introduction of dual flush toilets in the early 1980's to all new homes as an example of a previous regulatory progression in improving the efficiency of water use within the home (Water Resource Strategy Committee for the Melbourne Area 2002;74).

2. Minimize off site run off.

The use of on site stormwater should not be maximized to the detriment of trying to emulate the predevelopment stormwater runoff regime and levels. Limiting flow regimes by preventing all run-off may not be favourable for the condition for the catchment.

Underground storage pits retain stormwater run-off and provide 3 functions: on-site detention reduces peak flows and associated issues; stored stormwater can be reused for non-potable uses; and water quality improved as sediments and their attached pollutants settle to the bottom (MDG Landscape Architects & KLM Development Consultants, 2002;45).

Porous pavements allow the ingress of water and flow through to the paving substrate and eventually into the underlying subsoil. Benefits include; providing onsite retention of stormwater runoff; reduction in overall volume of stormwater run-off from site; and, minimizing previously exported sediments and pollutants from site (MDG Landscape Architects & KLM Development Consultants, 2002;19).

3. Maximize water use and reuse on site.

Greywater can be sourced from bathroom basins, baths, showers, dishwashers and or washing machines and used for garden irrigation or toilet flushing. Rainwater tanks reduce peak discharges and associated negative environmental impacts and reduce the need to import water. Research in Newcastle indicates that rainwater tanks can "provide up to 50 percent mains water reduction and up to 24 percent annual maximum daily peak water demand when used for hot water, toilet and outdoor uses" (Coombes & Kuczera, 2001;4).

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[2] Consultants in Urban and Regional Planning
[3] Consulting Engineers and Environmental Scientists
[4] Landscape Architects

4. Improve the quality of the water leaving the site.

Filtration Trenches / Bioretention Trenches "provide infiltration of stormwater run-off into the ground; improve emerging water quality; and reduce peak flows during a storm event in the system". Swales are grassed or vegetated linear depressions used for the transportation of stormwater runoff. Benefits include a reduction in the total amount and speed of stormwater runoff and catch sediments and associated contaminants. (MDG Landscape Architects & KLM Development Consultants, 2002;18,37).

Gross Pollutant Traps remove relatively large debris found in stormwater. Such devices include: simple grated entry pits which prevent litter from entering the drainage system; side entry pits, are basic baskets or screens placed at, or near, the entry point. Constructed wetlands are a human made replica of a natural wetland system. Wetlands remove sediments and suspended solids and their attached pollutants, and dissolved nutrients and contaminants (MDG Landscape Architects & KLM Development Consultants, 2002;22, 35).

Policy options, scenarios and responses

Wolf (1998) indicates that many international trans-boundary water related treaties lack appropriate monitoring provisions, the delineation of particular allocations, and effective enforcement measures. These deficiencies are evident in national and state water related policy. State environment protection policies identify the resources to be protected and stipulate acceptable and detrimental levels of compounds in the air, land and water environment. Land use planning legislation or regulation in most states provides little reference to the need for urban water conservation. Some states have developed general or implementing mechanisms through statutory instruments such as planning schemes or codes for medium density development, or for greenfield subdivision. Some states have developed urban and environmental policies which include water conservation measures.

It is essential that stronger regulatory measures are provided through a nationally agreed approach to urban water conservation as a critical component to the implementation of the concept of sustainability. Incentives, marketing, and pricing can promote limited uptake of measures, but the inclusion of compulsory Water Sensitive Design measures in statutory planning instruments and building codes would be expected to achieve major water savings on the model which led to the compulsory installation of insulation into new houses.

The following are policy measures drawn from a range of state policies, statutory measures or codes which could form the basis of stronger regulatory measures.

- Promote water efficient practices in new and refurbishment developments by incorporating the National Water Rating and Labeling Scheme for water efficient fixtures, fittings and appliances into the Building Act and Building Code of Australia for implementation in 2004 and introduce a WaterSmart rating system for all buildings.
- Adopt codes and provide incentives to encourage use of alternative water sources such as rainwater tanks, stormwater and recycled water by local government, developers and households.
- Ensure that local treatment and recycling of stormwater for non-potable uses is provided in all new greenfield and other major infill developments.
- Reduce potable water consumption in the household and industry through use of pricing measures, incentives, promotion and regulatory tools.
- Develop WSUD guidelines to promote sustainable water use in urban development (including houses and buildings) particularly in growth suburbs.
- Require the adoption of water efficient appliances in all new houses, such as introduction of mandatory AAA shower roses, taps and pressure reduction valves by 2005, AAAA washing machines by 2007, and rainwater tanks by 2005 for new developments.

- Adopt a performance target by requiring that all new housing developments achieve water savings of at least 25% via measures such as recycled water via third pipe systems, rainwater tanks or the reuse of stormwater within a specified timeframe.
- Include the provision of water efficient technology and recycling in approvals for commercial, retail and industrial developments.
- Amend legislation to enable property buyers to be informed of the water efficiency of houses and buildings.
- Provide water rebates for rainwater tanks with connection to toilet; retrofitting of dual flush toilets; AAA shower roses; water conservation home audits; AAAA clothes washing machines, AAA dishwashers.
- Require the containment of sediment on site for all new developments and subdivisions.
- Require that at least 20 percent of the site must not be covered by impervious surfaces and encourage the use of porous pavement.

LOCAL GOVERNMENT INITIATIVES

Local municipalities have considerable power to guide developments within their own municipalities, yet need to develop well-researched detailed policies in order to do so. Some existing guidelines centre on stormwater management within subdivisions, and omit reference to WSUD elements within higher density developments.

Some councils are attempting land use planning controls for the inclusion of WSUD within their City's Drainage Strategy. Others have implemented an Environmentally Sustainable Design (ESD) Scorecard for assessing residential development proposals, which in part targets WSUD. Incentives could be provided to councils by state or Federal governments to encourage takeup of such controls.

A number of housing projects have incorporated elements of water sensitive design. These include

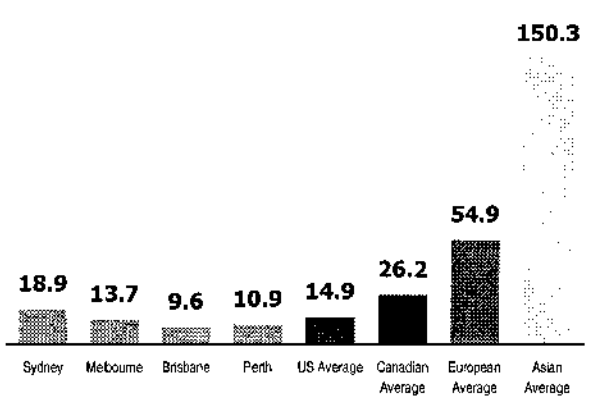
- *Wattle Grove*: this 216 project by Delfin Property Group and Defence Housing Authority at Liverpool, south west of Sydney, incorporates a series of wet and dry retention basins to control stormwater run-off into the Georges River catchment system. The lake acts as part of the retention system and as a sediment basin. Gross pollution traps are used.
- *New Haven estate*: this estate initiated as part of the multifunction polis project by the SA Housing Trust reduces mains water use by collecting, treating and recycling storm water and sewerage as reclaimed water. The reclaimed water is used to water gardens, public open space, street trees, and to flush toilets. Drip systems are used for watering public open space.
- *Lynbrook Estate*: This is a 1700 lot Greenfield residential development by VicUrban in the south-east growth corridor of Melbourne using WSUD principles for 271 lots. Wetlands, infiltration system, grass swales and bio-retention systems were used.
- *Inkerman Oasis development*: This development includes 236 dwellings on 1.2 hectares in St. Kilda, Melbourne. It includes recycling of domestic greywater for garden irrigation and toilet flushing, a 400 square metre native wetlands, capture and filtration of storm water. The greywater recycling will achieve a 20-40 percent reduction in the usage of potable (40 percent in Summer and 20 percent in Winter).

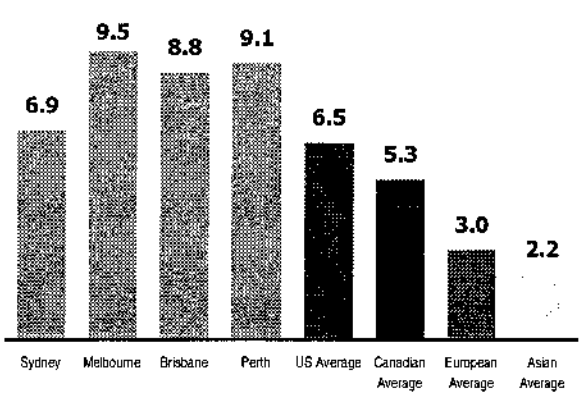
Chapter 4 Develop sustainable transport networks, nodal complementarity and logistics

Background and Current Practice: The Crisis of Automobile-Dependent Urban Transport

For most of the 20th century, Australian cities have expanded gradually through the building of relatively low-density detached housing and segregated uses. Urban design in outer urban areas has been dominated by a curvilinear street pattern and cul-de sac model, leading to a pattern of car dependency. The Australian Urban and Regional Development Review (1995:127) commented that "the development industry, and the legislative and regulatory environment... [has imposed]... a rigid conservatism on urban design... This pattern has determined a generation's expectations of subdivision layout and housing type, and has reinforced conservative attitudes by the development industry of what will sell. Market choice is locked into a conservative and mutually reinforcing set of seller and buyer expectations".

Since 1945, the growth of Australian cities has been based on the presumption that most urban travel would occur by private automobile. Generous road-building programmes have led to further car use. The legacy of post-war land use and transport planning has left Australian cities with some of the lowest population density and the highest road provision among urban centres internationally (see Figures 1 and 2).





