The sustainability of Australian cities

Chapter 5

Introduction

Human settlements and their populations place pressure on the environment through the demand for water, energy and land, and through the production of wastes including greenhouse gas emissions. These impacts can be direct, through the use of water, energy and land, or indirect, through the production and distribution of goods and services that households and businesses consume.

Urban communities are feeling the impacts of these pressures through, for example, extensive water restrictions across several of our major cities, air pollution, and the loss of productive land, open space and habitat on urban fringes. We are increasingly aware of our vulnerability to a changing climate, with many cities experiencing unprecedented high temperatures, fires and storms in recent years.

There is evidence that our way of living and direction of development is not ecologically sustainable. A recent analysis has demonstrated a high degree of variability in the environmental impact between locations, and overall Australia's major cities are having a greater environmental impact than regional and rural locations.

Yet Australian cities provide many opportunities to lead the nation towards a more sustainable future. The way in which cities are planned, built and function can promote more efficient use of resources including water, energy and land, minimise the production of waste and encourage more reuse and recycling, reduce greenhouse gas emissions, and support biodiversity in and around urban areas through better management of open and green space.

Cities can be a resource for the generation of renewable energy, they can reduce pressure on potable water supplies through decentralised water collection, and they can produce food. Some of this can be achieved through technological advances, but recent trends in water consumption and passenger travel also suggest that changing individual, household and community practices are making significant contributions to improving the sustainability of urban systems.

This chapter compiles a range of available indicators that measure the environmental performance of Australia's urban settlements and their residents. While the data indicate significant gaps, particularly in information available at the city level, they provide a basis for further discussion on how our cities are progressing in terms of ecological sustainability.

Summary indicators

Dimension	Key Indicators
Water	Water consumption by sector, Australia
	Changes in personal water use in the last 12 months, Capital cities
	Households with water conservation devices, Australia
	Households with rainwater tank installed at dwelling, Capital cities
Energy	Australian energy consumption, by industry
	Home energy use
	Persons taking steps to limit use of electricity, Capital cities
	Dwellings with insulation, Capital cities
	Awareness of GreenPower Scheme, Capital cities
Climate change	Net greenhouse gas emission by sector, Australia
	Base case projections of direct greenhouse gas emissions for Australian transport
	Summary of capital city emission reduction targets
	Trend in annual rainfall, Australia
Air pollution	Exceedence of fine particle health standards, selected cities
	Trend in peak ozone levels, selected cities
Waste	National waste generation by source
	Waste generation by state
	Per capita waste generation

Key findings

- Water restrictions in major cities across the nation saw total consumption by households fall by 7 per cent between 2000–01 and 2004–05 despite population growth over the period.
- Residential energy use accounted for approximately 7 per cent of total energy consumption in 2007–08, but grew at a high rate (2.2 per cent) relative to other sectors over the period. This growth is attributed to population increase, higher ownership of appliances and IT equipment per household, and increases in the average size of homes. Standby power was the greatest contributor to average annual growth in household energy use over the period 1989–90 to 2006–07.
- Transport emissions are one of the strongest sources of emissions growth in Australia. Strong growth in emissions from the transport sector is expected to continue, with direct CO_2 equivalent emissions projected to increase 22.6 per cent over the period 2007 to 2020 (or around 1.58 per cent a year).
- Climate change is affecting rainfall patterns. Since 1950 much of eastern Australia and the far southwest, where our largest cities are located and the majority of the population lives, have experienced an annual decline of up to 50 mm in rainfall per decade affecting both the availability and quality of water supplies across urban areas.

- Levels of the key pollutants of lead, carbon monoxide, sulphur dioxide and nitrogen dioxide in the largest capital cities have decreased significantly over a ten-year period. However, particulate air pollution and ozone levels have remained at or above national air quality standard levels over the period and showed no evidence of decline.
- While national recycling rates have increased, total waste generation has also continued to increase—by around 31 per cent from 2002–03 to 2006–07, exceeding the rate of population growth of 5.6 per cent over the period.
- When both direct and indirect environmental impacts are taken into account, higher environmental impacts at the household level are associated with higher incomes and smaller household sizes.

Water

Australia's total water consumption was 18,767 gigalitres in 2004–05, a reduction of 14 per cent from total consumption in 2000–01 (Table 5.1). This reduction has been attributed to drought conditions over the period.

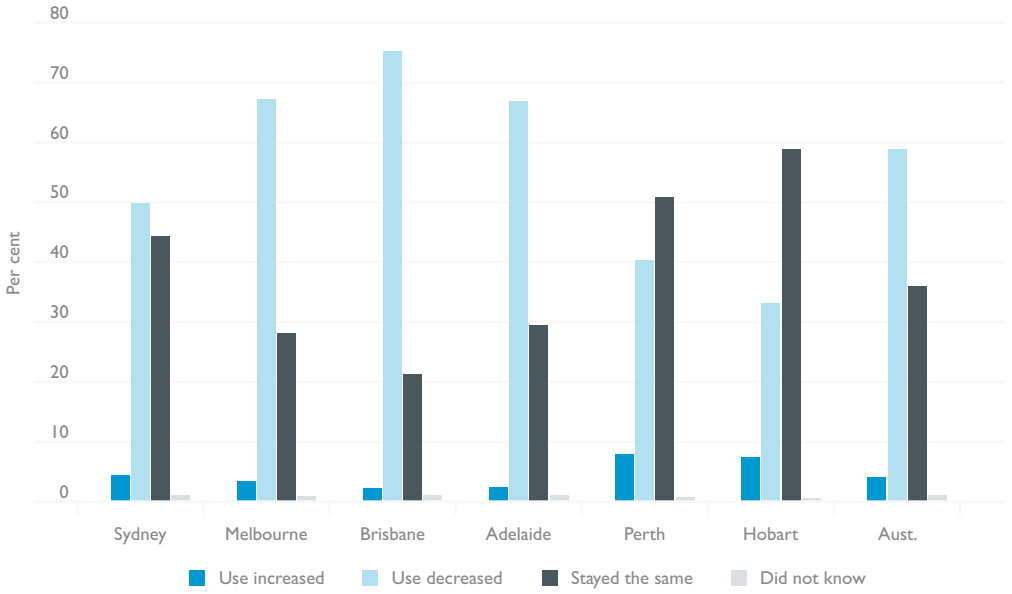
Table 5.1 Water consumption by sector, Australia

	2000–01		2004–05	
	Volume (GL)	% of total	Volume (GL)	% of total
Agriculture	14 989	69.1	12 191	65.0
Household	2 278	10.5	2 108	11.2
Water supply (a)(b)	2 165	10.0	2 083	11.1
Other industries	1 102	5.1	1 059	5.6
Manufacturing	549	2.5	589	3.1
Mining	321	1.5	413	2.2
Electricity and gas	255	1.2	271	1.4
Forestry and fishing (c)	44	0.2	51	0.3
Total	**21 703**	**100**	**18 767**	**100**

(a) Includes sewerage and drainage services
(b) Includes water losses
(c) Includes services to agriculture; hunting and trapping
Source: ABS 2006a.

