DETAILED CONTENTS CHAPTER **FIVE**

CHAPTER FIVE HUMAN SETTLEMENTS

BACKGROUND

This chapter examines some of the key environmental pressures resulting from the everyday lives of Victorians. Population growth, the use of energy and water, and consumption and waste, are the overarching drivers of environmental degradation.

Energy use (including transport energy) is the major source of Victoria's greenhouse gas emissions, and is responsible for a range of pollutants that affect air quality (see Part A: 1 Climate Change and Air Quality). Water use is also a key issue for Victoria, with cycles of drought and significantly reduced river flows a threat to water resources and aquatic health (see Part A: 3 Inland Waters).

Waste generation reflects the level of consumption of material resources and manufactured goods. Increased consumption places pressure on the natural environment through the demand for resources (including water) and energy needed to produce and transport goods.

As consumption increases, so does the amount of waste generated, placing greater pressure on waste management systems, All of these pressures are exacerbated by a growing population, which increases demand for energy and resources, as well as land for development.

When the goods are manufactured outside of Victoria, consumption choices can also put pressure on interstate and international ecosystems and resources.

Current patterns of resource use in Victoria are unsustainable, placing enormous stress on natural ecosystems. In 2008, Victoria's annual ecological footprint was three times larger than the world average and one and a half times the land area of Victoria.[1] Energy generation and consumption was the single biggest impact on the state's ecological footprint.

It is clear that Victorians need to reduce their ecological footprint. If everyone lived like us, almost four planets would be needed to sustain the current global population.

Climate change

Climate change will have significant consequences for water resources and energy use in Victoria.

Reduced rainfall and increased evapotranspiration are likely to increase the frequency and severity of drought, and permanently reduce the availability of water resources. Under climate change, streamflow is projected to decrease by up to 50% across much of Victoria by 2070 (see Part A: 1 Climate Change and Air Quality).[2] This will result in less water in storages and groundwater resources, putting pressure on water supply for cities and towns, industry and agriculture. Reduced water resources will have important consequences for the supply and use of water in the future.

A warmer climate will lead to rising temperatures in Victoria with hotter summers and the increased occurrence of heatwaves. This will result in increased energy use for cooling during such periods. Consequently, hotter periods will place energy infrastructure under enormous strain, possibly leading to power cuts, which have already occurred in Victoria during the 2009 heatwaves. Increased energy use will also lead to more greenhouse gas emissions given Victoria's use of brown coal as its main fuel for electricity generation.

The impacts of climate change on Victoria is discussed in detail in Foundation Paper One, *Climate Change Victoria: The Science, Our People, and Our State of Play*.[3]

MAIN FINDINGS

Victoria's population

- In 2011, the population of Victoria was 5.53 million people, with the Greater Melbourne area accounting for 75% of the total population.
- Between 2001 and 2011, Victoria's population increased by 15%, or 730,000 people. The population of Greater Melbourne increased by 18%, or nearly 650,000 people, accounting for 89% of the total population growth in Victoria.
- For regional Victoria, the population grew by 83,000 people, an increase of only 6% between 2001 and 2011.
- Regional Victoria's share of the state's population decreased from 27% to 25% over the period, reflecting the relatively high growth in Greater Melbourne.
- Most of the population growth in Greater Melbourne and the regional centres occurred in the outer suburbs, generally as a result of greenfield or peri-urban development activity. Coastal towns also recorded strong population growth rates, particularly in areas close to Melbourne.
- Development in peri-urban and coastal regions is resulting in the loss of natural habitat and biodiversity, as well as agricultural land. Coastal development is a major pressure on coastal and marine ecosystems.
- Victoria's population is projected to increase to around 8.3 million by 2051 (2.7 million more people than in 2011).

Energy use

- Victoria's electricity consumption more than doubled between 1980–81 and 2010–11, although population grew by only 40% over the same period.
- Electricity consumption per capita increased by 45% since 1980–81.
- Victoria's electricity generation continues to be dominated by non-renewable sources, which accounted for 94.5% of the total electricity generated in 2010–11. Brown coal produced 97% of the electricity generated from non-renewable sources.
- Only 5.5% of Victoria's electricity was generated from renewable sources. Wind and hydro accounted for the majority of renewable sources (48% and 37% respectively).
- Victoria's net energy consumption nearly doubled between 1973–74 and 2010–11.
- Victoria's final energy consumption is dominated by petroleum products which accounted for 46% of the energy use in 2010–11.
- Between 1973–74 and 2010–11, the consumption of petroleum products only increased by 17%, whereas electricity consumption nearly trebled.

Water resources and consumption

- The drought conditions between 1996 and 2010 severely reduced Victoria's water resources across many catchments, particularly in central and western Victoria.
- In 2010–11, record-breaking rainfall and flooding greatly increased surface water, groundwater and water storage resources across much of the state.
- In 2006–07, total surface water resources were only 7,000 gigalitres (GL) – only 26% of the long-term average. In contrast, the high rainfall in 2010–11 resulted in surface water resources 175% greater than the long-term average.
- Melbourne's water storage levels declined to a record low of only 26% of the total storage capacity in 2009. For the major regional water storages, drought conditions led to levels of just 15% of the total storage capacity in 2009.
- Wastewater recycling has remained stable at around 25% (approximately 95,000 ML) of the total wastewater produced.
- The loss of harvested water is a significant problem in Victoria. In 2010–11, 17% of total water supply was lost during water distribution, the second-highest level in Australia.
- The percentage of the available surface water extracted was nearly 50% in 2006–07 compared to only 6% in post-drought 2010–11. In times of low water availability, large proportions of total flows are extracted for water supply, placing enormous pressure on river systems.
- About three-quarters of surface water harvested in Victoria is typically used for irrigation. The urban and commercial sector accounts for between 20% and 28% of water usage.
- The percentage of the available groundwater extracted ranged from 50% in 2006–07 to 22% in post-drought 2010–11. Irrigation, commercial and salinity control uses account for most of the groundwater consumption in Victoria. While groundwater supply is important for many regions of Victoria, it only accounted for 7% to 13% of the total water used.
- Melbourne accounts for about 10% of the total water harvested for consumption in Victoria.
- The power generation sector is a significant water user, accounting for 16% of total urban and commercial metered water use – nearly a third of Melbourne's total water use.
- Victoria's per capita water use was 192 L/person/day in 2010–11. Melbourne's per capita consumption has continued to decrease from 253 L/person/day in 1996–97 to 147 L/person/day in 2010–11, a reduction of 42%.

Trends in solid waste generation and management

- Between 2002–03 and 2010–11, Victoria's per capita waste generation increased from 1.7 tonnes per year to 2.1 tonnes per year, an increase of 23% over the period.
- Waste generation increased from 8.6 million tonnes in 2002–03 to 12 million tonnes in 2010–11, an increase of nearly 40%.
- Recycling increased from 4.4 million tonnes to 8 million tonnes between 2002–03 and 2010–11, raising the annual recycling rate from 51% to 68%.
- In 2010–11, the majority of waste produced in Victoria was from the construction and demolition sector, which accounted for 41% of the total waste produced.
- Recycling rates improved for all sectors. The biggest rise was for the construction and demolition sector, which increased from 54% in 2002–03 to 83% in 2010–11.
- Despite the improvement in the overall recycling rate, the increase in waste generation means that Victoria is becoming more waste-intensive.

INDICATOR ASSESSMENT

Indicator Summary

Indicator	Summary	Status and trends (Good | Fair | Poor | Unknown)	Data quality
HS1 Victoria's population	Victoria's population is rapidly growing, with most of the increase in Greater Melbourne. Population growth is increasing pressure on Victoria's environment and natural resources, especially in terms of land-use change.	NA	●
HS2 Energy use	Victoria total and per capita energy use continues to increase. Victoria's electricity generation continues to be dominated by non-renewable sources, with only 5.5% of Victoria's electricity generated from renewable sources.		●
HS3 Water resources and consumption	Victoria's water resources fell to record lows during the 1996 to 2010 drought period. While per capita water consumption is improving, the level of overall demand and use of water resources continues to impact on the environment. Inefficiencies in the distribution system continue to result in high water loss.		●
HS4 Trends in solid waste generation and management	Waste generation: Victoria's total and per capita waste generation is increasing.		●
	Waste management: Victorians are recycling more, with the annual recycling rate increasing from 51% to 68% between 2002–03 and 2010–11.		●

Indicator Assessment Legend

Status

- Pressure likely to have negligible impact on environmental condition.
- Pressure likely to have limited impact on environmental condition.
- Pressure likely to have significant impact on environmental condition.
- Data is insufficient to make an assessment of status and trends.

Data Quality

- Good: Adequate high-quality evidence and high level of consensus
- Fair: Limited evidence or limited consensus
- Poor: Evidence and consensus too low to make an assessment

Trends

Deteriorating | Improving | Stable | Unclear

NA Assessments of status, trends and data quality are not appropriate for the indicator.