Figures 1, 2: Urban density in residents per hectare in cities in developed countries, 1995 (left); Road length in metres per capita, 1995 (right). Source: Kenworthy and Laube 2001

The dominance of the car and the low-density suburb has resulted in growing environmental pressures. Examples include the excessive use of energy, higher air pollution, increased land take and deteriorating public health. Conventional transport and access policy has also contributed to social divides. Higher-income groups tend to be located in well-serviced, inner urban areas where they are mobility-rich; while lower-income groups tend to be located in poorly-serviced areas, often at the fringe of cities where they are mobility-poor. In car-dependent areas, it has become the norm for children, the elderly and people with disabilities to depend on others to drive them around, or to stay at home.

From an economic perspective, there are also critical disadvantages to an excessively automobile-oriented city. Where the car is relied on for most trips and where public spaces for people to congregate become scarce, there are diminished possibilities for what David Engwicht (1997) calls *spontaneous exchange*. This describes the opportunity for businesses and individuals to network, socially, professionally or both at once, as an essential ingredient for a vibrant and innovative urban economy and culture.

In this context, it is not surprising that our ideals of the future Australian city have begun to change. For many people, it has become as fashionable as convenient to live in the city again, and to draw on a rich variety of shops and services within walking distance. Simultaneously, a new suburban culture is emerging, with recently developed suburbs now trying to copy such qualities rather than continue to grow on the model of car-oriented dormitory communities. To ensure the success of this transition, the physical design of these new urban environments plays a crucial role.

In addition to patterns of recent urban development, our activities and movement patterns in the city have also changed. Instead of commuting from the suburbs to the centre for a long-term, full-time job, many people now juggle a number of professional and educational commitments over time and space - and change them quite regularly. Many women now are part of the workforce and often have to coordinate job commuting with household and childcare chores. Single people and childless couples, single parents, young adults, 'empty-nesters' and seniors now far eclipse the nuclear family in household numbers. Each of these groups has different mobility needs, particularly with regard to their leisure time.

Some commentators have argued that these patterns indicate a shift from a single-centred to a multi-centred metropolitan form, functionally connected through an ever widening commuter belt (O'Connor and Stimson 1994, 1996, McKenzie 1996). Brotchie (1992), Brotchie et al (1993, 1995), O'Connor (1992, 1994, 1998), and O'Connor and Stimson (1994, 1996) identify elements they believe are associated with dispersal: central city employment is proportionally declining, manufacturing has relocated to outer suburbs, employment and housing have dispersed, and outer urban population grown. In their view, this has led to dispersed commuter patterns with shorter circumferential trips within the outer suburbs replacing longer radial trips to the central city and leading to lower work trip times. Mees (1995) contests this argument, pointing to the relative increase in suburban employment to be an invariable outcome of population growth and the evidence that most intra-suburban commutes remain radial in direction.

From the perspective of transport users, however, the result of these trends is primarily an experience of traditional peak hours of traffic (inbound in the morning, outbound in the evening) increasingly extending to other times and places. It is no longer unusual to encounter traffic congestion or crowded trains and buses anywhere across the metropolitan area, at any time of the day or week.

Issue Identification: Urban Form, Integration of Uses and Transport Impacts in Sustainable Cities

The problem of dysfunctional traffic patterns in large cities, and their apparent unresponsiveness to policy interventions has renewed policy debates about the interaction between urban transport and land use patterns across Australia. In the light of sustainability, this has focussed attention on models of urban form that maximises its resource efficiency and exchange opportunities. Williams, Burton and Jenks (2000) argue that "to realise the 'sustainable city' there has to be a clear and common-held concept of what it will look like, how it will function, and how it will change over time". The following models are adapted from those presented by Minnery (1992), Banister (1992), Newton (2000), Loder and Bayly (1993), and many other commentators.

- **Compact city (conventional consolidation):** Intensification of population and activity through infill development and higher density housing anywhere in a metropolitan area, but particularly in inner and middle ring suburbs.
- **Compact city, or multi-nodal city (traditional neighbourhood, or urban village, development):** Intensified development of mixed use, higher density areas within 400 metres of a public transport location, with increased street connectivity, in both the existing metropolitan area, and in new development areas on the urban fringe.
- **Dispersed city (business as usual, fringe or edge city):** Low density development of detached housing and separated single uses in car dependent suburbs, with retail and commercial development concentrated in vehicle oriented regional nodes linked by freeways or major arterial roads. This type of development occurs in extending outer suburbs, usually without greenbelts.
- **Corridor city:** Urban development is channelled into a number of linear corridors following public transport routes and separated by rural green belts (or "wedges"). Development can be compact or dispersed in corridors.
- **Decentralisation and new towns (ultra city):** Housing and employment located in existing small towns, regional towns, or newly constructed towns outside and separated from the metropolitan area.

The academic debate on the potential merits and shortfalls of these models in sustainability terms remains controversial (Troy 1996, Breheny 1996, Ewing 1997, Gordon and Richardson 1997). However, academic and practitioner input into policy making (Katz 1994, Morris and Kaufman 1996, Newman and Kenworthy 1999), and the resulting state policies themselves (such as Melbourne 2030 in Victoria (DOI 2002) and Liveable Neighbourhoods in Western Australia (WAPC 2000)) have begun to strongly favour the compact, multi-nodal city as the preferred blueprint for urban sustainability.

A sustainable urban transport and access system will simultaneously address economic, social and environmental issues. It will pursue enhancement of a city's economic performance, its social equilibrium and justice, and the state of the urban and natural environment. In the Western Australian State Sustainability Strategy (DPC 2003), urban sustainability is understood as the quest to make cities more liveable while reducing their consumption of resources and discharge of wastes. In transport terms, these premises translate into a three-pronged goal:

- integrating the provision and operation of all transport modes,
- reducing the present volume of travel while improving accessibility to the city's opportunities for all users,
- shifting as much as possible of the remaining volume of travel onto the most environmentally friendly modes - walking, cycling and public transport,

- ensuring that the environmental impact of motorised transport, both private and public, will be further reduced by applying energy-efficiency technologies, alternative fuels and traffic management approaches that promote the coexistence of walking, cycling and vehicle traffic,
- relating transport modes to land use planning, resulting in integrated land use and transport planning.

In line with the compact, multi-nodal development model, a sustainable urban transport strategy will also set out to influence the physical form of the city by:

- endeavouring to mix housing, jobs and services in walkable precincts connected by good public transport;
- developing more urban areas to higher density to relieve rural and bushland surrounding the city from urbanisation pressure; and
- integrating natural features such as water courses and parkland with urban development.

There are many benefits in this model that translate into cost savings for users, communities and the private sector. Public transport that serves higher-density urban areas which accommodate both origins (housing) and destinations of trips (jobs, shopping, services, leisure) enjoys higher and more even passenger numbers over the day. Land use decisions also affect transport patterns. Housing and other uses developed at higher densities theoretically minimise land costs and can thus be supplied at more affordable prices.

Theoretical academic debate and empirical evidence appear to support these statements, however, there is still considerable controversy about the degree of influence mixed-use urban nodes have on transport patterns. Van and Senior (2000:141) comment that there is "increasing scepticism about the strength, and even the existence, of the impacts of land use diversity on travel behaviour". However, their research found that land use mix affected some transport decisions, and that car use for commuting declines as land use mix increases. In the United States, Ewing et al (1994) found significant differences in travel behaviour between residents in higher density mixed use, and low density areas. Frank and Pivo (1994) and Cervero (1996) found that mixed uses affected commuting behaviour.

A general picture emerged by the early 1990s that redeveloped mixed use activity areas around public transport modes within existing cities, in preference to outer urban fringe area development, produce transport savings (Banister, 1992, ECOTEC 1993). Winter and Farthing (1997) report that the provision of local facilities with new residential developments reduces average trip distances. ECOTEC (1993) reported a clear relationship between the distance from a local centre and the frequency of vehicle use and average journey distance. Hanson (1982) reported similar findings.

There is considerable research to indicate that density and land use mix are both related to modal choice and that as these increase, transit usage and walking rise while single occupant vehicle use falls. Increasing this level of land use mix at trip origins and destinations achieves the same results (Frank and Pivo 1994). Localization of employment and services, accessibility and high quality public transport are critical variables affecting results of studies. For example, higher density centres without these factors may lead to an increase in cross town vehicle use.

Newton (2000) also has pointed to the strong comparative environmental performance of compact city forms. He evaluated the urban environmental performance of six urban development scenarios involving different types of compactness, dispersal and corridor development. He concluded that the compact city was the most fuel efficient of all urban forms with 43 per cent less fuel consumption than business-as-usual, or laissez-faire, low density, dispersed development. The compact model delivered the lowest output of carbon dioxide emissions due to greater use of public transport and fewer vehicle kilometres travelled, as well as lower pollutant emissions for VOC, oxides of nitrogen, Carbon monoxide and Sulphur Dioxide. A corridor model in 2011 would deliver a 55 per cent improvement over the base situation for 1991. In contrast, business as usual development would result in an increase by 71 per cent in the population exposed to smog at levels above those considered appropriate by current Air NEPM standards.

Best Practice, Policy Responses and Scenarios: Achieving Synergistic Outcomes with Integrated Urban Policies

The pursuit of sustainable urban transport and access systems is a holistic process, where the measures in different fields support each other and help reduce environmental pressures as well. For instance, the provision of better public transport and the design of more walkable neighbourhoods will increase the use of non-car modes. This improves energy efficiency in transport: in Australian cities, urban rail uses 18% of end-use energy per passenger kilometre compared to cars (Kenworthy and Laube 2001), most of which, moreover, is electric energy, which may increasingly originate from renewable sources in the future.