Between 2002 and 2003, drought conditions caused a reduction of more than 20 per cent of the water stored in large dams around the country, which by 2005 had failed to recover to pre-2002 levels (ABS 2006a). In response, state and territory governments introduced water restrictions in major cities, which saw total consumption by households fall by 7 per cent between 2000–01 and 2004–05 despite population growth over the period.

Figure 5.1 Changes in personal water use in the 12 months to 2007–08

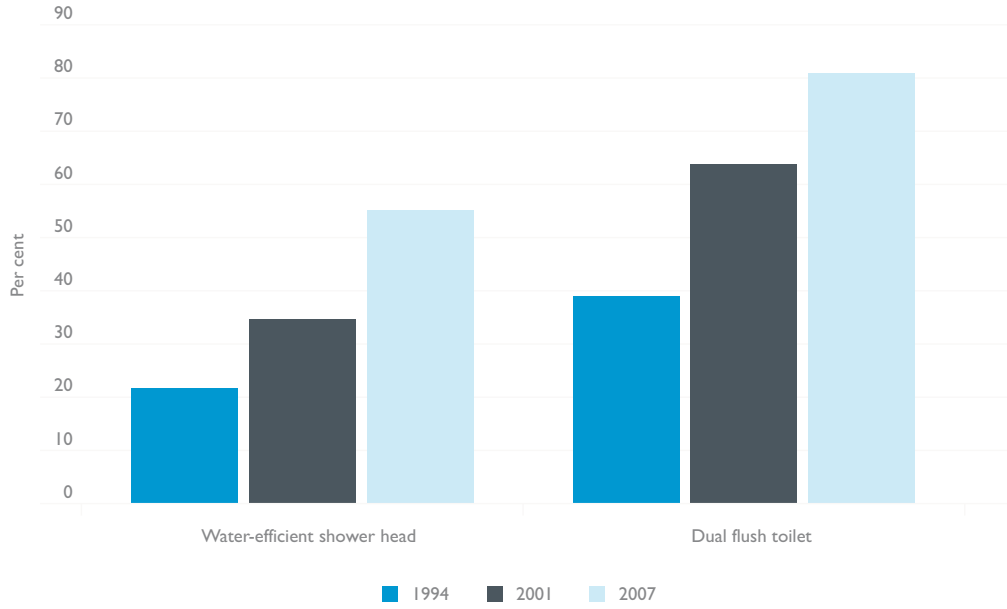


Source: ABS 2009a.

Water restrictions in urban areas have generated a greater awareness of water conservation in the community. Figure 5.1 shows high proportions of householders across most of the capital cities of Australia had decreased their personal use of water over the 12 months to 2007–08. Brisbane had the largest change, with over 75 per cent of households reporting a reduction in personal water use, followed by Melbourne (67.3 per cent) and Adelaide (66.9 per cent).

This reduction has been facilitated by the adoption of voluntary measures by households to reduce water use and install water-saving devices such as water-efficient shower-heads and dual-flush toilets (Figure 5.2). By the end of 2007, more than 80 per cent of Australian households had installed a dual-flush toilet—an increase of 107 per cent from 1994.

Figure 5.2 Households with water conservation devices, Australia—1994–2007

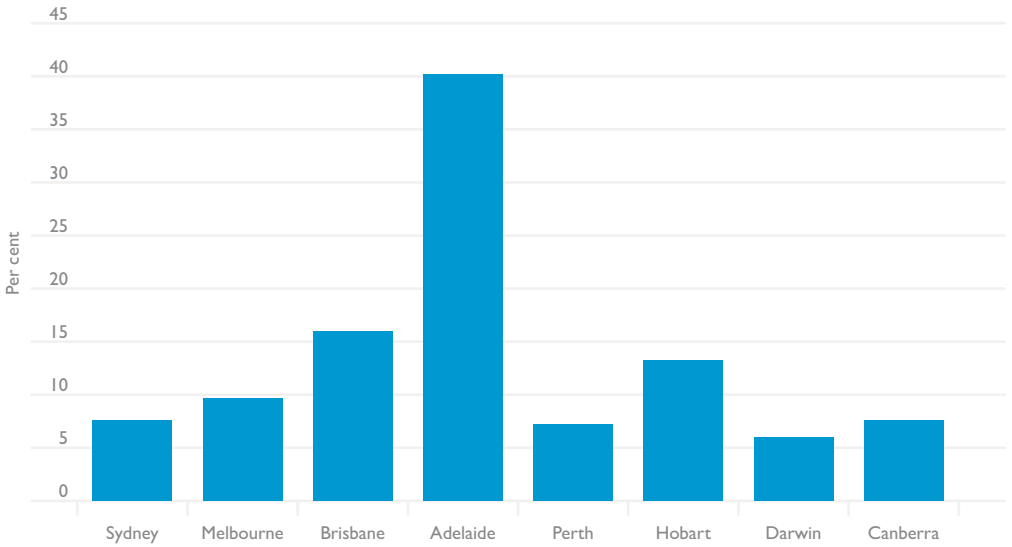


Source: ABS 2007a.

While the majority of households in capital cities have access to mains water supply, some households are supplementing their supply, for example through the use of rainwater tanks (Figure 5.3). Over 40 per cent of households had a rainwater tank in Adelaide in 2007, contrasting with only 7 per cent across Sydney, Perth and Canberra.

The difference across capital cities can partially be explained by the introduction of regulations and incentives to install rainwater tanks across various states and local governments. For example, since 1 July 2006, building rules in South Australia have required new dwellings (and some extensions or alterations) to have an additional water supply to supplement the mains water, and rebates are offered to install rainwater tanks on existing homes (Planning South Australia 2009).

Figure 5.3 Households with rainwater tank installed at dwelling—2007



Source: ABS (2007) *Environmental Issues: Peoples Views and Practices,* March 2007 (cat. no. 4602.0).

Households accounted for over 11 per cent of total water consumption in Australia in 2004–05 (Table 5.1). By comparison the Agriculture sector was the greatest user of water at 65 per cent. Other major industry sectors, including Water supply, Manufacturing, Mining, and Electricity and Gas notably increased water consumption over the period 2000–01 to 2004–05.

This has implications for our cities, because while the direct use of water by households is proportionally small in comparison with other industry sectors, much of the water consumed by households occurs indirectly—through, for example, the production of food we eat, the clothes we wear, the goods and services we buy, and even the generation of electricity for use in our homes, workplaces and shopping malls. More efficient use of water requires households to consider the impact of the goods and services they consume in addition to undertaking water conservation measures in the home.