Indicator HS1: Victoria's Population

The Millennium Ecosystem Assessment reports that over the past 50 years humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history – largely to meet the needs of a rapidly growing population. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth and the degradation of many ecosystem services.[4]

Population growth increases the demand for land, energy, water and other resources, food, housing and other infrastructure, transport, and a range of goods and services. Growing populations can lead to direct environmental impacts through:

- changes in land use from conservation and agriculture to built environments resulting in the loss of vegetation and biodiversity, increases in introduced species and impacts on water quality.
- increased harvesting and diversion of water resources, altering river flows and impacting on ecosystem health – greater demand for water is particularly problematic during periods of drought and is likely to be a significant issue in the future with the predicted decrease in rainfall as a result of climate change.
- increased air pollution, including greenhouse gas emissions.
- increased disposal of solid wastes and discharge of human and industrial wastes to water bodies.

Population trends in Victoria

In 2011, the population of Victoria was 5.53 million people, with the Greater Melbourne area accounting for 75% of the total population (Figure A.5.1). Between 2001 and 2011, Victoria's population increased by 15%, or 730,000 people.[5]

This was mostly due to the population growth in Greater Melbourne, which increased by 18% (or nearly 650,000 people) over the period. Greater Melbourne accounted for 89% of the total population growth in Victoria. Victoria's population growth was the second-largest in Australia, after Queensland. Melbourne's growth is faster than that of the average of Australia's capital cities.

For regional Victoria, the population grew by 83,000 people, an increase of only 6% between 2001 and 2011.[5] Regional Victoria's share of the state's population decreased from 27% to 25% over the period, reflecting the relatively high growth in Greater Melbourne. The highest regional growth was in Geelong, with a 13% increase in population between 2001 and 2011. Other large increases occurred in Bendigo, where the population grew by 9.5% and Ballarat by 9%. These increases were higher than the overall growth for regional Victoria.

The population of some 40% of regional Victoria's Statistical Area Level 2 divisions (officially gazetted state suburbs and localities) declined between 2001 and 2011, with around half of these declining by more than 5% (Figure A.5.2). Eight of the 10 fastest declining divisions were in the state's north-west.

Peri-urban and coastal development

Most of the population growth in Greater Melbourne and the regional centres occurred in the outer suburbs, generally as a result of greenfield, or peri-urban development activity (Figure A.5.2).[5]

Coastal towns recorded strong population growth rates, particularly in areas close to Melbourne (e.g. Bass Coast, Cardinia, Casey, Surf Coast and Wyndham). Much of this is related to the growth of Melbourne and Geelong and the subsequent expansion of the commuter belt, as well as lifestyle factors, such as demand for more space and larger homes, the rising cost of city living and retirement migration.

Development in peri-urban and coastal regions is resulting in the loss of natural habitat and biodiversity, as well as agricultural land. Coastal development is a major pressure on coastal and marine ecosystems (see Part A: 4 Marine and Coastal, Indicator MC2: Conservation of Marine and Coastal Areas).

In the Urban Melbourne reporting area of the Port Phillip and Westernport Catchment Management Authority, only 5% of original vegetation remains.[6] This is a significant concern in Wyndham and Melton, where urbanisation is driving a reduction in the extent of native grasslands on Victoria's volcanic plains – the most cleared vegetation classes and one of the most cleared regions in the state (see Part A: 2 Biodiversity and Land).

Urban expansion has also driven increased demand for transport infrastructure, such as freeways, ring-roads, and public transport. In addition, climate change is becoming a consideration in planning decisions on the coast, with some areas predicted to be subject to inundation more frequently.[3]

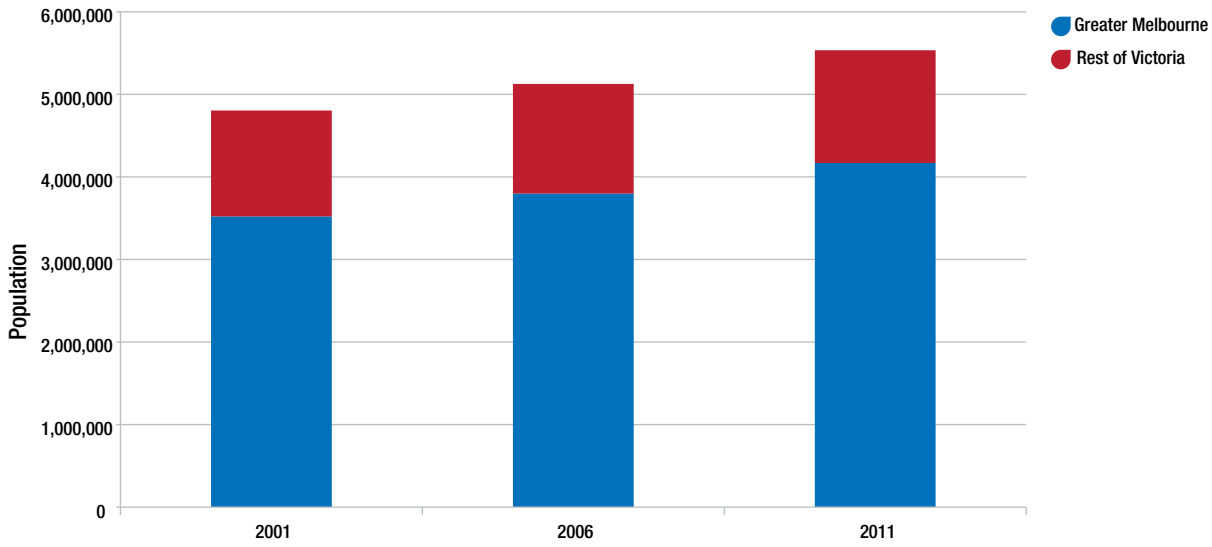


Figure A.5.1: Victoria's population growth, 2001 to 2011

Source: ABS

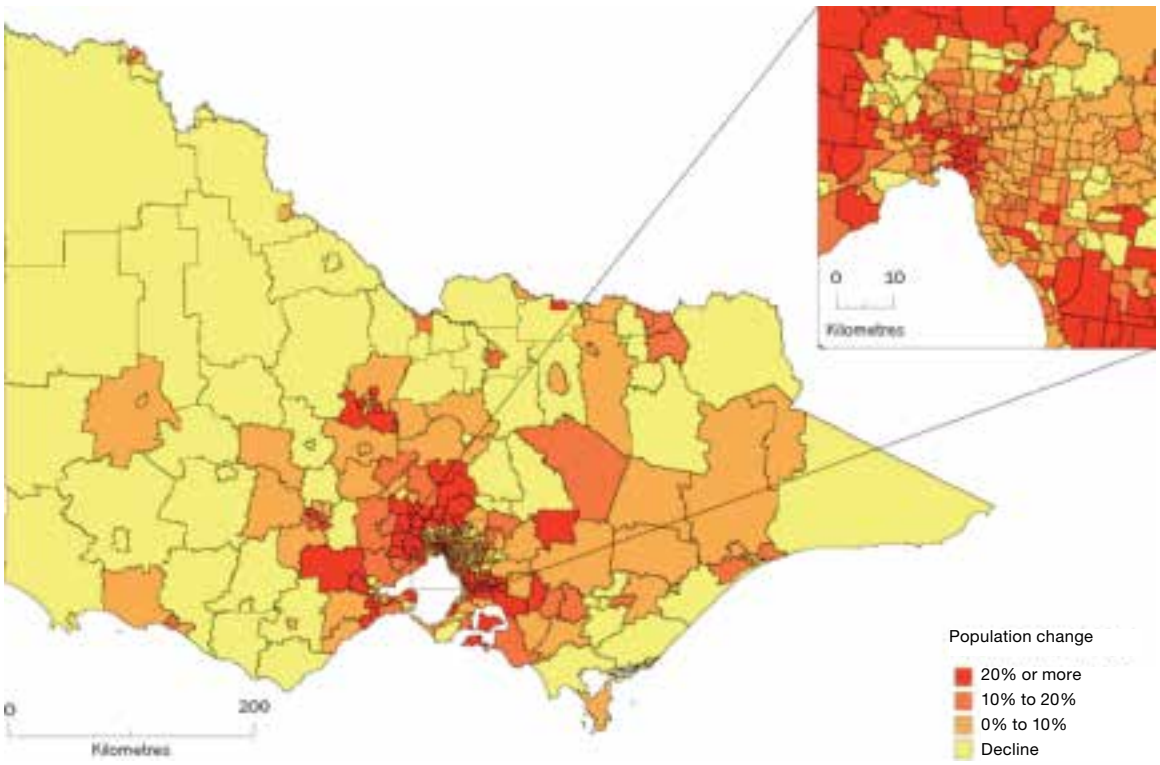


Figure A.5.2: Population change in Victoria, 2001 to 2011

Source: ABS.

Note: This map shows SA2 divisions, which are based on officially gazetted suburbs and localities.

Victoria's future population

Victoria's population is projected to increase to around 8.3 million by 2051, some 2.7 million more people than in 2011 (Figure A.5.3).[7] The majority of this rise will be in Greater Melbourne, which will increase by 2.3 million, accounting for 86% of the total projected population increase. Regional Victoria's population is projected to increase by 375,000 people between 2011 and 2051.

Victoria's projected population rise will increase the demand for peri-urban and coastal development, particularly around the Melbourne and Geelong areas. It will also increase the demand and consumption of water and other resources, energy, food production and a range of products and services. This will have severe consequences for Victoria's environment.