Where the use of public transport, walking and cycling becomes more widespread, the demand for urban infill and densification will increase, as will the supply of such solutions, as far as planning regimes allow. This takes pressure off undeveloped land at the urban fringe and may enable the creation of growth boundaries around metropolitan areas in the interest of rural uses and an intact natural environment in the city's surroundings.

Where more dense and diverse neighbourhoods exist, there are also very favourable conditions for lifestyles with low car use and ownership, particularly where travel demand management programmes can help to make such choices convenient and acceptable. Fewer parked and moving cars enable the creation of traffic-calmed and more people-friendly open spaces, and the retention or rehabilitation of natural features such as water and vegetation in urban neighbourhoods.

Such gains in liveability will strengthen the attraction of higher-density, car-reduced neighbourhoods, not least for people who are fond of spending time outdoors and who would otherwise prefer to locate in the outskirts of the city. The extra attractiveness of the public spaces works as a compensation for the relative loss of private spaces. Further improvements in public transport, walking and cycling networks enable this type of neighbourhoods to proliferate.

In conclusion, changes to urban form need to be linked to other measures aimed at discouraging car travel, such as residential, commercial and retail car parking restrictions, pricing measures, traffic restrictions, and ultimately perhaps restrictions on car use. Such other variables may be also important influences on the amount of vehicle use. Variables such as the accessibility and availability of high quality public transport and the localisation of employment and services may exert powerful reinforcing impacts on each other. There is evidence also that high quality public transport can reduce car use independently of urban form (Mees, 2000).

Locational factors are not the only type of variables which influence the type of transport use. Fuel pricing and demographic characteristics may also be important. Studies report that with increasing income, trip frequency increases (Hanson, 1982), as do commuting distances (Cervero, 1996) and overall transport energy consumption (Næss, 1993). Other studies report that total travel distance correlates positively with car ownership (Næss and Sandberg, 1996), that car ownership increases as the distance from the city centre increases (Mogridge 1985, Næss and Sandberg 1996). Car ownership tends to be lower in the inner areas of many larger cities, although this can depend on income levels, urban form, and public transport quality. Typically, households in inner suburbs of Melbourne and Sydney own fewer cars per capita than households in the outer suburbs and the metropolitan average, are less likely to use them to travel to work, and spend a lower proportion of their income on transport (see also Dodson, forthcoming).

PUBLIC TRANSPORT IN THE 21ST CENTURY CITY

These trends challenge our current transport and access systems. Public transport networks have traditionally focussed on the city centre because the high concentration of jobs and services there creates the highest 'natural' level of demand. While these are convenient and important functions for the city centre, the radial network form of public transport fails to address the needs of those whose trips criss-cross the metropolitan area in a more diverse fashion. To gain an increased market share from such travel

needs, public transport networks must look more like a grid pattern, offering a multitude of transfer points all over the urban area. Ideally, these transfer points would be located near suburban shops, services and schools, so passengers can easily combine changing routes with running errands. It is also important that the timetables of different public transport modes and operators are coordinated, and that they can be accessed by using the same ticket. As Paul Mees (2000) describes it, this allows public transport to retrace the vital fabric of the city and further consolidate it into a polycentric structure of activity nodes. Public transport then forms a city-wide network that is in principle as easy to navigate as the road system with its 'go anywhere, anytime' quality.

Another aspect of the new mobility culture in cities is the way in which more sustainable travel behaviour is marketed and made attractive for users. Encouraging people to use their cars less has been a popular policy goal for many decades. However, the most prominent tools to achieve this have been monumental public investments in high-quality public transport infrastructure, in particular upgraded and expanded rail systems that match the car in speed and convenience. Thus by focussing on the *supply* of travel alternatives it was assumed that demand would automatically follow. Such programmes may be successful - for example, Perth's rail patronage quadrupled as a consequence of the system being electrified and extended in the early 1990s. Maintaining public transport systems in good shape and extending them where necessary remain significant tasks for the future. The expansion and modernisation of light rail and tram systems in particular, which is still in its infancy throughout Australia, offers a host of exciting opportunities in the field of urban design. However, to achieve the scale of change required towards a truly sustainable city, the physical provision of new facilities alone will be insufficient. It will be necessary to interact much more closely with the needs of users.

TRAVEL DEMAND MANAGEMENT

An approach which aims to modify travel *demand* resonates directly with the new patterns of movement - which are ever more individual than collective in character, more incidental than predictable. Such an approach is known as *travel demand management*. Its focus is to influence travel choices by addressing users' specific needs rather than second-guessing them, and then responding by providing appropriate infrastructure. This applies on a number of levels. In many cases, users would undertake more non-car trips if relatively simple measures were taken, for example, if better information about a local bus service was available, or if a better pedestrian crossing to access a nearby commercial area was created. Removing such barriers to sustainable transport and access is the task of community representatives, local governments, transport providers and design practitioners in an interactive process, facilitated by professional skills. Traffic calming - the quest to harmonise the coexistence of vehicular traffic, walking and cycling, and the coexistence of transport and non-transport activities in our streets and public spaces - is an example of a practice that thrives on intensive input from the design profession.

Transport demand management can also be applied to the destinations of trips, where a range of incentives to encourage visitors to carpool or use alternative modes can be used. Examples include:

- Employers imposing higher charges on parking facilities
- Shopping centres offering free home delivery to their customers
- Entertainment venues engaging with public transport operators to integrate the travel fare with their admission tickets.

Additionally, travel demand management offers opportunities for efficient freight transport, which is currently largely uncoordinated and therefore imposes a disproportionate burden on the transport system and the wider community.

RESPONSES: INITIATIVES TO OVERCOME AUTOMOBILE DEPENDENCE

As is often the case with issues involving cultural change, the implementation of more sustainable transport and access systems in Australian cities is controversial. The current situation in urban accessibility and transport favours cities based on automobile travel, and people and institutions who also enjoy the largest degree of influence on policy decisions. As long as owning and using cars remains relatively cheap to the user, the improvement of public transport systems or the retro-fitting of suburbs to make them more walkable may appear to be a waste of taxpayers' money and, perhaps even more crucially, a less than viable investment for the private sector.

Altering this policy focus requires stronger market signals and behavioural incentives from the government sector, which has the formal power to pass such regulations, that is, a change to planning and other regulatory regimes is essential for the adoption of more sustainable land use and development patterns. Incentive regimes could also be considered to encourage mixed use neighbourhoods with good transport access, and discourage lifestyles and business relations involving excessive travel. However, governments acting alone cannot achieve the required level of change. The transition to a more sustainable transport and access system in Australian cities requires the input and the commitment of all stakeholders - governments, the private sector and civil society - and needs to take the user perspective as a benchmark.

There are a number of existing laws and regulations that act as barriers to the transition towards less automobile-dependent cities and present suitable starting points for action:

Transport infrastructure funding still largely occurs by sector and by mode. Traditionally, there are separate budget for roads, airports, public transport and pedestrian and cycling infrastructure. Such a regime leads to a rather narrow vision towards the real needs of users when tackling a particular transport or access problem. It can only conceive of solutions that consist in improving the conditions for one particular means of transport, for example, by tackling traffic congestion, by widening roads and increasing the capacity of intersections. This often does very little but further increase traffic volume and all negative side-effects.

An infrastructure policy approach more in tune with sustainability goals would look into transport reduction potential rather trying to further expand mobility. For instance, this approach would examine how the excess of traffic demand that leads to congestion could be shifted to other modes of transport, to closer destinations and even prevented through alternative, non-transport inducing activities such as working at home or shopping through the internet. This highlights the importance of a close integration of infrastructure (supply) management and travel demand management approaches.

Furthermore, the allocation of funds to the needs of different transport modes remains far from equitable. For instance, while substantial federal grants are available towards urban freeway construction, no designated Commonwealth programme exists to assist the development of urban rail infrastructure. Rail and other public transport projects generally draw on the limited spending capacity of state agencies, a practice that is severely out of tune with urban transport funding regimes in practically every other OECD country except New Zealand (Laird et al 2001) This circumstance goes a long way towards explaining why Australian urban rail systems have been struggling to keep up with the pace of metropolitan growth, leading to an outer ring of extremely car-dependent suburbs around every major Australian city where high-quality public transport does not exist. **Australia needs a significantly boosted federal commitment to upgrading and expanding fixed public transport systems in its major cities.**

The land use planning system in Australian cities still grapples with the legacy of half a century's policy and practice based on a vision of segregated urban functions - keeping housing, jobs, shopping and leisure facilities apart from each other. This obviously increases the need to travel while making access to everyday destinations unnecessarily difficult for the transport-disadvantaged. A plethora of regulations requires urban development to conform to such practices as to provide generous road access and parking supply and not to exceed certain densities. This has resulted in formidable legislative barriers to initiatives

for more integrated urban design solutions that try to minimise the direct and indirect effects of road-based transport.

Recent planning reforms have begun to change this picture. Many state governments in Australia have adapted planning codes to cater for better accessibility, less resource-intensive transport impact and higher-density, mixed-use urban development. These changes include a renewed commitment to the creation and reinvigoration of local and regional centres to respond to the needs of the pedestrian and thus facilitate non-motorised access. **Urban development across the country needs new technical manuals and new approval procedures to ensure sustainability objectives are enshrined in design practice. Incentives could be provided to make this happen or to promote best practice.**

Significant failures in coordination between government agencies have hampered integrated solutions to urban problems. During most of the 1990s, agency decisions on environmental, planning, and transport issues tended to be sectoral. Government responses were not coordinated effectively around policies and measures aimed at controlling road use, reducing energy use, implementing alternative approaches to urban form, and protecting environmental values. The development of metropolitan and greenhouse policies provide the opportunity to remedy this deficiency.