Energy

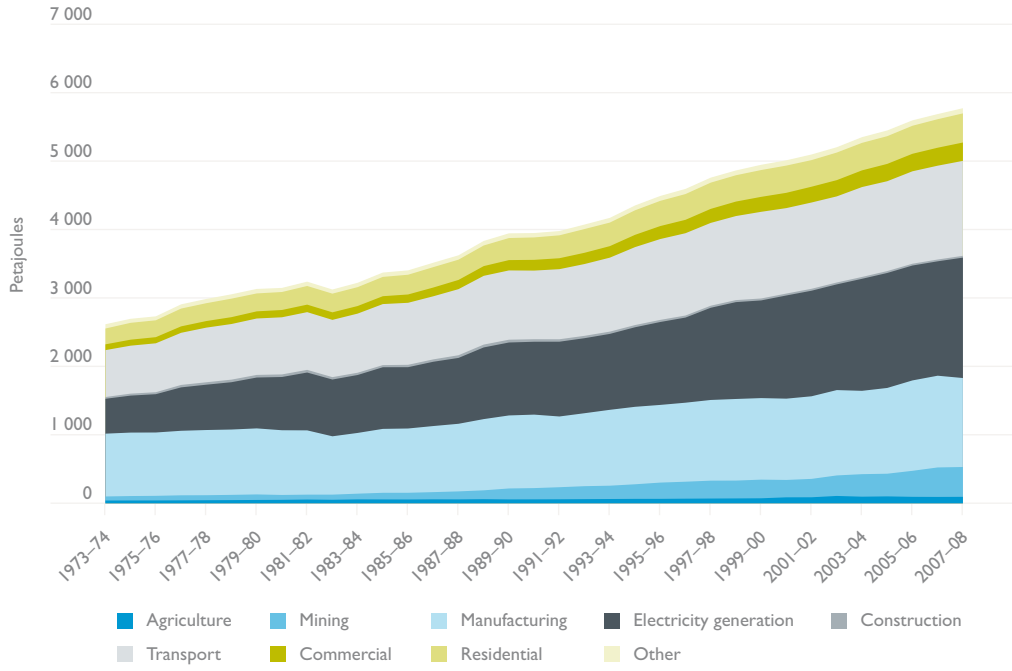
Energy is vital for economic growth and the high standard of living enjoyed by all Australians. Although economic growth is progressively becoming more energy-efficient, Australia remains one of the highest consumers of energy per capita in the world (International Energy Agency 2009a). Although robust data are not available on the contribution of Australia's cities to energy consumption, it is estimated that cities consume around 75 per cent of the world's energy (C40 Cities 2009).

Around 97 per cent of energy used in Australia in 2007–08 was sourced from non-renewable sources, including coal, petroleum products and natural gas (ABS 2010). This particular mix of energy sources and high rates of energy consumption has implications for the environment, including greenhouse gas emissions, resource depletion, and other pollution associated with the production and consumption of energy.

Energy consumption has steadily increased over the past three decades (Figure 5.4).

The electricity generation sector was the greatest contributor to growth in energy consumption in 2007–08. Electricity generation accounted for over 30 per cent of energy consumption in 2007–08, followed by transport (24 per cent) and manufacturing and construction (23 per cent).

Figure 5.4 Australian energy consumption, by industry



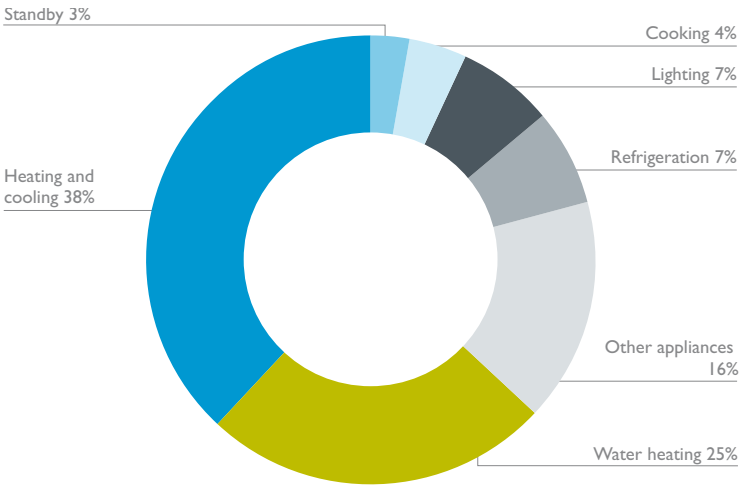
Source: Shultz 2009.

Within the transport sector, around 60 per cent of energy consumed is associated with the movement of passengers that is dominated by cars, and the remainder with the distribution of goods and services (Sandu & Petchey 2009).

Residential energy use accounted for approximately 7 per cent of total energy consumption in 2007–08, but grew at a high rate (2.2 per cent) relative to other sectors over the period. This growth is attributed to population increase, higher ownership of appliances and IT equipment per household, and increases in the average size of homes (ABARE 2009). However, standby power was the greatest contributor to average annual growth in household energy use over the period 1989–90 to 2006–07 (Sandu & Petchey 2009).

Around 38 per cent of energy used in the home is for heating and cooling purposes (Figure 5.5). Water heating accounts for 35 per cent of total household energy use, followed by other appliances (16 per cent) and lighting and refrigeration (7 per respectively).

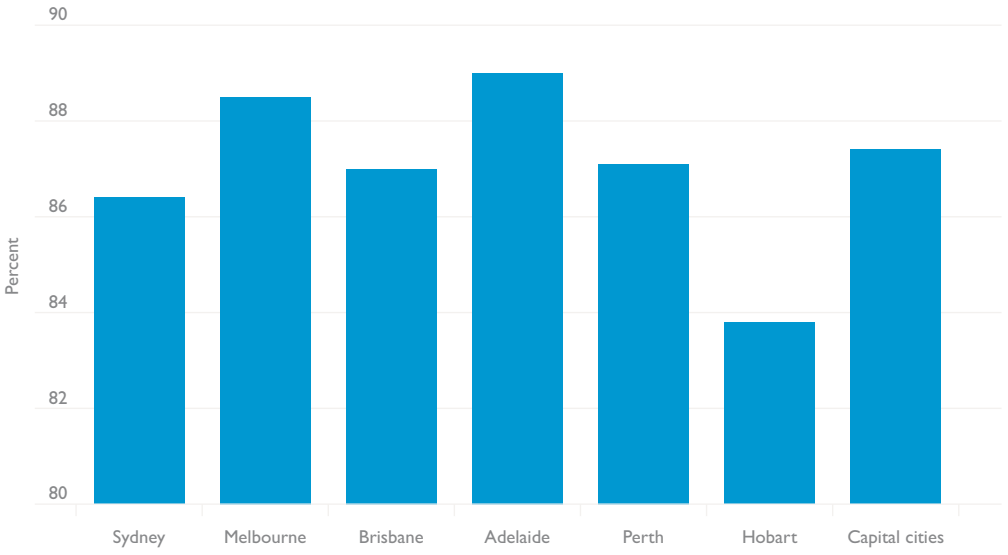
Figure 5.5 Home energy use (baseline energy estimates) 2008



Source: DEWHA 2008

Greater awareness of environmental issues and higher energy costs has prompted household interest in energy efficiency. Across the capital cities of Australia, over 87 per cent of households reported that they had taken steps to limit their use of electricity over 2007–08 (Figure 5.6). Almost 90 per cent of households in Adelaide applied energy efficiency measures in their homes over the period, closely followed by Melbourne (88.5 per cent).

