Chapter 2

Trends in waste production in Australia

2.1 This chapter addresses term of reference (a) concerning trends in waste production across Australia. It considers waste generation trends; deficiencies in waste data; some of the key areas of waste growth in Australia; and the impact of such waste on our environment, society and economy.

2.2 Waste is what society throws away because it is no longer needed, wanted or valued and can be generated at each stage of the production process from extraction to consumption and includes items that can be used again.[1] Waste can be classified by source (municipal, commercial and industrial, construction and demolition) or by composition (such as organic, paper, glass, metal, and plastic). Just as the physical and chemical properties of waste materials are different, each individual material has its own unique life cycle which affects its impact on the environment.[2]

2.3 The types of waste discussed in this report typically refer to solid waste rather than liquid or gaseous waste. The report does not consider 'prescribed' or controlled' waste as defined in state and territory regulations.

Waste generation is increasing

2.4 Although estimates vary, commentators agree that the amount of waste generated in Australia each year is continuing to grow, with current generation approaching 40 million tonnes per annum. The 2006 Productivity Commission *Waste Management* report (Productivity Commission report) noted that Australia generated approximately 32.4 million tonnes of solid waste in 2002–03, producing an average of 1 639 kilograms per capita in that year alone.[3]

2.5 WCS Market Intelligence & WME Environment Business Media provides an alternative estimate of more than 38 million tonnes of waste generated in Australia in 2004–05. This represents a 34 per cent rise relative to its estimate of 28.4 million tonnes generated in 1999–2000.[4] These figures are plotted in Figure 2.1.

2.6 According to the Australian Bureau of Statistics (ABS) solid waste generation has risen at around six per cent per annum on average from an estimated 23 million

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1 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends 2006*, *Solid waste in Australia*, Report no. 4613.0, 2006.

2 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends 2006*, *Solid waste in Australia*, Report no. 4613.0, 2006.

3 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 17.

4 WCS Market Intelligence & WME Environment Business Media, *The Blue Book – Australian Waste Industry,* 2008, p. 49.

tonnes in 1996–97.[5] This rate is faster than annual GDP growth. The ABS estimates the amount of waste generated in Australia rose from 22.7 million tonnes in 1996–97 to 32.4 million tonnes in 2002–03.[6]

2.7 The Productivity Commission report concluded that despite difficulties resulting from the differences in how data is collected and reported, it was reasonable to conclude that total waste generated per person in Australia has been increasing over time.[7] Indeed, the Department of the Environment, Water, Heritage and the Arts (Environment Department) has stated that from 1996–97 to 2002–03 there was a 42 per cent increase in waste generated in Australia.[8]

2.8 In 2005 the Australia Institute put a dollar figure on the nation's consumption patterns. Its *Wasteful Consumption in Australia* report revealed that in 2004, Australians spent $10.5 billion on goods and services that they never or hardly ever used with food consumption amounting to the largest waste category.[9] The report highlighted that Australians threw away $5.3 billion worth of all forms of food in 2004 which by comparison was thirteen times the amount donated by Australian households to overseas aid agencies in 2003.[10]

5 Australian Bureau of Statistics, *Australian Social Trends, 2007: Household Waste*, Report no. 4102.0, 2007.

6 Australian Bureau of Statistics, *Media Alert Environmental snapshot: recycling up, but e-waste a looming issue*, 10 November 2006.

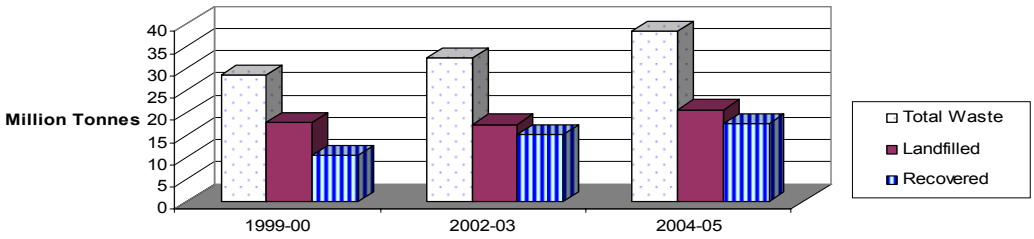
7 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 15

8 Department of the Environment and Heritage, *Submission to the Productivity Commission Inquiry into Waste Generation and Resource Efficiency*, February 2006, p. 11.

9 The Australia Institute, *Wasteful Consumption in Australia*, Discussion Paper no. 77, March 2005, p. vii.

10 The Australia Institute, *Wasteful Consumption in Australia*, Discussion Paper no. 77, March 2005, p. viii.

Figure 2.1—Waste Generation and Management in Australia



WCS Market Intelligence & WME Environment Business Media, *The Blue Book – Australian Waste Industry*, 2008, p. 49 and Productivity Commission, *Waste Management*, Report no. 38, 2006, p. xxvii.[11]

2.9 Medium to long term projections show a similar trend. For example Hyder Consulting estimated that based, on data from Sydney, Victoria and the Australian Capital Territory, waste generated in Australia would rise from 31.6 million tonnes in 2002–03 to 42.6 million tonnes in 2012–13 and 57.5 million tonnes in 2022–23 assuming an average annual per capita GDP growth of 1.88 per cent and average annual population growth of 1.13 per cent. By 2022–23, the projected tonnage of material disposed in landfill would amount to over 31.6 million compared to an estimated 25.8 million tonnes recycled.[12]

2.10 The Environment Department cautions that Australia lacks reliable, comprehensive, contemporary waste information at a national level which would otherwise inform projected waste trends.[13] Indeed, as the department stated in its submission, it requires 'more robust information to allow it to better understand not only the level and types of waste generated but the implications of this for the environment, the economy and society'.[14] The poor quality of waste–related data in Australia is discussed later in this chapter.