Inter-agency processes based on an adoption of a cross sectoral sustainability ethic are essential for delivering a metropolitan strategy which achieves environmental objectives. The strategy should be developed and monitored by a unit acting independently from infrastructure sections of government. A matrix management model of implementation is appropriate with strong monitoring and reporting to Cabinet on implementation. **Government funding, regulatory and other implementation mechanisms should both deliver and not work against adoption of sustainability outcomes.**

Current taxation regimes reward high energy use and car commuting. Australian fuel taxes and vehicle registration are among the lowest in the developed world. Whether or not they cover their original purpose of road building and maintenance may be disputable, but it is certain that they do not fully cover the external costs associated to automobile transport, such as air pollution damage, noise mitigation and above all public health costs related to road accidents. Fringe benefit taxation enables employers to supply company cars to employees at very favourable conditions which encourage maximum car use, but usually still does not provide for public transport tickets to be included in salary packages or offer any reward to employees who walk or cycle to work. Compared to other modes of transport, the car is a substantial recipient of public welfare. **Overcoming this imbalance of hidden subsidies requires tax reforms that support the sustainability goals of minimising fossil fuel use, encourage true pricing of car ownership and usage, and financially rewarding the choice of public transport, walking and cycling over the car in urban areas.**

CONCLUSIONS

Policy makers have long regarded transport solely as an exercise of movement of persons and goods, and made it a goal to render this movement as efficient as possible. However transport, by definition, is not an activity undertaken for its own sake, but is a means to an end. Transport serves to access urban facilities and to enable exchange between economic, social and cultural players. Australia's existing transport systems must be assessed with regard to how well they provide these access and exchange opportunities. This approach departs from measuring the quality of urban transport solutions in terms of speed and throughput of people or goods, but rather examines the capacity of individuals - mobility-rich or mobility-poor - to pursue their everyday out-of-home activities with minimal cost and effort, and the capacity of businesses to form networks of commercial interaction and innovation with minimal need for physical transport.

Users will play a crucial part in achieving more sustainable transport and accessibility solutions. Their behavioural patterns and their flexibility for change must be at the heart of policy making and makes their broad involvement imperative. Supply-side and demand-side strategies must complement each other. Urban development and travel behaviour need to be continuously assessed for on-the-ground

performance and policies further adjusted where necessary to improve their outcomes in sustainability terms.

In a sustainable city, the design quality of transport and access facilities is at least as significant to achieve positive results as the quantitative provision of physical infrastructure.

QUESTIONS FOR CONSIDERATION:

What initiatives can assist in the reduction of automobile dependence?

Urban form: Australian cities should pursue urban development policies that strengthen the multi-nodal city by increasing density and diversifying uses in activity centres linked to public transport, and by promoting integrated residential and employment precincts at the urban fringe and in larger infill development. New and revitalised neighbourhoods should offer easy walkability to local destinations and public transport. Residential and employment densities in green field urban developments should aim at a minimum standard of 15 residential units and 22.5 jobs per hectare of urbanised land at district level, and rising to a high of 25 residential units per hectare. Parking requirements should be relaxed in all types of development, in conjunction with travel demand management programmes (see below).

Transport infrastructure and service: Australian cities need an investment campaign in high-quality public infrastructure, aiming at the upgrade and expansion of heavy and light rail systems and strengthening the role of high-frequency, fixed-route bus systems on links where rail is not available. The metropolitan public transport network should emulate the pattern of activity centres and the links between them and offer coordinated and fare-integrated transfers between modes. Conversely, federal and state governments should take a more conservative approach than at present in funding additional road infrastructure within existing urban areas. Pedestrian and cycling networks require improvements that ideally form part of urban design strategies for activity centres, neighbourhoods and arterial roads and strengthen the role of non-motorised modes in the transport mix.

Travel demand management: State and local governments should work with employers and local communities on user-based strategies to reduce car use through targeted, incremental measures at the neighbourhood/workplace level and through the promotion of behavioural change (eg. TravelSmart). These programmes support public transport infrastructure and service improvements as well as new urban development aimed at lower than average car use and ownership.

Should new transport technologies, such as electric cars and buses, be promoted as alternative to conventional fuels?

The promotion of alternative fuels and engine technologies are an integral part of sustainable transport policy; however, they only address selected problems associated with excessive automobile use, such as air pollution, greenhouse gas emissions and fossil fuel dependence. To reduce the spatial demands of road infrastructure, parking facilities and associated low-density land uses, to provide more equitable transport choices, to combat road trauma and public health issues associated with sedentary lifestyles, and to reduce the severance effect of heavily trafficked roads on urban neighbourhoods, it is imperative that improvements in transport technology go hand in hand with the urban form, infrastructure and travel demand management policy elements outlined above.

What are the features needed in new settlement areas to encourage more diverse and sustainable transport networks?

Ensure new settlement areas are configured in ways that encourage walking and cycling to and from all neighbourhood facilities, are connected to all surrounding sub-centres by high-frequency public transport and meets the density and employment integration standards spelled out above. Conventional fringe area development typically creates up to twice the level of car ownership and use of inner urban neighbourhoods. New fringe area development should aim to bring down these figures significantly.

What is the role of federal government in assisting metropolitan areas to restructure transport networks in line with more sustainable settlement patterns?

Federal government needs to shift its funding priorities from support for urban road infrastructure towards a substantial commitment for urban public transport investment (see above). Federal government could further promote and reward excellence in transit-oriented redevelopment and urban design in Australian cities, for instance through campaigns similar to the Better Cities programme in the early 1990s. The government could also initiate a national cities policy which gains intergovernmental agreement on the points outlined in this chapter.

What are the needs of transport systems for them to be equitable, accessible and economically viable?

Public transport systems should

- Provide high-quality service for both local (slow) and metropolitan (faster) trips, though as much as practical separate these by mode or product
- Progressively redesign stationary facilities and replace vehicles to ensure 100% disabled access. Work with local governments to ensure pedestrian access routes to railway stations, bus and tram stops are safe, direct and negotiable for people with disabilities
- Provide for secure bicycle parking facilities at rail stations and major bus and tram interchanges, enable bikes to be carried on trains and on buses and trams that serve longer distance routes
- Work with state and local government to ensure urban development focuses around heavy and light rail routes, and makes most of this opportunity in promoting travel patterns with high public transport use with its occupants (travel demand and parking management)
- Progressively develop route networks that serve reverse and cross-city commuting needs as well as traditional CBD commuting, by focussing routes on suburban activity centres and providing more orbital links.
- Create partnerships with employers, entertainment venues etc to expand the base of regular public transport users through job tickets, combination ticketing etc

Is a more decentralised nodal type of transport network appropriate for commuter and traveller needs?

Australian cities already have a multi-nodal structure and urban development policies in most states seek to reinforce this for its opportunities to achieve sustainability outcomes. It is most appropriate that metropolitan-wide public transport networks evolve to reflect this pattern (road infrastructure by and large already does reflect it).

What are the transport logistic needs of industry and how can these be managed in a sustainable city?

Much greater emphasis needs to be given to rail freight both within and between cities.

AUSTRALIAN STUDIES INTO DENSITY, MIXED USE AND TRAVEL PATTERNS

The Australian evidence that changes to the urban form of our cities could lead to substantial reductions to transport and housing energy use and infrastructure costs includes a wide range of studies. Kinhill (1995) found that greenfield residential densities of 15 lots per hectare and higher street connectivity led to a six per cent saving on infrastructure costs compared to a conventional "sprawl" scenario using 10 lots per hectare. The Kinhill study also found that infrastructure costs were likely to be inversely related to density. McGlynn et al (1991) compared total annual transport energy use for Australia's capital cities under four scenarios: base case involving expansion at urban fringes, market driven with utilization of spare capacity in established areas; policy forced with more direct government driven re-urbanization; and urban centres focusing all population and employment growth into established centres. All scenarios

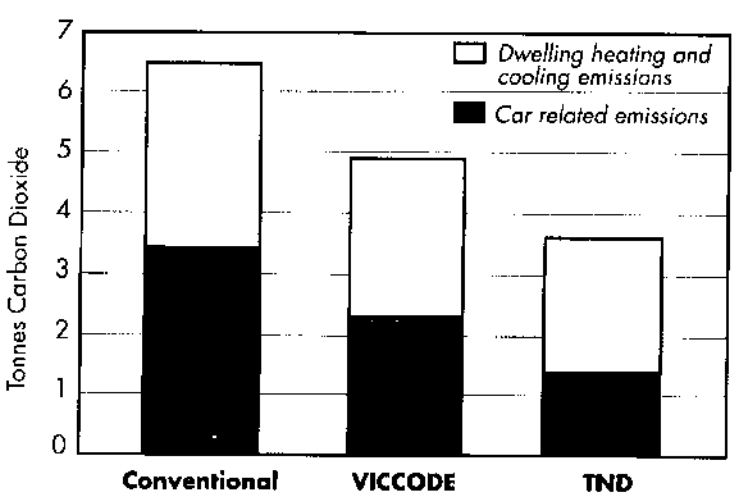
reduced growth in energy consumption compared with the base case. Non transport infrastructure savings for urban centres compared to the base case ranged from $2.1 - $4.2 billion.