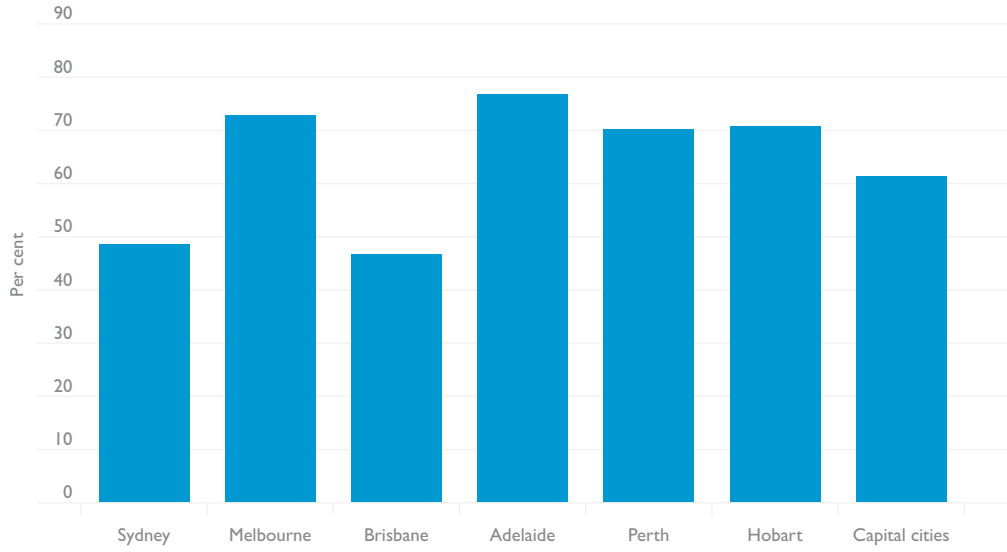
Figure 5.6 Persons taking steps to limit use of electricity—2007–08



Source: ABS 2009a

A common energy efficiency measure applied by households was the installation of insulation. Over 61 per cent of households across capital cities reported their dwellings had insulation in 2008 (Figure 5.7). However, figures varied greatly between the cities. Adelaide reported the highest proportion (77 per cent) of dwellings with insulation, followed by Melbourne (73 per cent), Hobart (71 per cent) and Perth (70 per cent). The cities of Brisbane and Sydney reported the lowest proportion of dwellings with insulation, at 47 per cent and 49 per cent respectively. Incentives provided under the recent Home Insulation Program will have increased these figures.

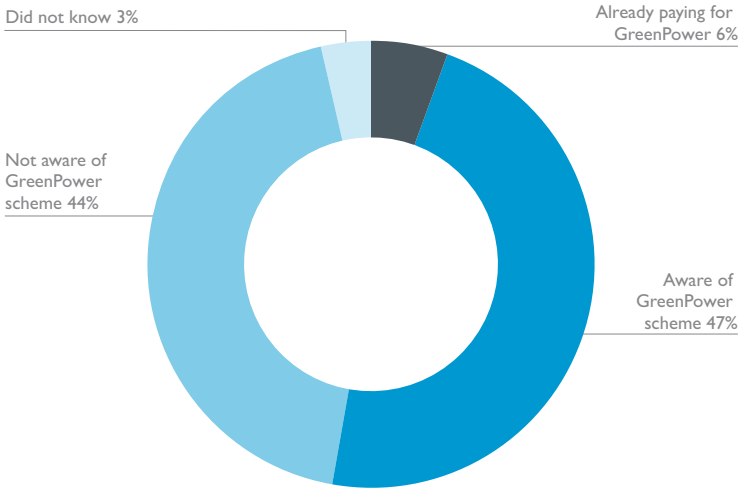
Figure 5.7 Dwellings with insulation, 2008



Source: ABS 2008

Capital city household awareness of the GreenPower scheme remains low at approximately under 50 per cent (Figure 5.8). The GreenPower scheme is a government accreditation program for renewable energy, whereby participants pay extra into their electricity account for their energy providers to invest in the renewable energy sector on behalf of customers (GreenPower 2010). Only 6 per cent of households across capital cities have taken up the scheme.

Figure 5.8 Awareness of GreenPower scheme, capital cities, 2008



Source: ABS 2008

Climate change

Greenhouse gas emissions

Observed anthropogenic (human induced) emissions of carbon dioxide are tracking at the upper limit of projections by the Intergovernmental Panel on Climate Change (Steffen 2009). While the global economic crisis has temporarily slowed the growth of greenhouse gas emissions, carbon pollution and the impacts of climate change are projected to continue to increase without action.

As large users of energy, cities produce a significant proportion of greenhouse gas emissions. There are no reliable estimates for the contribution of cities to greenhouse gas emissions. However, it has been estimated that up to 75 per cent of global greenhouse gas emissions are attributable to cities (C40 2009). A rough estimate for Australian cities places this figure below 67 per cent of national emissions (Dunstan et al. 2009). This can be partially attributed to the dominance of agriculture in our emissions profile.

Australia's per capita emissions are among the highest of any OECD country (International Energy Agency 2009b). Our per capita emissions are relatively high as we are an exporting nation of agriculture, mining and metal products (such as aluminium), and our energy production is reliant upon coal fired electricity.

National greenhouse gas emissions have increased over 6.5 per cent since 1990, with an average increase of 1.5 per cent a year over the past three years (Table 5.2). The energy sector was collectively responsible for over 71 per cent of national emissions in 2007, with stationary energy[3] and transport contributing to 51 per cent and 14 per cent of emissions respectively. The agriculture sector produced almost 16 per cent of national emissions over the period.

Stationary energy accounted for the greatest growth in emissions (50 per cent since 1990), followed by industrial processes (41 per cent) fugitive emissions (release of emissions such as gas or vapour that typically result from leaks) (37 per cent), and transport (32 per cent).