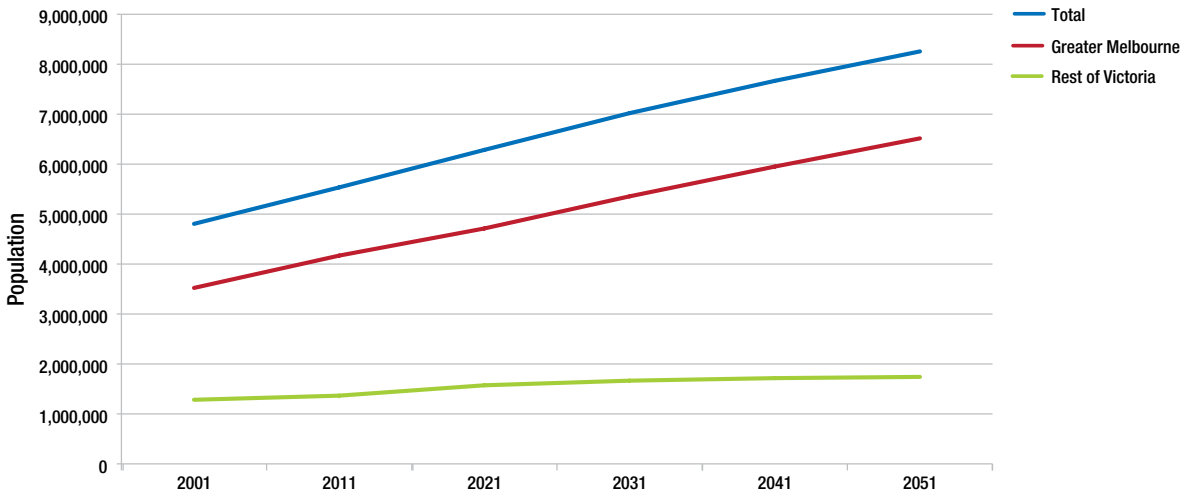


Figure A.5.3: Victoria's population growth 2001 to 2051

Source: ABS.

Note: Population growth from 2011 to 2051 are Australia Bureau of Statistics projections.

Indicator HS2: Energy Use

This indicator assesses Victoria's energy use. For greenhouse gas emissions and air pollution resulting from energy generation and use, including transport, see Part A: 1 Climate Change and Air Quality.

Energy generation and consumption is fundamental to everyday life and underpins social and economic activity. However, the reliance on fossil fuels for energy creates significant pressures on the environment.

In Victoria, energy use (particularly electricity generation and use) has the single biggest impact on the state's ecological footprint[1] and presents a range of environmental pressures, including the emission of greenhouse gases and other air pollutants, water consumption (see Indicator HS3: Water Resources and Consumption) and land use. Many of these environmental impacts will be exacerbated by climate change and will continue into the future unless there are significant changes to the way energy is generated and consumed.

Victoria's energy system is principally based on fossil fuels from the Gippsland Basin and imported oil. Brown coal is the most abundant of non-renewable energy resources in Victoria, and is the main fuel used to generate the state's electricity.

Energy generation and use is a major issue in Victoria because of the reliance on energy supplied from brown coal – the most greenhouse-intensive energy source in Australia. Electricity generated from brown coal is 30% more polluting than black coal, and almost six times as polluting compared to that generated from natural gas. The use of brown coal also impacts on air quality in the Latrobe Valley.

Energy consumption is driven by a range of factors. These include the structure and activity of the economy and changes in fuel mix resulting from government policies and initiatives, as well as consumer demand for cleaner energy. Greater uptake of energy efficiency and renewable energy will play a key role in decreasing consumption of fossil fuels in the future. Victoria has great potential for renewable energy – including wind, solar, wave and geothermal – yet very little has so far been exploited.

Consumption and generation of electricity

Victoria's electricity consumption more than doubled between 1980–81 and 2010–11. This is despite the population growing by only 40% over the same period (Figure A.5.4). The rise can be attributed to the electricity consumption per capita, which has increased by 45% since 1980–81, although this rate has declined slightly since 2006–07.

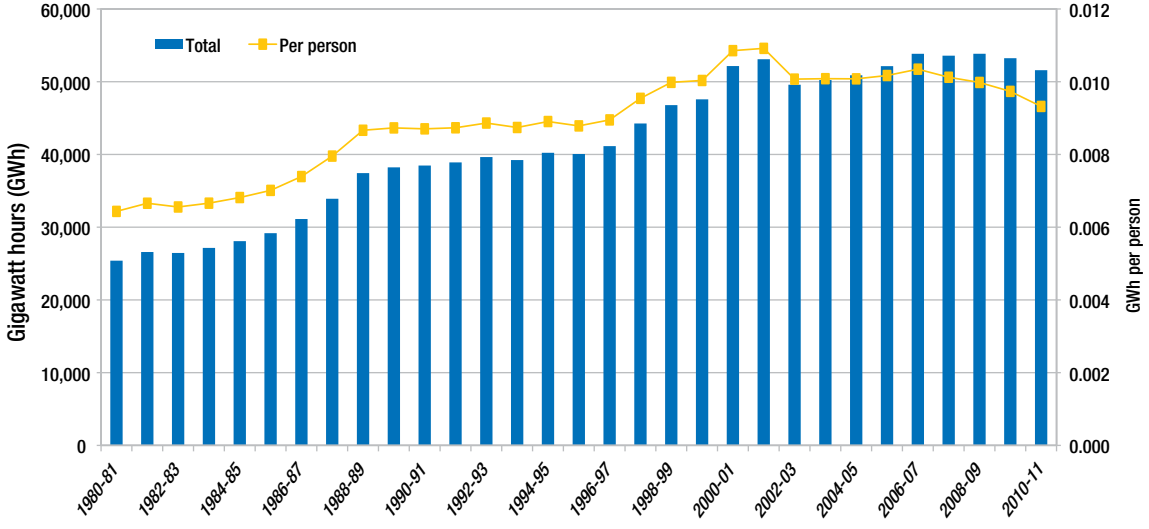


Figure A.5.4: Victorian consumption of electricity, 1980–81 to 2010–11

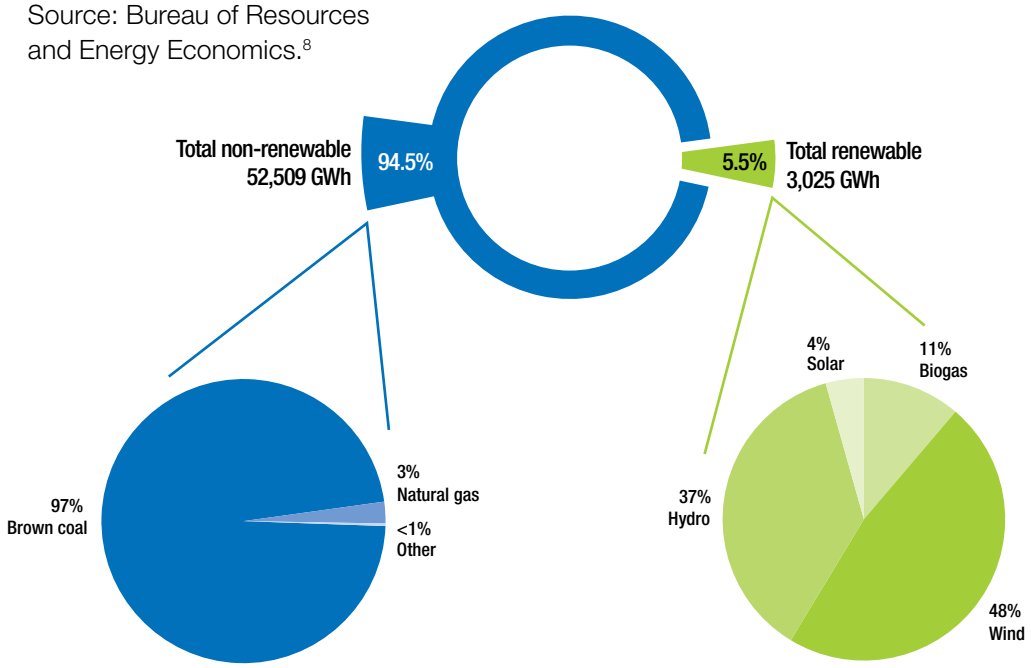
Source: Bureau of Resources and Energy Economics.[8]

Only 5.5% of Victoria's electricity was generated from renewable sources. Wind and hydro accounted for the majority of renewable sources with 48% and 37% respectively. Solar electricity generation only accounted for 4% of renewable electricity generation.

Electricity generation from renewable sources has been steadily increasing in Victoria. Installed capacity of renewable generation technologies has increased by nearly two and half times since 2000, with the wind sector significantly expanding over the period. Wind now accounts for over 25% of installed renewable electricity generation capacity in Victoria. Solar capacity has also significantly increased since 2000.[9]

Figure A.5.5: Electricity generation in Victoria, by fuel type, 2010–11

Source: Bureau of Resources and Energy Economics.[8]



Energy consumption

Electricity generation accounted for the majority of Victoria's net energy consumption (total energy used within the economy, including conversion, transmission and distribution) in 2010–11 with 39% of the total energy used (Figure A.5.6). Transport was the next highest sector with 21% of the total, followed by manufacturing (17%), residential (12%), and commercial (7%). Victoria's net energy consumption nearly doubled between 1973–74 and 2010–11, with energy consumed by electricity generation nearly trebling, residential energy increasing by 81%, transport by 60%, and manufacturing by 42%. However, the biggest increase was for the commercial sector, which more than trebled, although it accounts for only a small percentage of the total energy consumed.