Maunsell and Glazebrook (1994) reviewed an extensive literature on the effects of road and public transport oriented policies and have catalogued the benefits of integrating transport and land use planning around mixed use activity centres. The options for Melbourne's future pattern of land use and development were summarized in a review for the Commonwealth Department of Housing and Regional Development: continuing present trends towards dispersal of employment closer to homes linked by private transport and use of tele-commuting; a reversal towards traditional neighbourhood land use and transport patterns, of modes for employment, high density housing around transport interchanges; and a combination of the two.

The *Victorian Greenhouse Neighbourhood Project* (Loder and Bayly, 1993) quantified the effects of increasing dwelling density and introducing mixed uses on energy use, transport patterns and greenhouse gas emissions, and associated infrastructure costs, in a new outer suburban greenfields site. This study demonstrated the significant impact of urban form on energy use.

Three alternative residential neighbourhood designs were modelled on a site on the western metropolitan fringe of Melbourne: the conventional subdivision of the 1980s, with a net density of 10 dwellings per hectare, few local employment and retailing opportunities, a hierarchical street network with a curvilinear street pattern and many culs-de-sac, with mainly single storey detached houses on standard lots with no particular regard for solar access; subdivisions shaped by the Victorian Code for residential development 1 (VicCode 1) with a net density of 15 dwellings per hectare, some mix of dwelling types, a more interconnected than hierarchical street network with some culs-de-sac and solar access to 70 per cent of lots; a traditional neighbourhood design (TND) with a net density averaging 25 dwellings per hectare, a greater mix of attached and detached dwelling types, a high level of local retail and employment opportunities with one job available for every two resident workers, a highly interconnected street network typical of the inner grid pattern areas of Melbourne, with few culs-de-sac, good public transport services and solar access to 70 per cent of lots.

Figure 3. Combined dwelling heating and cooling and car-related greenhouse gas emission reductions by neighbourhood type (tonnes CO_2 per dwelling per year). *Source: Greenhouse Neighbourhood Project*



The three major parameters considered in the study were housing energy use, transport energy use, and infrastructure costs. The study found that substantial savings in energy requirements and greenhouse gas emissions could be achieved through changes in urban form. Use of the TND model in comparison with conventional development practices, led to carbon dioxide emission reductions of up to 42 per cent by

combining land use and transport related factors to reduce car travel and by using dwelling siting and design to reduce heating and cooling related emissions.

Savings of up to 57 per cent of transport energy use could be achieved primarily by increasing the proportion of local employment, retail and related land uses which provided high levels of self containment for daily activities. Increased residential densities alone led to more limited reductions in travel and emissions but remained important.

Energy savings of up to 26 per cent over conventional detached housing could be made by designing houses to make the most of solar energy for heating and cooling, and using shared walls and floors like those in terrace or apartment housing. Density alone was less important than increasing solar access. As the degree of attachment between dwellings and story height increased energy requirements were reduced. A combination of improving solar access and thermal performance through attached housing forms rather than separate dwellings with poor solar access is the key to reducing dwelling heating and cooling energy requirements at higher densities.

The study also found that car travel time and distance travelled per dwelling reduced markedly with the increase in density from Conventional to VicCode to TND neighbourhood types, as can be seen in the following table. Increased density was a significant factor in reducing transport greenhouse gas emissions. But the greatest gains were made when there was a higher density in combination with a mix of land uses and local employment opportunities leading to greater self containment and fewer longer external trips. This regional reduction led to major savings in emissions.

Table 1. Estimates of hourly a.m. peak car travel time per dwelling (minutes). ***Source: Greenhouse Neighbourhood Project.***

Residential Density	**Neighbourhood Type**		
(dwellings/hectare)	Conventional	VicCode	TND
10	**8.3**		
15	7.6	**7.0**	
25	7.0		**5.4**

Chapter 5 Incorporate eco-efficiency principles into new buildings and housing

Background and current practices, trends and data

Green building in Australia emerged from two separate sources. On one hand, researchers at the Experimental Building Station in the 1950s and CSIRO and universities in the 1960s and '70s explored the potential to make Australian homes comfortable and energy-efficient by utilising insulation, appropriate orientation, shading and other features. At the same time, a culture of owner-builder construction using natural materials and natural energy sources evolved into a key element of the alternative lifestyle movement of the 1970s.

After the 1973 oil crisis, governments focused on saving energy, and a Victorian Parliamentary Committee in 1976 proposed introduction of mandatory home insulation. Nationally, interest in solar and energy-efficient house design grew, with the Australian government offering tax rebates for ceiling insulation for a brief period in the early 1980s. Governments focused on building energy efficiency, and solar-efficient house design was promoted around Australia during the 1980s, culminating in the introduction of the industry based Glass Mass Insulation 5-Star Design Rating, which used CSIRO research to specify guidelines for new homes. This scheme failed because it was restrictive of design, and at the same time declining oil prices and new power station projects reduced interest in saving energy.

In 1991, the Victorian government introduced the first mandatory insulation regulations for housing, describing them as a 3-star rating, and foreshadowing introduction of 5-star requirement within three years. A change of government blocked progress. In 1995, the Australian Capital Territory introduced mandatory insulation regulations, but quickly shifted towards Australia's first mandatory 4-star energy rating, using an early version of the Victorian FirstRate software. This software was, in turn, based on CSIRO's computer simulation program CHEETAH, which was also incorporated in the NatHERS rating tool used widely around Australia. NatHERS was used (along with manual checklists) for compliance with the NSW Sustainable Energy Development Authority's *Energy Smart Homes Policy* which was introduced by most NSW councils during the late 1990s as a de facto regulatory framework.

In 1997 Prime Minister Howard foreshadowed building energy regulation if the building industry did not implement voluntary improvement within a year. In 2000, in the absence of effective industry action, the Australian Building Codes Board (ABCB) and the Australian Greenhouse Office (AGO) agreed to develop regulations. They introduced amendments to the Building Code of Australia in 2003 to require energy efficiency features in new dwellings. These amendments are being adopted by most states, although Victoria has chosen to shift to a mandatory 5-star rating by 2005.

It is something of an embarrassment that Australia is only now introducing national energy requirements for new housing, as most developed countries have had such requirements for many years. And our regulations are relatively limited in both scope and stringency compared with many developed countries.

But the story for non-residential buildings is worse. It was as recently as 1991 that the Victorian government began work on possible regulatory frameworks for commercial buildings, and this was taken over as a national process called the Building Energy Code of Australia. Progress foundered in 1993, and little happened until 1998, when the NSW Sustainable Energy Development Authority developed its voluntary *Australian Building Greenhouse Rating Scheme* (ABGR). This uses a 5-star rating system and applies to both existing and new office buildings. For existing buildings, it is based on actual energy billing data. For new buildings, developers must enter into a *commitment agreement* that requires them to demonstrate that the building will perform to the expected standard, then prove performance by submission of actual energy bills once it is completed. This approach is a response to the complexity of commercial buildings and the fragmented processes associated with design, development, construction, commissioning and operation.

In 1999, the Australian Greenhouse Office commissioned a *Baseline Study* (EMET Consulting, 1999) which pointed out that greenhouse gas emissions from non-residential buildings were expected to almost double between 1990 and 2010 unless action was taken. This work underpinned the inclusion of a commitment to develop regulations for non-residential buildings in the AGO agreement with ABCB. It is expected that these regulations will be progressively introduced between 2004 and 2006.

The 1990s saw the beginning of green building rating schemes in Australia. In 1992 the Australian Conservation Foundation launched its *Green Building Guidelines* for Victorian conditions, and a display home was built with Victorian government funding. Through the 1990s, interest in incorporating a broad range of environmental features into homes strengthened, with a number of architects and designers establishing the businesses in this niche market. Indeed, SEDA's ABGR scheme was a response to enthusiastic efforts by, among others, staff of Standards Australia and CSIRO to promote development of an Australian commercial building green rating system based on the United Kingdom's BREEAM (Building Research Establishment Environmental Assessment Method) scheme, which was introduced there in the early 1990s. SEDA decided that development of a comprehensive green building scheme was beyond its capacity, so it focused on energy and greenhouse gas emissions which, in any case, it found to be a major element of building environmental performance.

The mid 1990s also saw increasing interest in research into the energy embodied in the materials of buildings, as well as indoor air quality, natural ventilation and management of building waste materials in Australia. There was also a growing international movement promoting green building, and this included development of various rating schemes such as BEPAC in Canada, EcoProfile in Norway and LEED in the USA. These fed into the growing interest in green building within Australia. In the late 1990s and early this century, a number of efforts have been made to incorporate green building principles into several building projects around Australia.

Recent Australian efforts to develop environmental rating schemes for buildings have begun to draw together this broad experience and integrate it into a coherent framework. We are still at an early stage in this process, and attempts to develop these rating schemes have highlighted that a great deal of work is still needed to develop the knowledge base and products and services needed to deliver green buildings. Nevertheless, some impressive projects have been completed, and interest within the commercial building market has begun to grow. This growing interest is reflected by the establishment of the building industry based Green Buildings Council.

While regulations and policy responses to date have focused mainly on new buildings, the reality is that there is an urgent need to focus attention on existing buildings and, in particular, on major renovations and refurbishments. The reality is that most homes can be converted into eco-efficient homes at less than the cost of renovating a bathroom or kitchen. Yet progress is slow.