Table 5.2 Net greenhouse gas emissions by sector, Australia

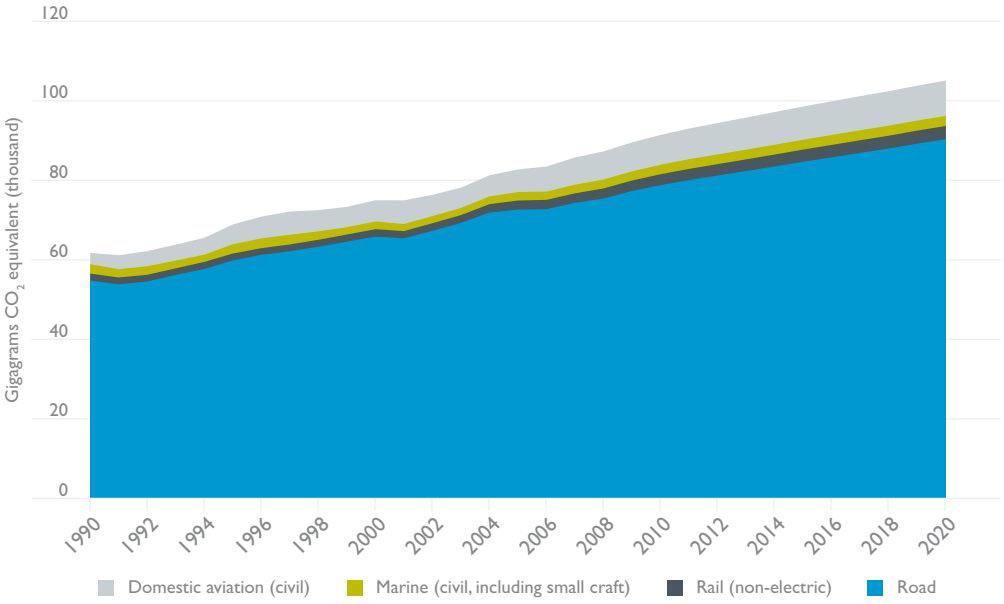
	Emissions Mt CO_2-e			
	1990	2008	% change 1990–2008	% emissions 2008
Energy	286.4	415.0	44.9%	71.2%
Stationary	195.1	293.0	50.2%	50.3%
Transport	62.1	82.0	32.0%	14.1%
Fugitive emissions	29.2	40.0	37.0%	6.9%
Industrial processes	24.1	34.0	41.1%	5.8%
Agriculture	86.8	91.0	4.8%	15.6%
Land Use, Land Change and Forestry	131.5	28.0	–78.7%	4.8%
Waste	18.8	15.0	–20.2%	2.6%
Net emissions	**547.6**	**583.0**	**6.5%**	**100.0%**

Source: Department of Climate Change 2009a

Transport emissions are one of the strongest sources of emissions growth in Australia. The increasing trend in transport emissions is of particular concern to Australia's cities, which feature high levels of personal car use and automobile dependency. Strong growth in emissions from the transport sector is expected to continue, with direct CO_2 equivalent emissions projected to increase by 22.6 per cent over the period 2007 to 2020 (or around 1.58 per cent a year) (Figure 5.9).

3 Stationary energy includes emissions from fuel consumption for electricity generation, fuels consumed in the manufacturing, construction and commercial sectors, and other sources like domestic heating.

Figure 5.9 Base case projections of direct greenhouse gas emissions (carbon dioxide equivalent) for Australian transport



Source: BITRE 2009

Australian capital city Lord Mayors have committed to emissions reduction targets irrespective of the development of national targets. These targets are summarised in Table 5.3.

Table 5.3 Summary of capital city emission reduction targets

	Reference year	Goal year	Community target
ACT	2000	2025	0%
	2000	2050	–60%
Sydney	1990	2050	–70%
	1990	2030	–50%
	2006	2030	–70%
Brisbane	2000	2010	0%
	2005	2011	–20%
	2006	2026	–50%
Adelaide	1994	2010	–10%
Hobart			None
Melbourne	1996	2010	–20%
		2020	–100%
Perth	1996	2010	–20%
Darwin	2001	2010	–25%

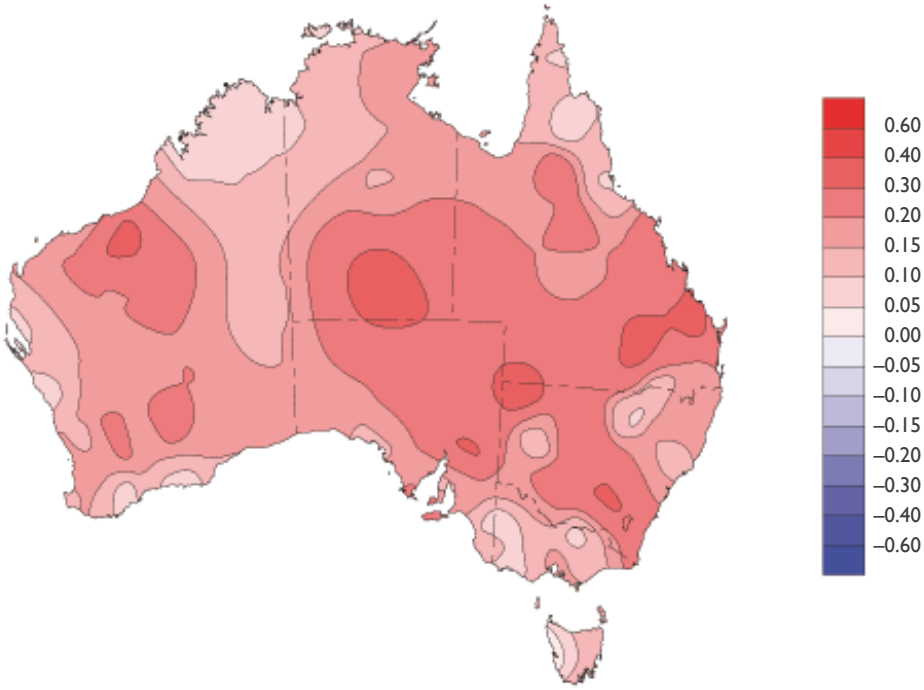
Source: Dunstan, Pillora & Glassmire 2009

Changes in climatic conditions

Even if all greenhouse gas emissions were reduced to zero, the effect of emissions released to date have committed the globe to an additional warming of 0.2–1.0°C by the end of the century (Preston & Jones 2006). This presents a significant challenge to the cities of Australia to prepare for and adapt their built environment and communities to the impacts of climate change while continuing to take action to reduce emissions.

According to the Intergovernmental Panel on Climate Change (2007), average global temperatures have increased 0.76°C since pre-industrial values, and are expected to rise 2.5°C by 2050 and up to 5.0°C by 2100. The Bureau of Meteorology (2010a) reported that 2009 ended Australia's warmest decade on record, with a decadal mean temperature anomaly of +0.48°C (above the 1961–90 average) (Figure 5.10) . In Australia, each decade since the 1940s has been warmer than the preceding decade (BOM 2010a). It is projected that annual average temperatures in Australia will increase by 1.0°C above 1990 levels by 2030 and up to 5.0°C by 2070 under a high emissions scenario (BOM & CSIRO 2009).