Energy consumption has outpaced the increase in population growth in Victoria.

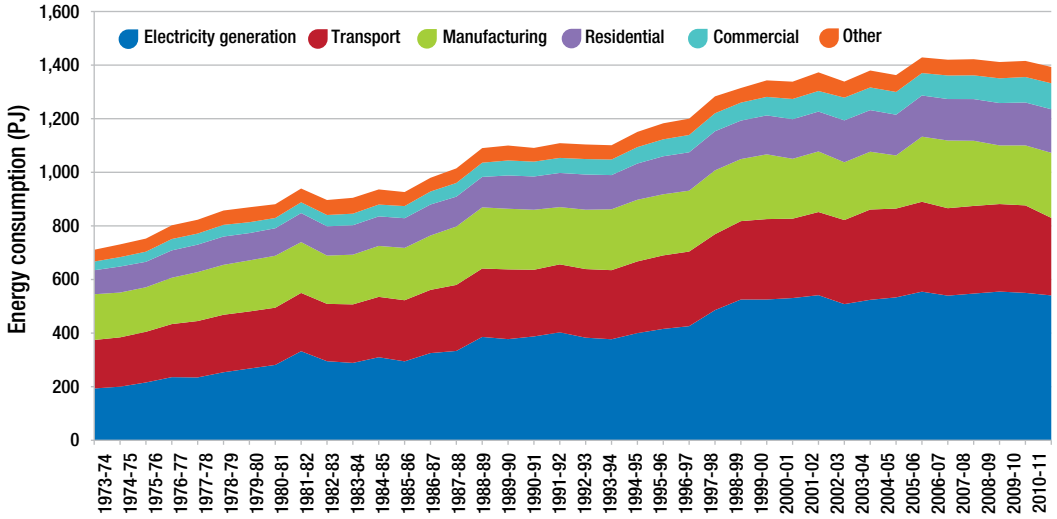


Figure A.5.6: Total net energy consumption in Victoria, by sector, 1973–74 to 2010–11

Source: Bureau of Resources and Energy Economics.[8]

Victoria's final energy consumption (total energy consumed – does not include the conversion, transmission and distribution of energy – is dominated by petroleum products (Figure A.5.7). In 2010–11, petroleum products accounted for 46% of the energy use – compared to 31% for natural gas, and 21% for electricity. These fuels supply over 97% of primary energy in Victoria.

Wood and wood waste combusted for space heating continue to dominate consumption from renewable sources. Between 1973–74 and 2010–11, the consumption of petroleum products only increased by 17%, whereas electricity consumption nearly trebled.

Consumption of natural gas increased rapidly in the early 1970s with the installation of Victoria's reticulated natural gas network, but has slowed since.

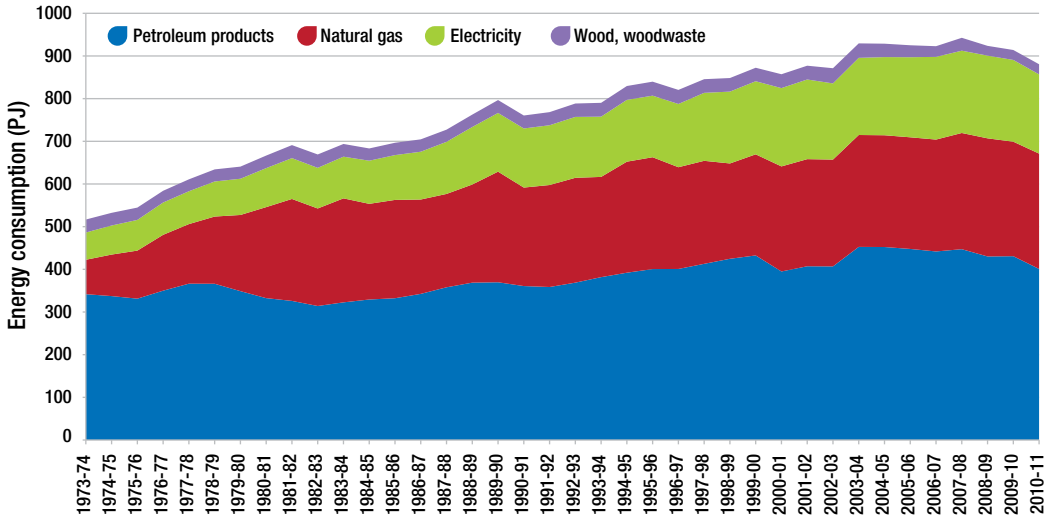


Figure A.5.7: Final energy consumption in Victoria, by fuel, 1973–74 to 2010–11

Source: Bureau of Resources and Energy Economics.[8]

Note: Data concerning refinery input and output, consumption of brown coal, production of petroleum products, and production and consumption of coke and coal by-products have not been included due to confidentiality.

Indicator HS3: Water Resources and Consumption

This indicator examines the availability and consumption of water resources in Victoria. For information on trends in river flows and groundwater levels, including the impacts of water extraction from these systems, see Chapter A: 3 Inland Waters.

The management of water in metropolitan and regional urban settings is discussed in Foundation Paper Three: *Water Victoria: The Science, Our Urban Communities and Our Water Futures*.[10]

Water is used for a variety of purposes, including residential supply, primary production (particularly for irrigation), power generation and industry. Water resources are vital for human health and wellbeing and for accommodating population growth.

The availability of water is also key for economic prosperity, especially for primary production industries. Victoria's water consumption increased over the last century, peaking in the 1990s, but dropped in response to water restrictions caused by long-term drought between 1996 and 2010. The severity of the water shortages has been particularly marked in central and western Victoria, where some storages were more than 90% empty at the end of the drought.

The availability of surface and groundwater resources is mainly determined by streamflow and rainfall, as well as impacts of land use on catchment hydrology. Streamflow in Victoria is highly variable, with most basins receiving only a fraction of their average flow in most years. The generally dry conditions are punctuated by wet years with flows well in excess of the average, which replenish storages and river systems. Surface water is more readily available in the eastern half of Victoria, which generates up to 80% of the state's streamflow.

In response to Victoria's highly variable streamflow, inland waters have been transformed into a complex and extensive system for harvesting, transporting and controlling the movement of water. There are 134 declared water supply catchments across Victoria and about 70 major storages, with at least one major on-stream storage constructed in 19 of Victoria's 29 river basins. In addition, there are over 455,000 farm dams in Victoria.[11] As a result, many river systems in Victoria are now environmentally degraded because of impacts on natural flow regimes (see Chapter A: 3 Inland Waters).

As demand for water has increased in Victoria, the use of groundwater to complement surface water sources has increased. Groundwater is now an important resource for agriculture, industry and domestic use.

Although useable groundwater resources are small compared to surface water (approximately 10% of surface water resources), it is widely used in more than 80 cities and towns in Victoria. In some regional areas, groundwater is the sole source of water.

During the Millennium Drought, the reduced surface water flows in Victoria were some of the lowest on record (see Chapter A: 3 Inland Waters). This focused attention on the management and use of water in Victoria. During drought periods, the state struggles to meet demand for water and there were are few opportunities to divert more water from rivers.[12]

To increase water capacity, the Victorian Government has embarked on two large infrastructure projects: the Bass Coast desalinisation plant and the pipeline to move water from the Goulburn River to Melbourne's Sugarloaf Reservoir. These will be used during times of severe drought and will provide more water security for Melbourne's growing population – particularly the desalinisation plant, which does not rely on rainfall.

The loss of harvested water is a significant problem in Victoria. Water is lost in the distribution network through evaporation and leakage. In 2010–11, 17% of total water supply was lost during water distribution, the second-highest level in Australia.[13] The majority of losses were from irrigation and rural water suppliers.

Water resources

Trends in Victoria's stream flows and groundwater levels are discussed in Chapter A: 4 Inland Waters.

The drought conditions between 1996 and 2010 severely reduced Victoria's water resources across many catchments, particularly in central and western Victoria. Many catchments experienced some of the lowest stream flows on record, with 2006–07 and 2008–09 volumes 27% and 32% of the long-term average respectively. Groundwater levels generally declined from the late 1990s to 2010 due to a combination of increased groundwater use and reduced recharge from both surface water irrigation and rainfall.

In 2010–11, the long-term drought ended in much of Victoria with high – and in some regions record-breaking – rainfall and flooding. This greatly increased surface water resources across much of Victoria and led to a rise or stabilisation of groundwater levels.

Victoria's total water resources between 2006–07 to 2010–11 are shown in Figure A.5.8. The impact of drought is clearly evident with total surface water resources in 2006–07 falling to 7,000 gigalitres (GL), only 26% of the long-term average. In contrast, the high rainfall in 2010–11 increased surface water resources to 175% of the long-term average. Victoria is heavily reliant on surface water, which accounted for most of the total water resources over the period – ranging from 87% in 2006–07 to 98% in 2010–11.