Figure 1. Trends in greenhouse gas emissions from residential and commercial sectors

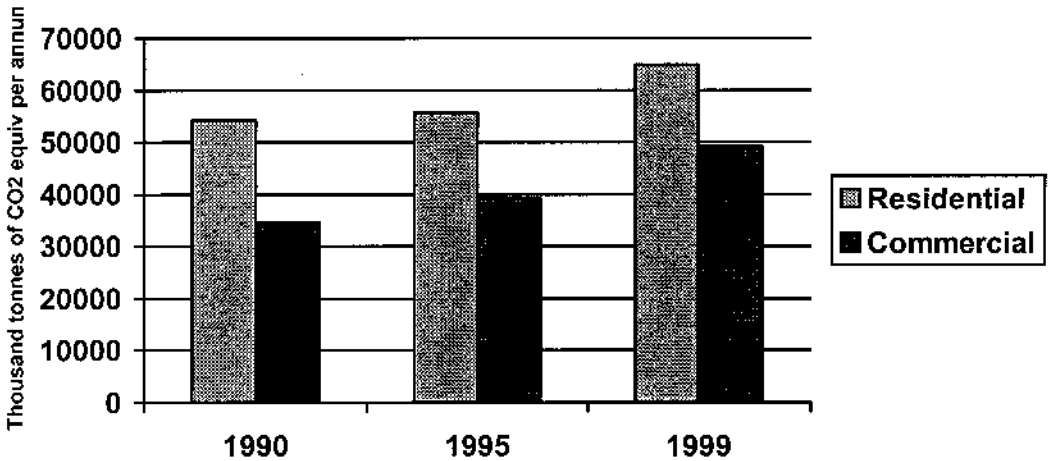
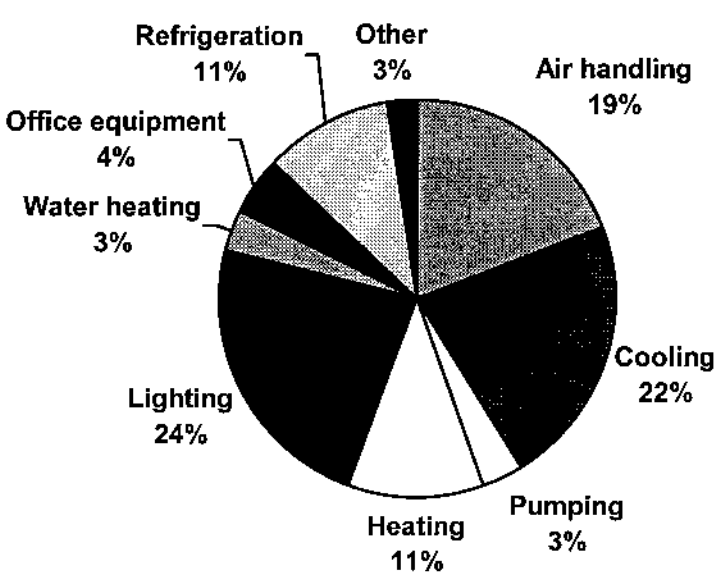


Figure 1 shows recent trends in greenhouse gas emissions from the residential and commercial sectors. Figures 2 and 3 show breakdowns of greenhouse gas emissions by activity within both sectors. It can be seen that in the commercial sector, three-quarters of emissions are associated with maintaining comfort and providing light for people to work. There is enormous scope for efficiency improvement here, as demonstrated by buildings such as the 60L Green Building. Various types of equipment comprise the remaining quarter of emissions, and programs such as the Commonwealth Department of Industry, Tourism and Resources Energy Efficiency Best Practice scheme have demonstrated scope for large savings there.

Figure 2. Australian commercial sector greenhouse gas emissions by activity, 1999 (Wilkenfeld and EES, 2002). Total 46.4 Mt per annum.



In the residential sector, maintaining comfort generates only around a quarter of emissions – although the significance of this activity for health, amenity and equity (given that a quarter of households rent), and as a driver of investment in expansion of energy supply infrastructure should not be undervalued. Increasing house size and a trend towards all-year whole home comfort conditioning is driving an increase in energy use in this area.

Provision of hot water is a major issue, due to a combination of wasteful water usage, inefficient plumbing systems, energy losses from hot water services and reliance by the majority of Australians on greenhouse-intensive electricity for their hot water.

Lighting is growing rapidly in significance as increasing numbers of households install large numbers of energy-intensive low voltage halogen lamps (each of which uses more than a 60 watt conventional light globe while producing a little more light). The growth in size of new homes is adding to this energy growth, along with increased installation of outdoor lighting.

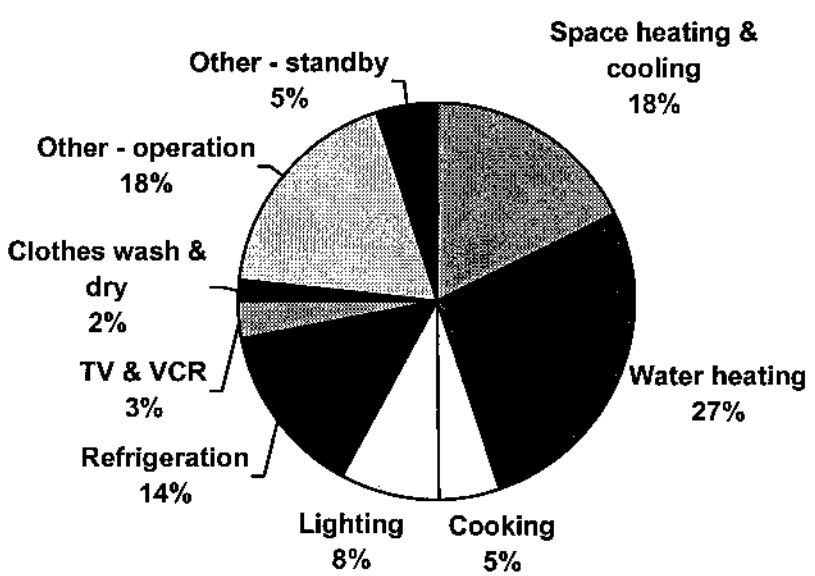
Clothes drying has already been mentioned as a potentially large greenhouse problem: a household that dries all its clothes in a conventional electric dryer generates 1-1.5 tonnes of greenhouse gas each year.

Installation of swimming pools can dramatically increase a household's energy use and greenhouse gas emissions, as filter pumps and salt chlorinators can easily generate 20 kg of carbon dioxide per day – almost as much as is generated by an average household for all its activities.

There is great scope to reduce these emissions, as discussed in Pears (1998).

Since the majority of emissions from households are not tied to the building envelope, but to appliances and equipment with much shorter lives, there is substantial scope for relatively rapid change. In any case, home renovation is a growing activity, and provides an important opportunity for upgrading performance.

Figure 3. Australian residential sector energy-related greenhouse gas emissions by activity, 1999 (Wilkenfeld and EES, 2002). Total 63.2 Mt per annum.



ECO-EFFICIENCY FEATURES FOR BUILDINGS

The following list summarises many of the environmental issues relating to buildings.

- Location – access/transport/cost of car ownership (equity)/congestion/time spent travelling
- Impacts on neighbours and local environment – or of the local environment on the occupants of the building:
    - glare
    - wind
    - overshadowing
    - streetscape
    - traffic and parking
    - noise
    - air pollution (e.g. wood smoke, odours)
    - privacy
    - contribution to street surveillance, safety
    - biodiversity
    - impacts during construction, such as trucks, noise, dust, etc
- Energy (including greenhouse gas emissions), resources and other impacts of materials used – on a lifecycle basis:
    - embodied energy: durability, flexibility/adaptability of building; maintenance; design for disassembly/recovery and recycling of materials
    - operating energy: building envelope, equipment and systems; ongoing costs to occupants
    - transport of materials and 'wastes'
    - impacts on sources of materials and sites where processing occurs
- Ozone depletion: air conditioners, solvents, foams
- Water: efficiency; collection; impact of stormwater; peak stormwater flows
- Sewage/grey water: management, treatment, utilization
- Health risks: OH&S for construction workers; hazardous materials, Legionella, mould growth, etc
- Provision of facilities to encourage environmentally sound behaviour, e.g. recycling facilities
- Indoor air quality and amenity: off-gassing from materials and finishes, appropriate controllable ventilation (e.g. exhaust fans, controllable outdoor air supply), indoor plants, glare, access to sun and light
- Provisions for disabled and elderly
- Functionality for intended purpose(s)
    - Aesthetics

From this list, it can be seen that there are many dimensions to sustainable buildings. What's more, there are major challenges in developing and applying objective criteria and analysis to many of these issues.

A key challenge facing efforts to improve eco-efficiency is the dramatic increase in dwelling size over the past decade, even while average household size has declined to 2.6 people, and 55% of households are comprised of one or two people. Larger houses consume more resources and require more energy and

environmental impacts to operate. For the owners and occupants, ongoing ownership costs are higher, while time spend on cleaning and maintenance is greater.

Historically, application of sustainability principles to buildings has involved a number of approaches with increasing sophistication over time:

- application of principles of importance to the designer and/or the client
- consideration of issues that can be quantified or evaluated in a manner acceptable to all parties
- consideration of issues where there is scope for cost-effective outcomes, such as energy efficiency
- comprehensive assessment using lifecycle assessment and other criteria developed by experts

In recent times, we have seen the emergence of a number of attempts to develop more comprehensive evaluation and rating systems, such as NABERS (Commonwealth Department of Environment and Heritage); BASIX (Planning NSW); Green Building Rating Tool (Green Building Council Australia).

A number of demonstration green buildings and developments have also been built. Often these demonstrate a subset of the sustainability criteria identified above, reflecting the areas of interest of the client or project team. Some future projects such as the Commonwealth Games village in Melbourne are building on the experience to date, both in terms of approaches to evaluation of environmental performance, and in green products, materials and design processes.