Figure 5.10 Trend in mean temperature, 1960–2009 (°C/10 yrs)

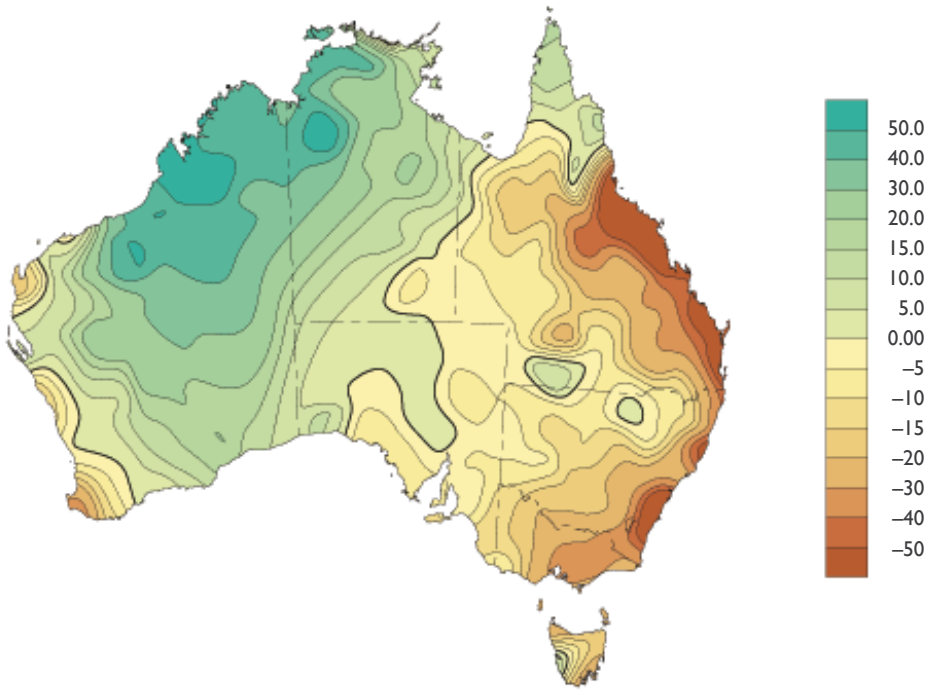


Source: Bureau of Meteorology 2010b

According to the Garnaut Climate Change review, Australia's exposure to the impacts and level of sensitivity to the impacts of climate change is high, with a range of implications for our settlements and infrastructure, including: changing rainfall patterns on traditional water supplies; sea-level rises for coastal cities; and increased frequency of extreme weather (Garnaut 2008).

Climate change is affecting rainfall patterns. Since 1950 the northwest region of Australia has seen an increase in rainfall while much of eastern Australia and the far southwest have experienced an annual decline of up to 50 mm per decade (Figure 5.11). It is in the southern and eastern regions where our largest cities and populations are located, and where population is projected to significantly increase. Best estimates of annual rainfall change indicate that decreases are likely across most of the continent, affecting both the availability and quality of water supplies across these urban areas.

Figure 5.11 Trend in annual rainfall, 1950–2009 (mm/10yrs)



Source: Bureau of Meteorology 2010c

Observations since 1961 show that the oceans have warmed as the result of absorbing more than 80 per cent of the heat added to the climate system largely because of the enhanced greenhouse effect, causing the oceans to expand and contributing to sea-level rise (House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts 2009). The average rate of sea-level rise from 1961 to 2003 was 1.8 mm/year and increased to 3.1 mm/year from 1993 to 2003 (Church et al. 2009). The range of all model projections over all scenarios up to 2100 shows sea levels rising 20–110 cm (Church et al. 2009).

The 2009 report *Climate change risks to Australia's coast – A first pass national assessment* (Department of Climate Change 2009b) found that:

- Between 157,000 and 247,600 properties are potentially exposed to inundation with a sea-level rise of 1.1 metres.
- Nearly 39,000 properties are located within 110 metres of 'soft' shorelines and are at risk from accelerated erosion due to sea-level rise and changing climatic conditions.

- The current value of existing residential buildings at risk from inundation ranges from $41 billion to $63 billion (2008 replacement value).
- There are many facilities supporting the delivery of community services in close proximity to the coastline. They include 258 police, fire and ambulance stations, 5 power stations/sub stations, 75 hospitals and health services, 41 landfill sites, 3 water treatment plants, and 11 emergency services facilities located within 200 metres of the shoreline and at risk.

Climate change is also expected to alter the frequency of extreme weather events such as droughts, bushfires, storm surges, cyclones and hail. This is expected to increase damage to infrastructure, disrupt key services, increase insurance costs, increase risk to human life including respiratory disease, heat stress, post-event disease outbreaks and other health-related impacts. For many locations around Australia, a 50 cm sea-level rise would result in the present one-in-a-hundred-year event becoming an annual or more frequent event by the end of the 21st century.

For example, substantial increases in the frequency of days over 35°C are projected for the major cities of Australia under all scenarios (BOM & CSIRO 2009). Extreme heat events cause damage to infrastructure and increase risk to human health, particularly for older people. The 2009 January heatwave in Melbourne resulted in the buckling of train tracks, collapsing transport networks across the city. In addition, city morgues exceeded capacity as they managed more than twice the number of bodies than in the same period of the previous year (ABC News 2009).

Air pollution

Air pollution occurs when substances are present in the air at amounts that can affect human and environmental health. A number of substances, or pollutants, are known to affect urban and regional air quality (Table 5.4).

High concentrations of the major air pollutants are associated with respiratory problems such as coughs, bronchitis, asthma and, in severe cases, developmental problems in children, and even death (DEWHA 2005).

The main pollutants of concern in the major urban centres of Australia are particles and ozone (DEH 2004). While the air quality of Australia's cities is good in comparison with other major cities around the world, air pollution consistently rates as a major concern for urban communities (DEH 2004).

The *State of the Air* report (DEH 2004) reported a significant decrease in the key pollutants of lead, carbon monoxide, sulphur dioxide and nitrogen dioxide levels over a ten-year period. However air particle pollution and ozone levels have remained at or above national air quality standard levels over the period and showed no evidence of decline (DEH 2004).

Fine particle health standards were periodically exceeded in select urban centres between 1997 and 2007, associated with severe fire and dust storm events (ABS 2009b).

Peak ozone levels experienced by most cities remain close to or above the National Environment Protection Measure for Ambient Air Quality (NEPM) standard, a trend particularly evident in the larger urban centres of Sydney and Melbourne, along with Brisbane and Perth (DEWHA 2006). The primary source of chemicals that react to form ozone is motor vehicle exhaust,

which accounts for up to 70 per cent of nitrous oxides and 50 per cent of the organic chemicals that form ozone (DEWHA 2005b).