Groundwater resources showed little variation, remaining around 1 GL over the period. It is important to note that, while total groundwater resources remained relatively stable, the levels of some individual groundwater areas declined during drought conditions (see Chapter A: 3 Inland Waters).

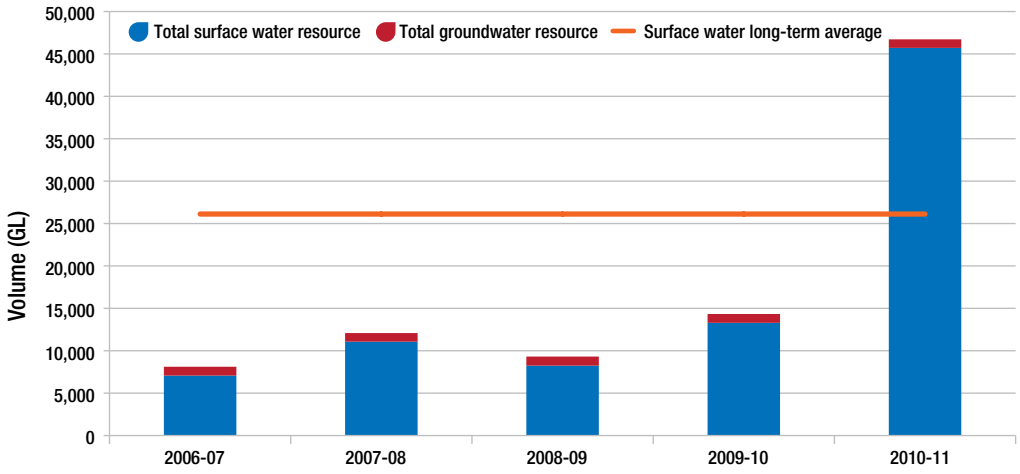


Figure A.5.8: Victoria's surface and groundwater resources 2006–07 to 2010–11, and long-term surface water average

Source: DEPI.

The impact of drought is evident for Victoria's water storages. Melbourne's water storage levels declined to a record low of only 26% of the total storage capacity in 2009 (Figure A.5.9). This was a result of historically low inflows.

The long-term average (1913–2011) inflow for Melbourne's water storages was 580,900 megalitres (ML) per year. However, during the drought (1996 to 2010) the average inflow dropped to 376,000 ML per year. In 2010–11, Melbourne's storage levels more than doubled – compared to the previous year to 56% of capacity – as a result of increased rainfall.

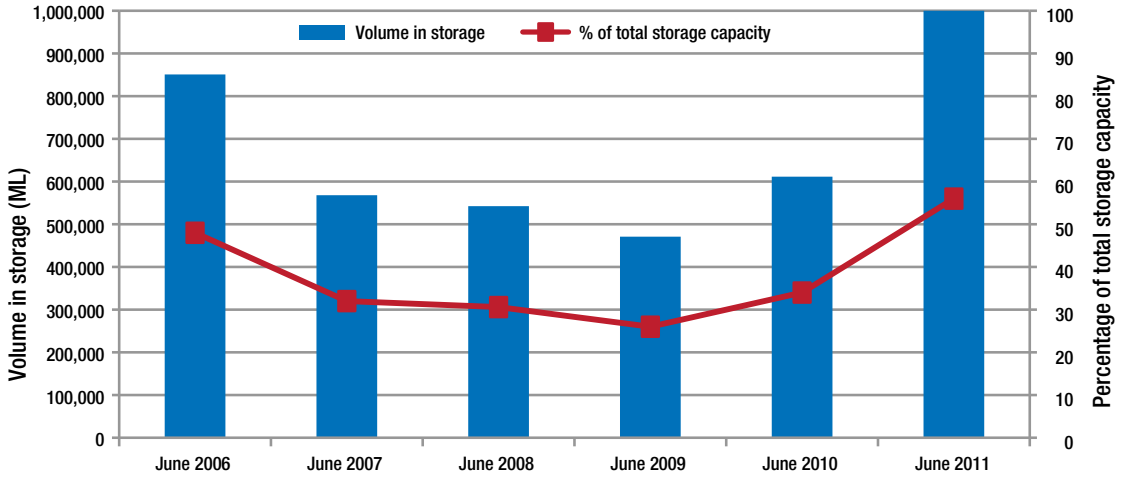


Figure A.5.9: Melbourne storage volumes, 2006 to 2011

Source: DEPI.

For the major regional water storages, drought conditions led to levels of just 15% of the total storage capacity in 2009 (Figure A.5.10). Storages most affected were in the Campaspe, Glenelg, Wimmera, Loddon, Maribyrnong and Werribee basins, which were less than 10% capacity at the end of June 2009. Storages in the Ballarat, Bendigo, Broken, Geelong, Goulburn and Murray systems were also extremely low with levels between 10% and 20% of total capacity.[14] The increased rainfall in 2010 and 2011 replenished regional storage levels to 84% of capacity.

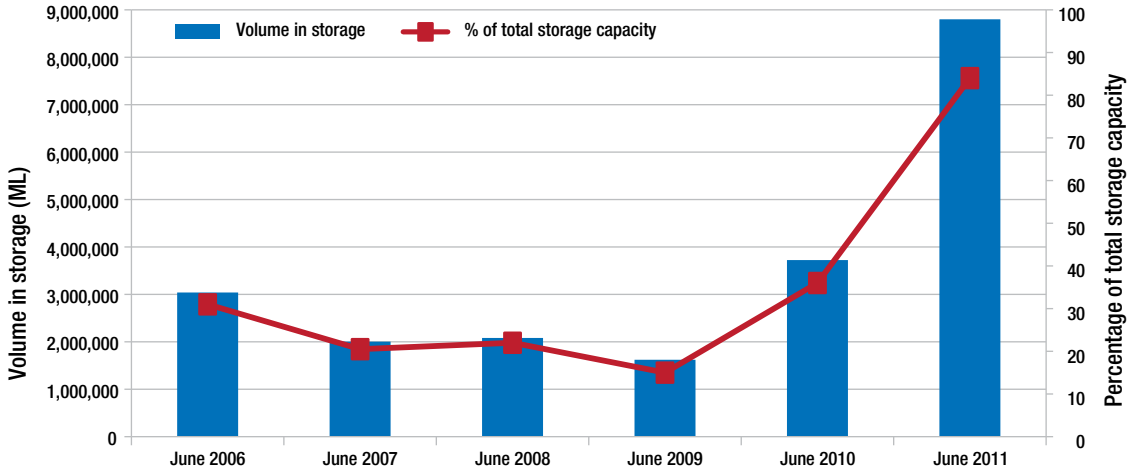


Figure A.5.10: Victorian major regional storage volumes, 2006 to 2011

Source: DEPI.

Wastewater recycling

Recycling wastewater has the potential to reduce the impact of wastewater discharges on the environment, reduce water harvesting from the natural environment, and potentially increase environmental flows. The volume of wastewater that the community produces is relatively stable, so recycling provides a reliable source of water.

Consumption of recycled wastewater is proportionally larger in regional areas due to the smaller volumes produced and proximity to fit-for-purpose uses.

Between 1996-97 and 2006–07, Victoria's wastewater recycling increased six-fold due to reduced water availability from other sources and greater investment in recycled water infrastructure.[1] However, from 2006–07 to 2009–10 wastewater recycling remained stable at around 25% (approximately 95,000 ML) of the total wastewater produced (Figure A.5.11). In 2010–11, wastewater recycling fell to 11% (approximately 55,000 ML) of the total wastewater produced. This was due to high rainfall increasing wastewater production and reducing the need for recycled water.

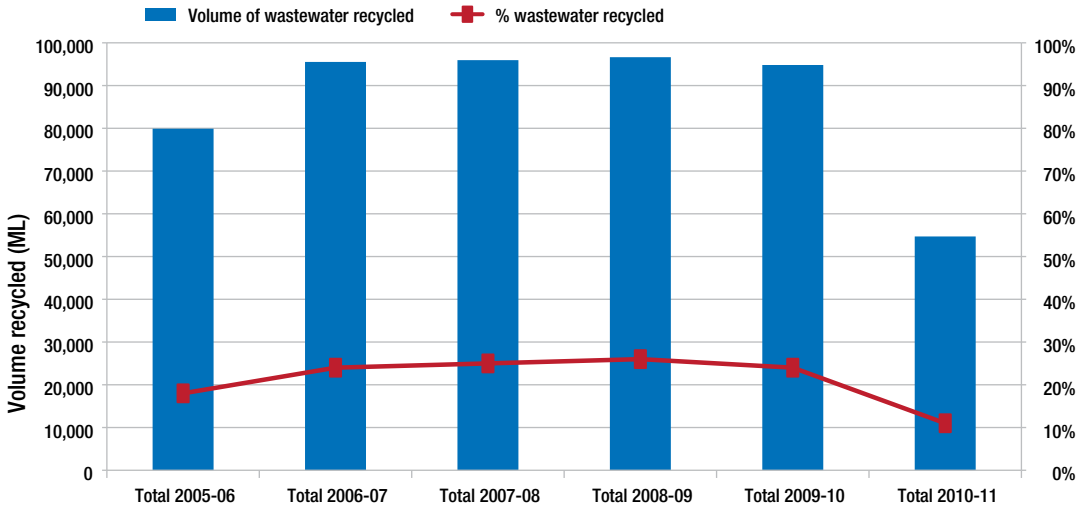


Figure A.5.11: Wastewater recycling in Victoria, 2005–06 to 2010–11

Source: DEPI.