Issue identification

Issues that have emerged from experience to date in eco-efficient or sustainable building include:

- In many areas, methodologies for evaluation are still immature, and data are insufficient for objective decision-making. In particular, information on specific products and materials is difficult to access, so certain materials may be 'labelled' good or bad, even though those materials could be acceptable if appropriately sourced. Emphasis has been placed on operating energy and water issues, for example, because methodologies are relatively advanced and practising professionals and tradespeople have some capacity to deliver in these areas.
- Many products and systems rate well on some environmental criteria, but poorly on others, so that designers and specifiers are forced to compromise. For example, windows often include timber sourced from unacceptable sites; building security systems may use lead-acid batteries; and so on
- A plethora of rating systems are emerging, each including its developers' perceptions of what is important and how environmental objectives can be achieved.
- Ratings and evaluations based on design intent have often, when evaluated for actual performance, been found to deliver less than was expected. In other cases, results have been better than expected. This reflects the immature state of the design techniques and tools, and the lack of resources allocated to RD&D and evaluation of past projects with a view to learning from experience.
- There is some evidence of 'reinvention of the wheel', as some of the professionals working in the field try to maintain control of the intellectual property they have built up. This also reflects a lack of post-occupancy evaluation of performance and a lack of formal performance requirements, so there is potential for more learning from experience.
- There is a lack of training and education of all participants in the building industry, ranging from manufacturers of products and systems, designers, installers and operators.
- Market failures of various kinds mean that the full benefits of many sustainability features in buildings cannot be captured by either the developer or the occupant. For example, water authorities are reluctant to reduce headworks charges for buildings that limit their stormwater discharges, although

this is improving. The difficulty of measuring other features such as indoor air quality means that the market finds it difficult to place a value on them.

- Some of the features most heavily promoted to new home buyers (such as larger dwellings and low voltage halogen lighting) are undermining achievement of environmental improvement by diverting capital from investment in eco-efficiency to features that increase environmental impacts and ownership costs: there is a need to help potential buyers appreciate the long term consequences (for them and the environment) of owning larger dwellings, while facilitating development of designs that can be built as smaller homes but easily extended, or dwellings that can be easily divided into two homes.
- Some household activities do not seem to be significant based on existing data, but there is scope for them to grow and potentially become problem areas if they are not dealt with effectively. For example, with increasing urban density, electric clothes drying could become a major component of household greenhouse gas emissions: provision of drying areas, internal clothes racks and drying cupboards, gas connections for gas-powered dryers in laundries, and other strategies could be applied. Swimming pools are another energy intensive type of facility
- Present building energy codes for housing do not include emphasis on peak heating and cooling energy demand. Yet this is expensive to supply and drives investment in expansion of energy supply infrastructure capacity. Discomfort at these times drives purchase of expensive and energy consuming heating and cooling equipment, and creates a significant amenity problem. Instead of basing house energy rating schemes on annual consumption, they could be biased towards peak performance, or could even have separate methods for rating peak performance.
- There is a need to focus improvement on existing buildings. Schemes such as the Australian Building Greenhouse Rating scheme for commercial buildings, and possibly new rating schemes for households, along with requirements to declare environmental performance at the time of sale or renting are potentially important strategies.

The above issues reflect the nature of an emerging paradigm, rather than being fundamental barriers to success.

Policy options

There is a clear need for ongoing development of evaluation and rating methodologies, so that the criteria for good environmental performance can be clarified. Manufacturers of materials, products and systems need assistance to identify the environmental strengths and weaknesses of their produce, so they can improve performance and promote their positive attributes. Specifiers, designers, builders, installers and customers generally need objective, product-specific information in a form they can understand, so they can create market 'pull'. A good example of a practical approach to provision of information is the materials flipchart developed by RMIT's Centre for Design for a major green housing development

Past projects should be evaluated and, where their performance falls short of expectations or there are other opportunities for improvement, assistance should be provided to upgrade. This is important, not only as a learning process, but also so that existing examples of environmental practice can be used to showcase the benefits of eco-efficient design. Doing this will also help to refine evaluation and performance monitoring techniques, as well as providing feedback on the benefits of various environmental features.

Markets related to buildings show serious imperfections, and the need for mandatory disclosure of performance and benchmarking of performance is obvious. Further, mechanisms are needed that focus lifecycle costs at the point of decision making could be important in influencing behaviour of designers, developers and builders. There is also a clear need for education and information programs targeting customers and market intermediaries with arguments that promote acceptance of sustainability features,

partly by challenging assumptions and beliefs, and partly through promotion of new solutions and technologies.

QUESTIONS FOR CONSIDERATION

How can green construction and refurbishment techniques be integrated into standard building practices?

Key elements of an effective strategy include:

- development of environmentally sound products, materials and systems for use in buildings
- development of rating and evaluation systems, as well as certification processes and supporting technical Standards, model Specifications and Codes of Practice
- training and certification of professionals and tradespeople to deliver eco-efficient buildings, including practical guidance towards suitable products
- education and information programs for home buyers, and prospective commercial building tenants
- market pressures and incentives for green building
- restructuring of pricing by infrastructure agencies to reflect cost savings resulting from eco-efficient building practices
- government leadership through requirements for government building and infrastructure projects
- as confidence and expertise builds, incorporation of eco-efficient building requirements in planning and building codes

How can eco-efficiency innovations be promoted to achieve a market value in both commercial and residential buildings?

Research and analysis is needed to quantify and document claimed benefits of eco-efficiency measures, such as improved productivity and comfort, energy savings, etc. At the same time, there is substantial scope for reduction in the cost and complexity of implementation of eco-efficient practices and products through improved design, increased economies of scale and technological development.

Housing and building markets tend to be influenced more by visible 'wow' factor features, while many eco-efficiency measures are not very visible. Education of customers, including feedback on experiences of people living and working in both conventional and eco-efficient buildings, as well as promotion of credible and well-promoted rating schemes can shift priorities. In Canberra now, existing homes must be energy rated, and the rating displayed in all advertising: this can influence buyer perceptions and create an incentive for sellers to upgrade the performance of their houses.

However, there is a long road to be travelled. For example, home and lifestyle magazines at present focus almost totally on aesthetics and image. They must be encouraged to rate the houses and buildings they present against environmental criteria, using house energy ratings, environmental ratings, etc – more like the road tests in car magazines. When will we see a picture of a house with vast areas of unprotected west glazing described as scoring only two stars on its energy rating, and rated as uncomfortable in hot or cold weather by its occupants? And when will we see home improvement programs tackling such a house and proposing smart strategies to shade the glass, provide insulating movable panels, or even reduce its glass area?

What are the impediments to eco-efficiency principles being taken up across new housing developments and commercial areas?

See above.

What types of incentives or standards for new developments might be appropriate to encourage more sustainable residential complexes?

A wide range of incentives and standards can be used. For example, display homes could be required to display their environmental ratings in a prominent place, and should be required to display energy meters and information on the capital and running cost of the air-conditioning and heating equipment they have installed. Too often, display homes use large heating and cooling systems to overcome the serious energy-related weaknesses of their designs, but these are not visible to the potential homebuyers. Only after they move into their own dream home do they discover the reality – when it is too late.

Example of RMIT Centre for Design green building flipchart for builders

Floors & Footings

Slab on ground

Element	Environment benefit	Product	Company contact	Cost
Concrete	Dilutes the cement by adding fly ash and slag by up to 50% reducing EE by over 50%	Envirocrete	Boral 03 9315 2555	Up to saving of 5%
Concrete	Dilutes the cement by adding fly ash and slag by up to 50% reducing EE by over 50%	Slagment	Blue Circle 03 5241 8291	Up to saving of 5%
Concrete	Dilutes the cement by adding fly ash and slag by up to 50% reducing EE by over 50%	Slag Blend	Pronto 03 9635 1333	Up to saving of 5%
Concrete	Dilutes the cement by adding fly ash and slag by up to 50% reducing EE by over 50% and uses recycled concrete aggregate	Premix concrete	Local Mix 03 5248 2434	0
Others added as available 3/2/03				

Recycled aggregate	Reduces resource consumption by using over 40% recycled content ie don't need to quarry for stone.	Recycled crushed concrete	Alex Frazer 03 9369 7388	Up to saving of 5%
Recycled aggregate	Reduces resource consumption by using over 40% recycled content ie don't need to quarry for stone.	Recycled crushed concrete	Boral 03 9315 2555	Up to saving of5%
Recycled aggregate	Reduces resource consumption by using over 40% recycled content ie don't need to quarry for stone.	Recycled crushed concrete	Blue Circle 03 5241 8291	Up to saving of 5%
Recycled aggregate	Reduces resource consumption by using over **80%** recycled content ie don't need to quarry for stone.	Recycled crushed concrete	Local Mix. 03 5248 2434	Up to saving of 5%
Others added as available 3/2/03				

Reinforcement	Reduces embodied energy and resource consumption by using over 50% recycled content	Mesh and bar products	Smorgons ARC 03 9279 5566	0
Others added as available 3/2/03				

Chairs and mesh support	Reduces embodied energy and resource consumption by using over 50% recycled content	Plastic reo support	Smorgons ARC 03 9279 5566	0
Others added as available 3/2/03				

Membrane	Reduces embodied energy and resource consumption by using over 50% recycled content	Slab membrane	Plastic Technology 03 9462 2011	0
Others added as available 3/2/03				

Formwork	Less impact on biodiversity (no imported hardwoods)	Formply (hoop ply face)	Boral 03 9790 1790	0
Formwork	Less impact on biodiversity (no imported hardwoods)	Formply (Radiata face) Product still in development.	Carter Holt Harvey 1800 335 293	0
Others added as available 3/2/03				

Chapter 6. Provide urban plans that accommodate lifestyle and business opportunities

Urban plans that increase lifestyle and business opportunities must aim to provide real options and choices for the maximum number of people. An urban form that increases disadvantage, or delivers choice to only a minority, will ultimately damage both social and economic capital. Plans deal with spatial arrangements. This section focuses on the spatial arrangements that can deliver lifestyle and business or employment choice. In particular it discusses the provision of community infrastructure, retail and employment centres within the urban form and the increasing disparity between areas well catered for and those which are deprived.