Table 5.4 Major air pollutants

Pollutant	Sources	Health effects
Carbon monoxide	Motor vehicles, burning of fossil fuels.	Blood absorbs carbon monoxide more readily than oxygen, reducing the amount of oxygen being carried through the body. Carbon monoxide can produce tiredness and headaches. People with heart problems are particularly at risk.
Sulfur dioxide	Coal and oil burning power stations, mineral ore processing and chemical manufacture.	Attacks the throat and lungs. People with breathing problems can suffer severe illness.
Nitrogen dioxide	Fuel combustion.	Affects the throat and lungs.
Volatile organic compounds	Motor vehicles, fuel combustion, solvent use.	Some VOCs cause eye and skin irritation, headaches or nausea, while some are classed as carcinogens.
Ozone	Formed from nitrogen oxides and hydrocarbons in sunny conditions. These chemicals are released by motor vehicles and industry.	Ozone attacks the tissue of the throat and lungs and irritates the eyes.
Lead	Exhaust gases from motor vehicles that use leaded petrol, smelters.	Particles containing lead in the air can enter the lungs. The lead can then be absorbed into the blood stream. Over a period lead can affect the nervous system and the body's ability to produce blood.
Particles	Motor vehicles, burning of plant materials, bushfires.	May cause breathing difficulties and worsen respiratory diseases. Some particles contain cancer-producing materials.

Source: CSIRO 2000

Waste

Waste generation—incorporating the three main waste streams of municipal solid waste, commercial and industrial waste and construction and demolition waste (Figure 5.12)—provides a measure of overall waste activity within the economy.

The Australian population produces solid waste at a higher rate compared with most other countries within the OECD (Productivity Commission 2006). This is of concern, as waste disposal is associated with impacts on human health and amenity, and environmental pollution including greenhouse gas emissions, with more recent concern focusing on the externalities associated with resource extraction and depletion (Productivity Commission 2006).

Detailed statistics for waste generation are available mainly at the national and state level, and are not readily available for all major cities in Australia. However, cities account for a large proportion of national economic activity and population, and are therefore considered major sources of waste.

Figure 5.12 Main waste streams, Australia

Municipal solid waste (MSW): Mainly household and council waste, and some construction waste from owner/occupier renovations delivered directly to landfill.

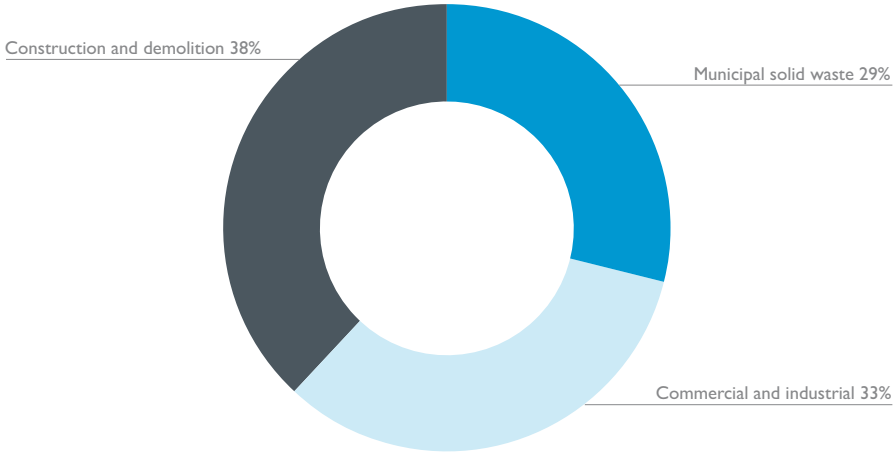
Commercial and industrial waste (C&I): Business, educational institution and government (other than council) waste.

Construction and demolition waste (C&D): Residential, civil and commercial demolition waste.

Source: Environment Protection and Heritage Council 2009

In 2006–07, construction and demolition waste accounted for the greatest source of waste in Australia (38 per cent of total waste), followed by commercial and industrial waste (33 per cent) and municipal solid waste (29 per cent)(Figure 5.13).

Figure 5.13 National waste generation by source, 2006–07



Source: Environment Protection and Heritage Council 2009.

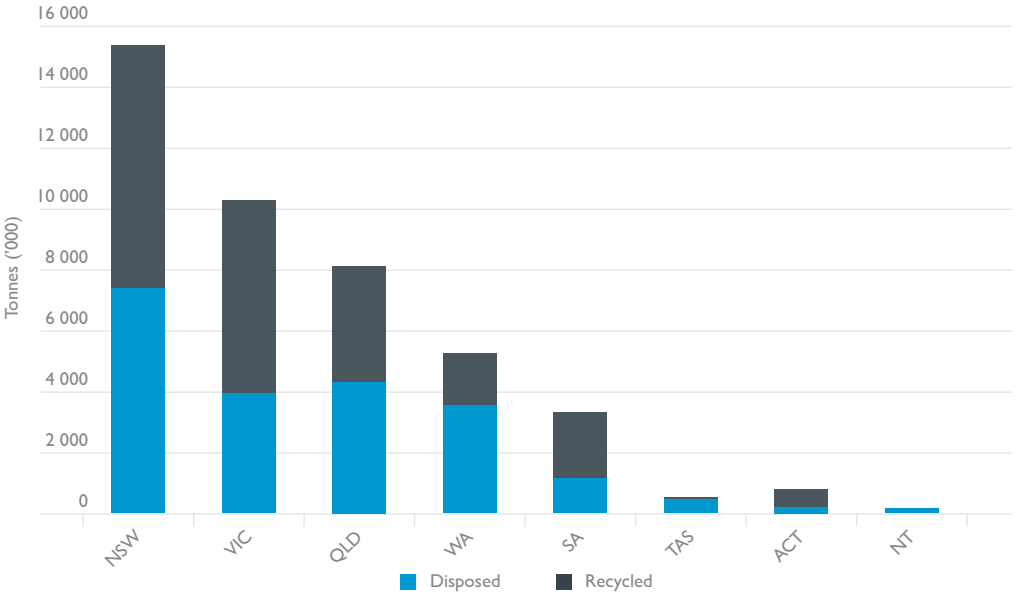
There has been a significant shift in the way that waste has been managed over the past decade or so, including an increase in recycling and the diversion of waste from landfill. For example, only 6 per cent of total waste was diverted from landfill in 1992, increasing to 52 per cent of total waste by 2006–07 (Environment Protection and Heritage Council 2009).

However, while national recycling rates have increased, total waste generation has also continued to increase. The *National Waste Overview 2009* (Environment Protection and Heritage Council 2009) noted that total waste generation increased around 31 per cent from 2002–03 to 2006–07, substantially exceeding the rate of population growth of 5.6 per cent over the period.

The Productivity Commission (2006) has suggested the increasing amount of waste generated per person in Australia relates to a number of factors, including: economic growth; decreasing household size corresponding with an increase in ownership of more durable goods per person; higher replacement rates of durable goods given changes in fashion and technology, reduced product durability, and lower prices compared with repairs; and higher package size to product ratios in small goods. It is also proposed that growing travel time between home and work is associated with an increased demand for time-saving devices such as dishwashers and pre-prepared food (Productivity Commission 2006).