Water consumption

Water consumption is determined by a range of factors, including population, consumptive entitlements, restrictions due to water availability, changes in need due to rainfall, and the water demand of primary industry.

It should be noted that while under the Victorian Government water allocation framework water users have set entitlements, this does not guarantee that the entitlement volume will always be available for use.[15] In times of low water availability, restrictions are applied to ensure resources are available for other users and the environment. However, the allocation system reduces water available to the environment more than for consumptive uses (see Part B: 1.3 Effective Protection and Delivery of Environmental Water). Consequently, during times of drought the overall demand and use of water resources impacts on the aquatic environment as the amount of water available decreases.

Surface water consumption

Between 2006–07 and 2010–11, the consumption of surface water ranged from a high of 3,456 GL in 2006–07 to a low of 2,822 GL in 2010–11 (Figure A.5.12). Consumption was influenced by drought conditions between 2006–07 and 2009–10, with severe water restrictions in place due to reduced water resources. In contrast, consumption in 2010–11 was influenced by the high rainfall, which reduced the need for water.[15]

The percentage of the available surface water extracted was nearly 50% in 2006–07 compared to only 6% in post-drought 2010–11. This shows the pressure placed on river systems in times of low water availability when large proportions of total flows are extracted for water supply.

Between 2006–07 and 2009–10, over 25% of Victoria's river basins had more than three-quarters of their annual streamflow harvested for consumption, and over 40% had more than half their streamflow harvested (see Chapter A: 3 Inland Waters).

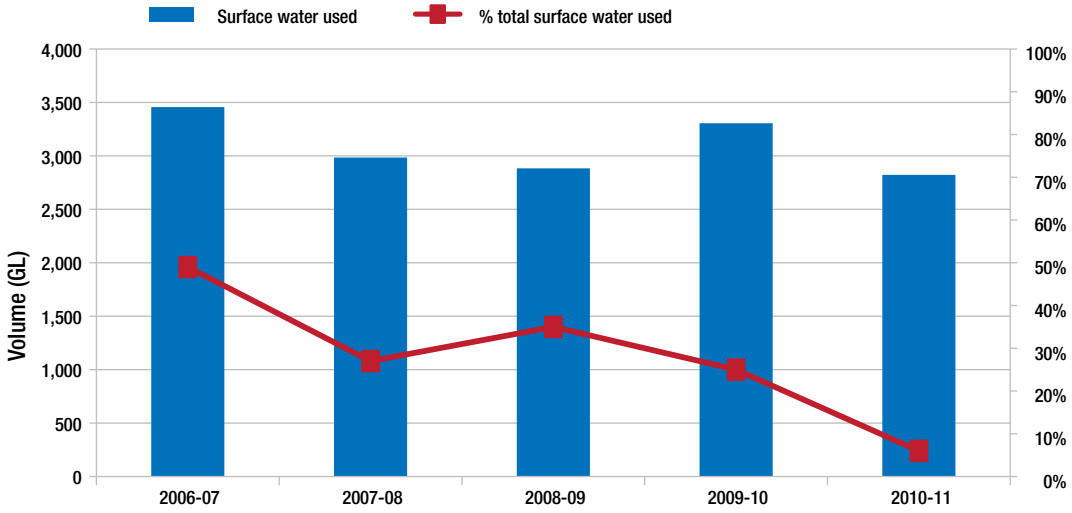


Figure A.5.12: Volume of surface water extracted and percentage of total resource extracted, 2006–07 to 2010–11

Source: DEPI.

About three-quarters of surface water harvested in Victoria was used for irrigation between 2006–07 and 2009–10 (Figure A.5.13). This decreased to 62% in 2010–11 because of the reduced need for water due to high rainfall. Over half of the water for irrigation is used for dairy production. Other significant uses include livestock, pasture and grains, and grapes and fruit. Most irrigation occurs in the Goulburn–Murray region.

The next biggest water user was the 'urban and commercial' sector, accounting for around 20% of water usage between 2006–07 and 2009–10. This rose to 28% in 2010–11 partly because of the reduction in irrigation use, but also because consumption for the sector increased by 138,000 ML compared to the previous year – possibly in response to the removal of some water restrictions. The 'domestic and stock' and 'power generation' sectors accounted for around 5% and 3% of the total surface water use respectively.

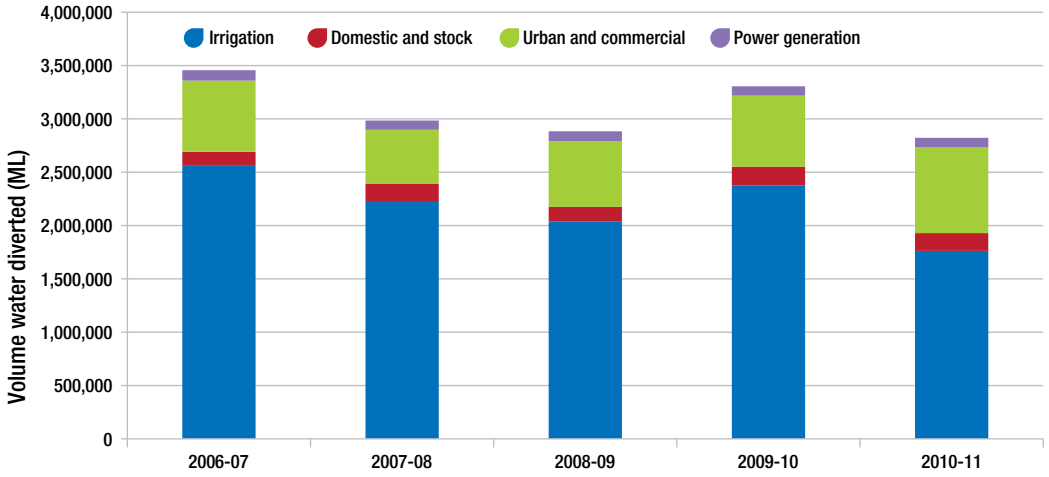


Figure A.5.13: Surface water diversions made under consumptive entitlements 2006–07 to 2010–11

Source: DSE.

Groundwater consumption

Between 2006–07 and 2010–11, groundwater extraction ranged from a high of 526,000 ML in 2006–07 to a low of 221,000 ML in 2010–11 (Figure A.5.14). The high rainfall in 2010–11 reduced groundwater extraction by approximately half due to reduced demand. The percentage of the available groundwater extracted ranged from 50% in 2006–07 to 22% in post-drought 2010–11. As with surface water resources, this shows the pressure placed on groundwater systems in times of low water availability, when large proportions of the total resource is extracted for water supply. While groundwater supply is important for many regions of Victoria, it only accounted for 7% to 13% of the total water used between 2006–07 and 2010–11.

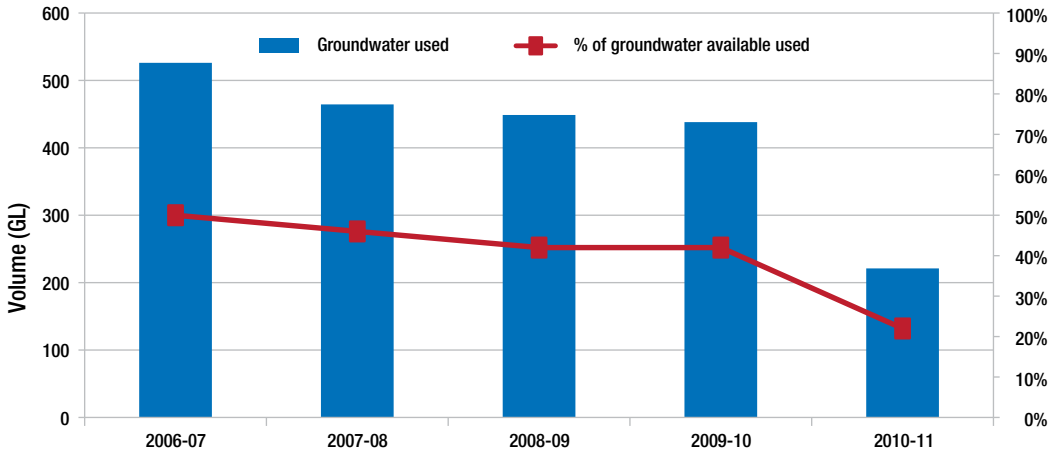


Figure A.5.14: Volume of groundwater extracted and percentage of total resource extracted, 2006–07 to 2010–11

Source: DEPI.

'Irrigation, commercial and salinity control' uses account for most of the groundwater consumption in Victoria (Figure A.5.15). Extraction for these purposes ranged from 75% during the drought period, to 55% in 2010–11, when the demand for water was reduced due to the high rainfall.

The 'stock and domestic' sector is another significant user, accounting for 27% of groundwater use in 2010–11. The Latrobe Valley coal mines can also extract high volumes of groundwater, accounting for 13% of total groundwater extraction in 2010–11. The Latrobe Valley coal mines and offshore oil and gas extraction has led to long-term declines in groundwater resources in Gippsland.