Background and trends

Australian metropolitan areas have been subject to both centralising and decentralising forces. Trends to medium density, higher rise and inner city housing are now strongly in evidence in all metropolitan areas. This trend has added to the gentrification already in evidence in Australian cities which has increased the cost of central city living forcing lower income people towards the periphery. At the same time consumption of land for urban growth is still largely built around preferences for relatively large areas of private open space, for fringe metropolitan development that also includes rural residential and lifestyle hobby farms and for weekenders and rural retreats distant from metropolitan areas as second homes.

Urban form and lifestyle have increasingly favoured personal car travel in preference to walking, cycling or public transport use. Australian cities have experienced the international trend towards car based stand alone shopping malls and large format stores located on major arterial roads and highways. Whilst the inner and established areas on many cities maintain strong traditional retail and service centres, many newer suburbs are bereft of mixed use centres providing goods, services, office based employment and recreational and social opportunities.

The distribution of lifestyle and business opportunities across Australian cities and regions to a large extent can be explained by economic and social processes which have been at work over recent decades. Economic liberalisation and labour market restructuring are two complex processes which have implications for the spatial distribution of services and jobs and the quality of urban and regional environments.

There is evidence that metropolitan business and employment locations are increasingly dispersed to suburban locations (O'Connor 2001). Since the early 1990s a number of authors have examined the spatial transformations taking place in Australian urban centres. Australia has been particularly exposed to

the processes of globalisation. Many local authors, including Fagan and Webber (1999), Rimmer (1997) Sheil (2001), Wiseman (1998), and Marceau (1997), among others, have charted in detail the spatial effects of the interaction between local and global restructuring processes experienced by the Australian economy. Coincident with concerns about the economic transformations taking place across the Australian macro-economy, have been attempts by a number of urban scholars to understand how these transformations have played out in socio-spatial patterns at the metropolitan level (O'Connor and Stimson 1995; Fagan 1997; Stimson 1997; O'Connor 1998; Stimson et al. 1998; Baum et al. 1999; Brain 1999; Connell 2000).

The differentiation under globalisation across urban regions in Australia has seen Sydney take on a significant international role as the centre of Australia's financial connections to the Asia-Pacific rim (Brain 1999). O'Connor and Stimson (1995) note that manufacturing in Australia is largely a Melbourne and Sydney activity with these cities together having over half the nation's manufacturing activities. However, the role of manufacturing is particularly important in Melbourne's economy, with greater reliance on this industrial sector in Melbourne than Sydney, despite the proportion of metropolitan employment shared by manufacturing in Melbourne declining since the 1960s (O'Connor and Stimson 1995).

In a study of Sydney, Baum (1997) suggested that three broad types of employment status could be discerned in the urban labour market. These types are that of a growing group of high-income, high-status jobs, with strong attachments to the global economy, a second growing group with only weak attachments to the global economy (low wage service workers) and a group outside the labour force who are dependent on welfare, and who have benefited very little from global processes (Baum 1997). Baum's findings, although lacking a spatial component would seem to be supported the more recent research of Brain (1999) which contains a significant spatial component.

Brain (1999) agrees with the global cities hypothesis and applies this analysis to metropolitan growth in Sydney and Melbourne. Brain asserts that globalisation has created urban push/pull forces of centralization and decentralisation, which attract financial and producer services into the city core, and push manufacturing and similar industries to the cheaper outer suburban land. Meanwhile, the outer suburban regions 'pull' manufacturing, industrial and distribution/logistics operations away from their traditional inner city locations, in a manner similar to the US experience described by Freestone and Murphy (1998). Brain identifies a set of 24 occupational types ('C21s') as being closely associated with global financial and producer services, such as business analysts, computing professionals, legal professionals, finance managers, media producers, IT managers, and policy and planning managers (1999). These occupations Brian suggests, are associated with superior real income gains compared to occupational groups falling outside this C21 category.

When areas within Australia's main urban centres are examined for the spatial distribution of these C21 occupations, Brain suggests that these jobs are mostly concentrated in the 'global core' of inner Sydney in particular, with similar but slightly weaker concentrations in the centres of Brisbane and Melbourne. In the CBD of Sydney for example, at least 25 per cent of workers had jobs in this C21 sector. Notably, the outer suburban metropolitan areas of both Sydney and Melbourne (including Melbourne's west) have a medium to very low concentration of such jobs (Brain 1999). The longer term effect of this concentration/deconcentration effect will be for C21 workers to push lower income households away from the inner city and to the more marginal outer metropolitan regions. The implication of Brain's work is that the outer suburbs of Sydney and Melbourne, for example, will become increasingly important as spaces where the outcomes of this occupational marginalisation are worked out, particularly in relation to the fortunes of the 'old economy'.

Residents of many outer suburbs fell behind metropolitan averages in their local access to social, cultural and transport services (Fagan 1997). Significant changes in this region occurred with a significant degree of job shedding, combined with a large growth in commercial and personal services (Fagan 1997). But during the 1990s, Sydney's outer suburban areas, for instance, particularly in the west, also received significant industrial relocation and reinvestment.

A recent study by Wulff and Reynolds found that across all areas within Melbourne, for example, there was an increase in the proportion of low and high income groups, but a decline in the proportion of middle income groups (2000: 4).The results reported by Wulff and Reynolds appear to strongly support the polarization thesis as it has played out in the suburbs of Melbourne. Importantly, also, they demonstrate that there is a strong link between housing wealth, personal opportunity and spatial location.

Issue identification

In order to draw up urban plans that accommodate lifestyle and business opportunities and choice the primary concern is to provide equitable access to employment, services, community and cultural facilities and infrastructure, environmental assets and recreational opportunities, and transport choices across Australian cities.

EMPLOYMENT AND BUSINESS OPPORTUNITIES

Urban plans need to redress the growing imbalance in employment and business opportunities across metropolitan and regional areas as previously outlined. Of particular concern is the provision of employment choice in regional centres and outer metropolitan areas. A key issue in the equitable distribution of job opportunities and the location of businesses is the provision of education and training facilities to provide appropriately skilled labour markets.

GOODS AND SERVICES

There are a number of environmental, economic and social costs associated with the provision of goods and services across metropolitan and regional communities. Urban plans need to specifically provide for the location of goods and services within easy access by a range of transport modes to reduce car dependency and social isolation. Localised shops and services are important sources of employment particularly for young people, as well as creating community focal points.

COMMUNITY AND CULTURAL FACILITIES AND INFRASTRUCTURE

The same principle applies to the provision of community and cultural facilities and infrastructure across metropolitan and regional communities. The localised provision of a full range of community services, both public and private, is critical to the strengthening of social capital and social cohesion. A downward economic and social spiral can occur following the loss of key community facilities, for example banks and hospitals, in small towns and neighbourhoods. It is critical that urban planning for new urban areas as well as established towns, ensure that community can cultural facilities and infrastructure are well provided for.

ENVIRONMENTAL ASSETS AND RECREATIONAL OPPORTUNITIES

The provision of recreational opportunities and protection and maintenance of environmental assets is critical to the social and environmental quality of urban communities. Cities that have protected their environments are likely to have the strongest economic future and to maintain social harmony. There liveability, defined by environmental, economic and social criteria will be enhanced by the effectively of their land use planning in maintaining connections between city and countryside.

TRANSPORT CHOICES

The trend towards car based transport over recent decades has significant impacted on the shape of the urban form and environmental quality. Urban plans for sustainable cities need to urgently address the reduction of car usage, through improving public transport services and encourage walking and cycling. Existing car based facilities, such as large shopping malls, need to be well serviced by public transport, while new facilities must be located next to transport nodes which offer a choice of transport options.

Maximising transport choice and encouraging the reduction of car usage in urban areas is critical to the environmental sustainability of cities.

Policy Recommendations

The following are a set of urban policy recommendations which aim to increase lifestyle and business opportunities in Australian cities and towns:

- Develop policy to determine the location of key community and cultural facilities, shops, services and employment sites within the centres of towns and neighbourhoods accessible by a range of transport modes.
- Discourage or prevent the location of facilities and services only accessible by car, in particular along highways.
- Develop a set of standards for the provision of neighbourhood shopping and community facilities within walking distance of all residences in new urban subdivisions.
- Direct public sector facilities and services to locate within activity clusters.
- Develop a program of expenditure to redress disadvantage in urban and regional areas which can include incentives to attract and incubate businesses and to establish education and training facilities.
- Redress the imbalance in expenditure between roads and public transport infrastructure and pursue international best practice public transport policies (as best exemplified by the cities of Toronto, Zurich and Copenhagen) which would include integrating transport modes and improving frequency and standard of services.
- Increase the provision of well integrated public housing across all areas.
- Ensure new residential areas are located in such as way that residents have access to green open space and both passive and active recreational facilities.
- Preserve non-urban areas surrounding cities to enable a continuing relationship with the rural hinterland.

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