New South Wales produced the largest volume of waste, accounting for 35 per cent of total waste generation in 2006–07 (Figure 5.14). Over half of this volume was diverted from landfill and recycled. Victoria was the next highest producer of waste in volume (23 per cent of total waste in Australia), but featured recycling rates in the order of 62 per cent.

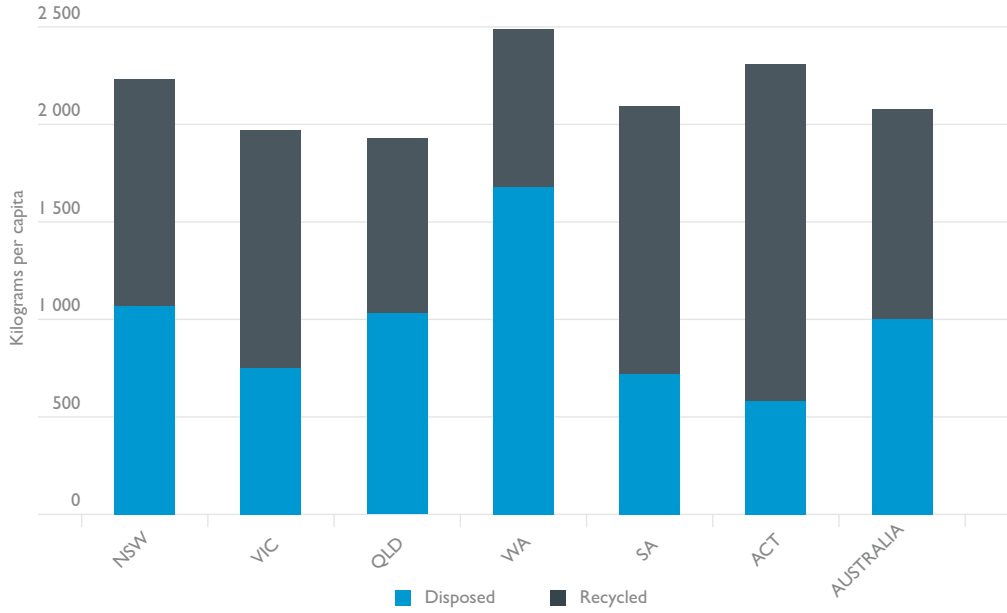
Figure 5.14 Waste generation by state, 2006–07



Source: Environment Protection and Heritage Council 2009.

There has also been a trend of increasing waste generation per person (ABS 2006b). Western Australia generated the most waste per capita at 2490 kilograms per person, followed by the Australian Capital Territory at 2310 kilograms per person (Figure 5.15). However, Western Australia recycled only 33 per cent of total waste—the lowest across the nation—while the Australian Capital Territory had the highest rates of recycling, diverting approximately 75 per cent of waste.

Figure 5.15 Per capita waste generation, 2006–07



Source: Environment Protection and Heritage Council 2009.

At the household level, all capital cities reported high rates of recycling (98.3 per cent of total households) and reuse of waste (84.3 per cent) (ABS 2009c). Based on area of usual residence, households in metropolitan areas had higher levels of recycling than non-metropolitan areas, but greater proportions of households in non-metropolitan reported reuse of waste (ABS 2009c).

Urban form

The urbanisation of the Australian population and structure and form of urban settlements has implications for the environment and sustainability.

For example, urban expansion competes for land with agricultural production and habitat purposes. The movement of people from rural and remote areas to cities and coastal areas has resulted in relatively high rates of land clearing for urban development, causing the loss of habitat for native plants and animals, and reducing their numbers and geographical spread (ABS 2007b).

Competition for arable land continues to be an issue for city regions. The urban fringes of Australia account for a significant proportion of some types of food production, particularly perishable vegetables. For example, the Sydney region is estimated to be responsible for producing around 90 per cent of cabbage and lettuce consumed in the city (Malcolm & Fahd 2009). The north-west and south-west growth centres of Sydney, designated to be progressively released for urban development over the next two decades, contain 52 per cent of Sydney's vegetable farming properties, 60 per cent of greenhouse industries, and 46 per cent of outdoor hydroponic vegetable industries in the region (Malcolm & Fahd 2009).

In addition, advances in transport infrastructure, machinery, storage and handling practice have enabled perishable food goods to be transported over considerable distances into our cities, from interstate and overseas. The reliance of transport on petrol and diesel fuels make supplies of fresh food vulnerable to changes in energy prices. The long-range transportation of food into our cities is also associated with an increase in greenhouse gas emissions.

The major cities of Australia have relatively low concentrations of population and dwellings. This feature of settlement has given rise to concerns about the unsustainable nature of 'urban sprawl'. In response, state governments have adopted planning policies to encourage greater urban consolidation, which is seen as a means of achieving a number of environmental objectives, including: reduced competition for land; lower resource use, particularly energy; reduced greenhouse gas emissions from transport; reduction in waste generation; and, improved health outcomes through an increase in active transport (that is, cycling and walking) (DEWHA 2006).

However, the debate relating to the sustainability outcomes of urban consolidation is considerably polarised. Low population and dwelling concentrations typical of suburban developments on the outer fringes of cities are argued to be inefficient in terms of resource use and the costs of infrastructure provision, encourage automobile dependency and transportation costs, produce higher greenhouse gas emissions, and gives rise to health costs related to inactivity (Newman & Kenworthy 1999; Trubka et al. 2009). Proponents of typical suburban developments point to the lifestyle choices and opportunities offered by this type of development including open space and amenity, and that urban design and technological improvements can reduce resource consumption and greenhouse gas emissions (Roberts 2007).

A recent analysis incorporating indirect environment impacts—that is, the impacts arising through the production and distribution of goods and services that households consume in addition to direct household use of water, energy and land—has associated higher environmental impacts with higher incomes and smaller household sizes (Dey et al. 2007).

Another study comparing the lifecycle energy consumption and greenhouse gas emissions of city centre apartments with suburban dwellings in Adelaide confirmed that more compact housing development provides opportunities for significant reductions in per capita transport emissions (Perkins et al. 2009). However, a combination of high building mass, inefficient design for operational energy savings and low occupancy rates of apartment dwellings results in higher energy use and greenhouse emissions on a per capita basis than for suburban dwellings. This study found that the most carbon-efficient form of housing was townhouses and villas in inner suburban areas.

The study also noted there are significant opportunities in the design and energy of apartments to reduce emissions, but the reduction of transport-related emissions in less compact outer suburban dwellings is more challenging and requires effective policy responses such as public transport investment, changes to urban form and energy efficient vehicles (Perkins et al. 2009).

The environmental merits of urban consolidation policies adopted in Australia's capital cities continue to be the subject of debate. However it is clear that planning for more sustainable urban forms and building design must be accompanied by policy that addresses the broader drivers of environmental pressure, particularly household consumption.

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