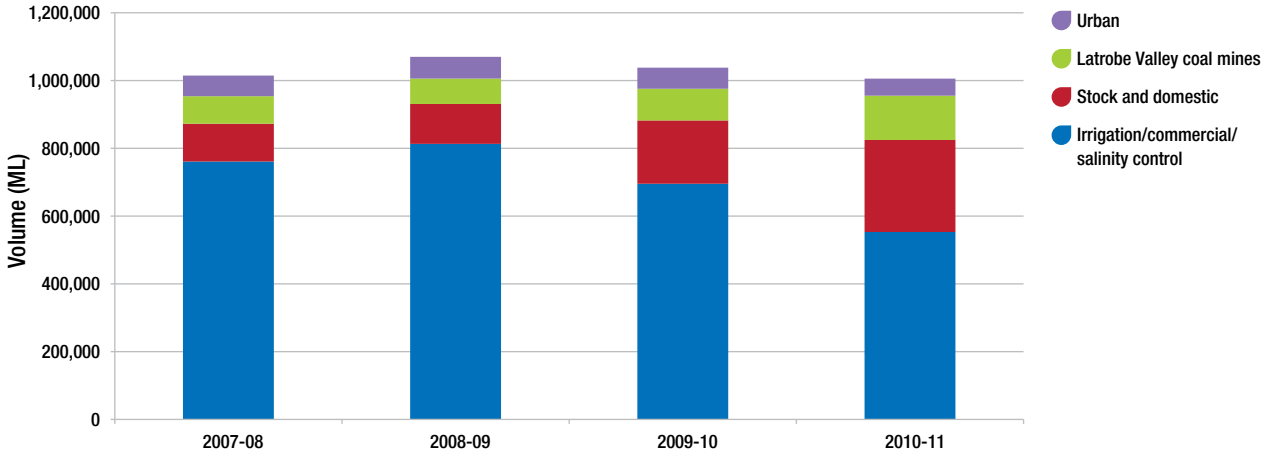


Figure A.5.15: Victorian groundwater extraction (Groundwater Management Areas and Water Supply Protection Areas) by use, 2007–08 to 2010–11

Source: DEPI.

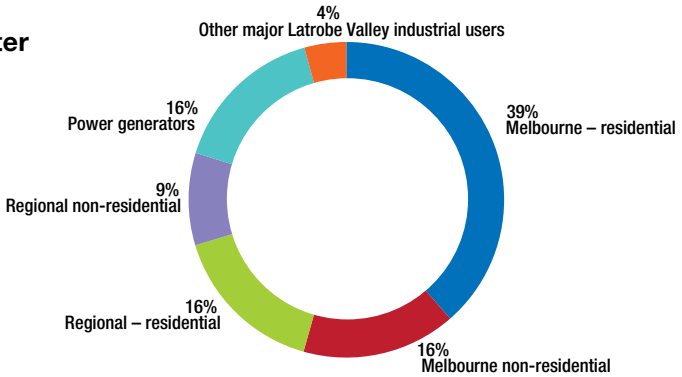
Urban water supply

Melbourne is home to 75% of the state's population and consequently is responsible for most of Victoria's urban water supply (Figure A.5.16). While Melbourne's residential use accounts for nearly 40% of the total Victorian metered urban supply, non-residential uses account for another 16%.

Melbourne accounts for about 10% of the total water harvested for consumption in Victoria. Regional Victoria accounts for 25% of the total urban water supply. The power generation sector is a significant water user, accounting for 16% of total urban water, nearly a third of Melbourne's total water use.

Figure A.5.16: Urban and commercial metered water consumption in Victoria, 2010–11

Source: DEPI.



Per capita water consumption

Victoria's per capita water use decreased from 229 L/person/day in 2008–09 to 192 L/person/day in 2010–11 (Figure A.5.17). While long-term consumption rates have been dropping due to water restrictions, this reduction is most likely due to the high rainfall in 2010–11 reducing demand for water.

Water usage across Victoria was variable, with Central Highlands having the lowest per capita use and Lower Murray the highest. However, it is difficult to compare regional per capita water usage as there are differences in levels of restrictions, climatic conditions driving demand for water, and different dwelling densities across the population centres.[15] Melbourne's per capita consumption has continued to decrease from 253 L/person/day in 1996–97 to 147 L/person/day in 2010–11 – a reduction of 42% (Figure A.5.18).

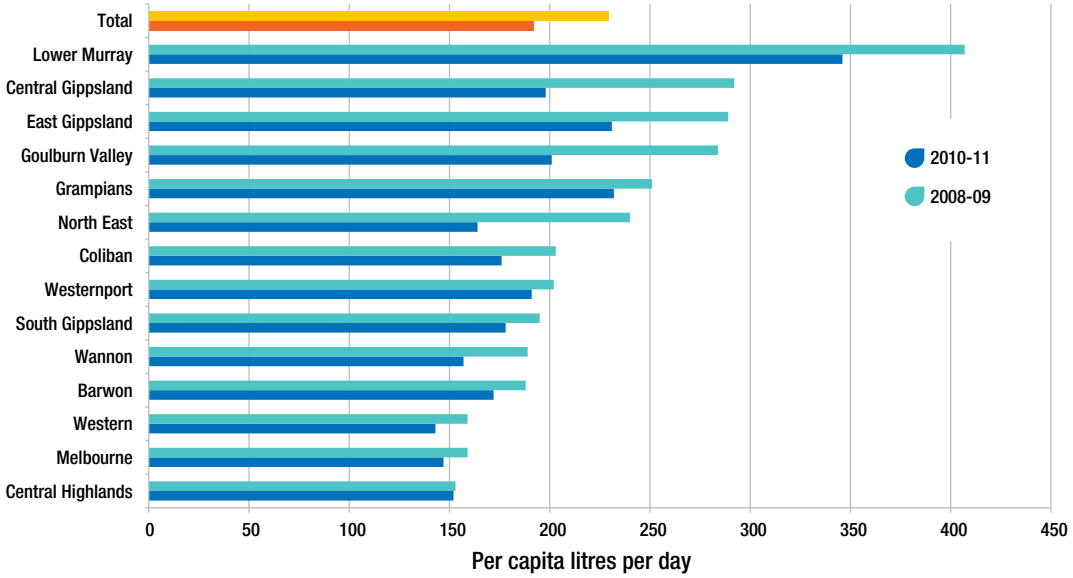


Figure A.5.17: Victoria's daily per capita water consumption, 2008–09 and 2010–11, by water corporation

Source: DEPI.

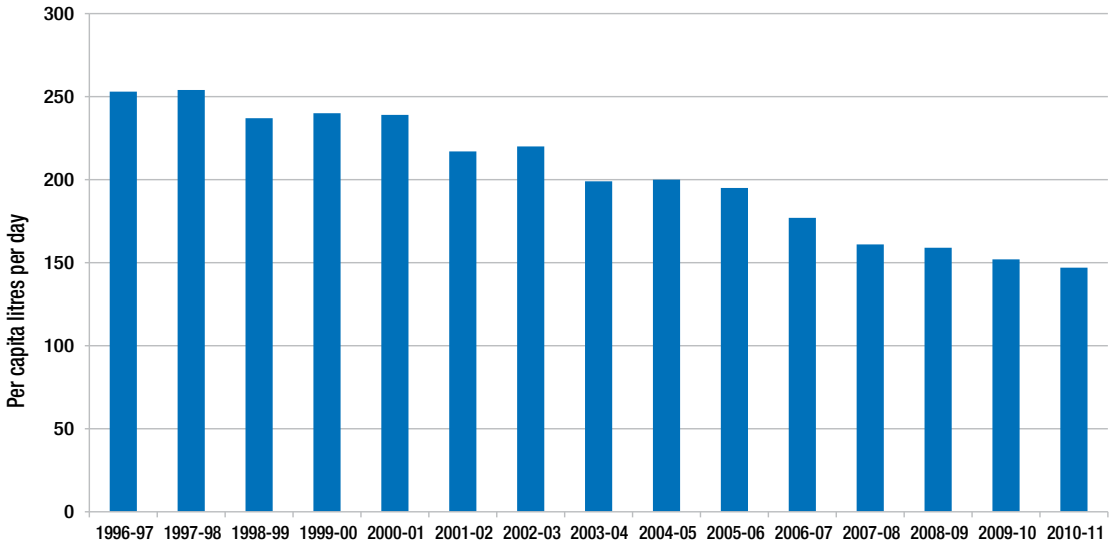


Figure A.5.18: Melbourne's per capita water consumption, 1996–97 to 2010–11

Source: DEPI.

Indicator HS4: Trends in Solid Waste Generation and Management

Waste is produced at all stages in the manufacture of products and services, as well as at the end of a product's lifecycle. Depending upon the way it is managed, waste can have a number of different environmental impacts, including:

- greenhouse gas emissions and pollution of groundwater from landfill
- the presence of hazardous and other waste and its impacts on amenity, ecosystems and human health
- conversion of land for waste disposal
- increased energy use to recycle products
- the effect of unmanaged outputs such as litter and dissipative wastes.

When waste is not reused, recycled or used efficiently, there is an opportunity lost, as the material can no longer be used to contribute to the economy.

Recycling waste not only makes such materials available to the economy, it also reduces the demand for resource extraction and conserves energy and water compared to manufacturing products from virgin materials. Further, due to the complex nature of material transformations, many of the substances that are produced are not able to be readily metabolised by the natural environment and may harm natural systems and biodiversity. Environmental management of waste, including landfills, recycling processes, management of prescribed waste and litter prevention, can greatly reduce these impacts. However, it is of great importance to reduce the amount of material requiring waste disposal.

A large proportion of waste comes from secondary industries, such as manufacturing and construction, some of which is potentially hazardous. Poor planning in design and assembly can lead to inefficient use of resources in manufacturing or construction, leading to unnecessary material waste. The management of such waste can be an economic burden, which is passed on down the supply chain of products, increasing the price to the consumer.

In the case of construction, poor design cannot only create unnecessary material waste, but also a legacy of inefficiency throughout a building's life.

Alternatively, waste products may be useful resources for other industries. For example, overburden material, such as soil, rock and gravel removed for construction and other activities, can become fill for landscaping, and manure can become fertiliser for agriculture (or even a bioenergy source for electricity generation). Similarly, wastes from households can be reused, recycled or composted, thus increasing their utility.

It is important to note that while waste policy can help to ensure that more waste is recycled, it is unlikely to reduce the amount of waste generated. This is because the total amount of waste generated is the result of consumption rates and other – social, cultural and economic – factors that are predominantly outside the influence of government waste policy.[16]

Waste generation and disposal in Victoria

Waste generation increased from 8.6 Mt in 2002–03 to 12 Mt in 2010–11, an increase of nearly 40% (Figure A.5.19). Recycling increased from 4.4 Mt to 8 Mt, raising the annual recycling rate from 51% to 68%. As a result of improved recycling, the amount of waste going to landfill decreased slightly over the period, from 4.2 Mt to 3.9 Mt.

Despite improvements in recycling, there are still valuable resources going to landfill. The marginal cost of increasing the recycling of all material types is currently prohibitive. However, a recent estimate found that if only high-commodity-value materials currently going to landfill (paper, cardboard, plastics and metal) were recycled, $172 million could be potentially made available to the Victorian economy.[16]

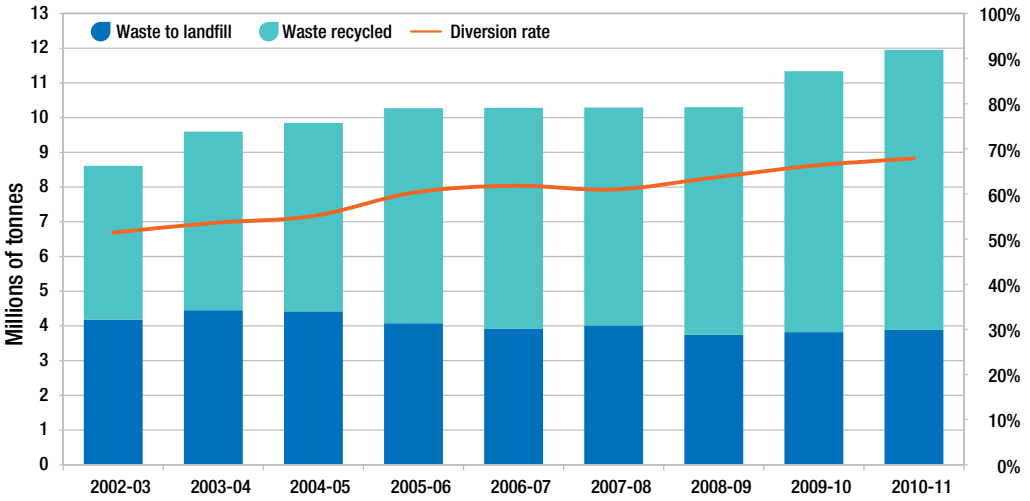


Figure A.5.19: Waste generation, landfill, recycling and the recycling (diversion) rate, Victoria 2002–03 to 2010–11

Source: DEPI.

In 2010–11, the majority of waste produced in Victoria was from the 'construction and demolition' sector, which accounted for 41% of the total waste produced (Figure A.5.20). The 'commercial and industrial' sector produced 34% of the total waste, with municipal solid waste accounting for 25%.

Between 2002–03 and 2010–11, the biggest rise in waste was for the 'commercial and industrial' sector, which increased by 47%. All sectors recorded significant waste increases over the period, with a 38% increase for 'construction and demolition' and 31% for municipal solid waste.

Recycling rates improved for all sectors. The biggest rise was for the 'construction and demolition' sector, which increased from 54% in 2002–03 to 83% in 2010–11 (Figure A.5.21). The recycling rate for municipal solid waste improved from 33% to 44%, whereas commercial and industrial only increased from 63% to 66%, a rise of only 3% over the period.

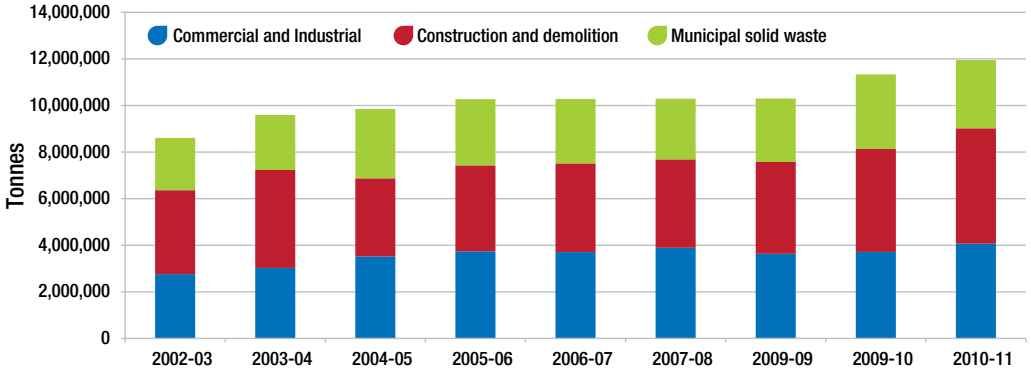


Figure A.5.20: Waste generation by sector, Victoria 2002–03 to 2010–11

Source: DEPI.

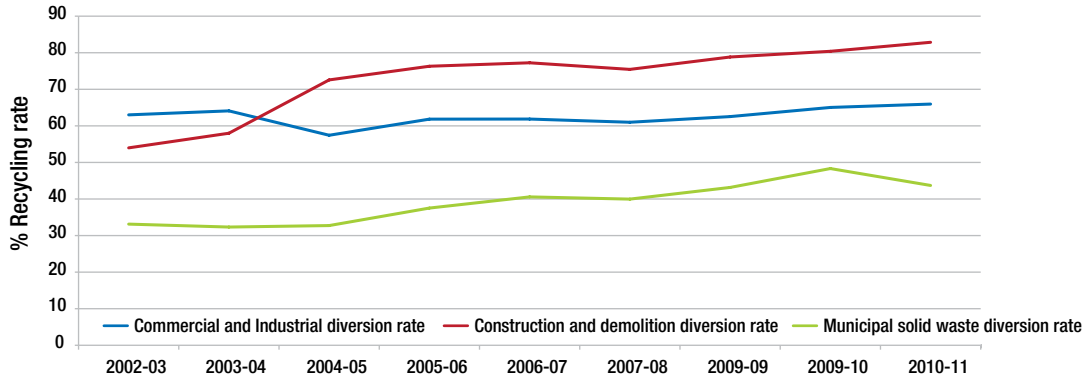


Figure A.5.21: Waste diversion rates by sector, Victoria, 2002–03 to 2010–11

Source: DEPI.

Despite the improvement in the overall recycling rate, the increase in waste generation means that Victoria is becoming more waste-intensive. Between 2002–03 and 2010–11, Victoria's per capita waste generation increased from 1.7 tonnes per year to 2.1 tonnes per year, an increase of 23% over the period (Figure A.5.22). This means that waste production is growing at a faster rate than population.

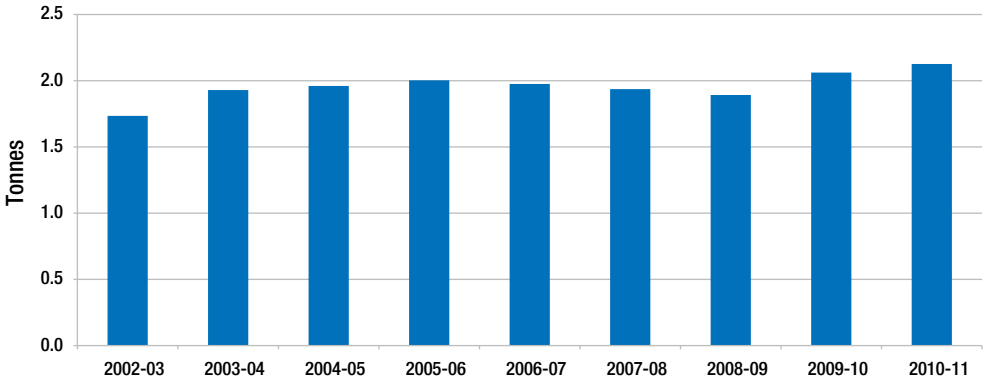


Figure A.5.22: Tonnes of waste per capita, Victoria, 2002–03 to 2010–11

Source: DEPI.