Drivers of waste generation

2.11 According to the ABS, the drivers behind the growth in waste generation in Australia include economic, demographic and geographic factors such as a growth in

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11 The 1990–00 and 2004–05 figures are taken from WCS Market Intelligence & WME Environment Business Media, *The Blue Book – Australian Waste Industry*, 2008, p. 49. The 2002–03 figures are taken from the Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. xxvii.

12 Hyder Consulting, *Waste and Recycling in Australia*, Paper prepared for the Department of Environment and Heritage, Short Paper, Report no. 4, 6 February 2006, p. 20, www.environment.gov.au/settlements/publications/waste/pubs/waste-recycling.pdf (accessed 10 July 2008).

13 Department of the Environment, Water, Heritage and the Arts, *Submission 78*, p. 4.

14 Department of the Environment, Water, Heritage and the Arts, *Submission 78*, p. 4.

household incomes and corporate earnings.[15] As noted above waste generation is increasing at a more rapid rate than GDP growth. The Productivity Commission noted that Australia's economic prosperity over the past decade or so has undoubtedly contributed to the growth in waste generation, which appears to be positively related to growth in household incomes and corporate earnings.[16]

2.12 One of the consequences of Australia's materially intensive economy is the production of relatively large qualities of waste.[17] Changes in population demographics including the fact that Australians are increasingly living in smaller household groups and consume a greater amount of smaller-serve goods which have higher packaging-to-product ratios than larger-serve goods, have all contributed to the growth in waste production. Coupled with this trend is the fact that consumer goods are more accessible and affordable than ever before.

2.13 The trend away from the production of re-usable to single use products, spurred by purported consumer demand for greater convenience, has led to a substantial increase in waste generation. This 'out with the old, in with the new' lifestyle has ensured that Australians live in a highly disposable society. As one case in point, Australians purchased more than 25 million electronic products in 2007 at a time when the country had a stockpile of 123 million items of e-waste.[18]

Increasing complexity and toxicity of waste

2.14 The ABS noted that associated with the large increase in the number and diversity of products available in Australia, there has been an increase in waste diversity, toxicity and complexity over the past decades.[19]

2.15 Electronic waste or e-waste is one such example of a complex waste that is estimated to be growing at more than three times the rate of general municipal waste.[20] Each year Australians buy more than one million televisions and 2.4 million computers.[21] In some cases, a range of hazardous chemicals contained in e-waste may

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15 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends, Solid waste in Australia*, Report no. 4613.0, 2006.

16 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 20.

17 Department of the Environment, Water, Heritage and the Arts, *Submission 78*, p. 3.

18 Total Environment Centre, *Submission 67*, p. 3.

19 Australian Bureau of Statistics, *Year Book Australia 2008, Waste & Recycling Practices of Households*, Report no. 1301.0, 2008,

20 Australian Bureau of Statistics, *Media Alert, Environment snapshot: recycling up, but e-waste a looming issue, Australia's Environment: Issues and Trends*, 10 November 2006. E-waste comprises obsolete electronic and electrical products including computers, televisions, VCRs, stereos, mobile phones, automobile and manufacturing components.

21 Australian Bureau of Statistics, *Year Book Australia 2008, Waste and Recycling Practices of Households*, Report no. 1301.0, 2008.

diffuse into the landfill leachate.[22] In instances where there is poor leachate control, for example when landfills are not lined or the liners fail, contaminants may escape into the wider environment including groundwater and adjacent waterways. The Environment Department recognises that it is difficult to quantify the nature and extent of this problem as well as the net environmental cost of such diffuse impacts, particularly when it may take decades before serious environmental impacts become evident. The department acknowledges that in considering end-of-life computer management, both recycling initiatives and improved landfill practices may need consideration.[23] Various options for managing e-waste are discussed at greater length in chapter 5.

2.16 Another area of growing concern is the disposal of used motor oil. Each year, more than 500 million litres of lubricating oil is sold in Australia and many car and machinery engines produce large volumes of used oil, which is a highly concentrated and toxic material that can be reclaimed and reused. Indeed, estimates suggest that between 280 and 300 million litres per annum of used oil is generated by industry and the community and is available for recycling.[24] The environmental impact of used oil is such that one litre of used oil can contaminate up to one million litres of water.[25]

2.17 Marketing innovations in the packaging industry have also led to an increasingly complex waste stream. One striking example raised in evidence was a single-serve tuna and biscuits snack which uses nine different items of packaging.[26]

Continued reliance on landfill

2.18 According to the ABS, 'Australia has a strong dependence on landfill for waste management with more than half (54 per cent) of all solid waste, some 17 million tonnes, deposited in 2002–03.'[27] The ABS estimates that 70 per cent of municipal waste, 56 per cent of commercial and industrial waste, and 43 per cent of construction and demolition waste went into landfill in 2002–03. These sectoral trends are explored in more detail later in this chapter.

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22 Leachate is liquid that has passed through solid waste and may have become contaminated with metallic, organic and inorganic compounds and toxins. Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. xxi.

23 Department of the Environment, Water, Heritage and the Arts, *Submission 78*, p. 9.

24 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends: Solid waste in Australia*, Report no. 4613.0, 2006.

25 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends: Solid waste in Australia*, Report no. 4613.0, 2006.

26 Mr David West, National Campaign Director, Boomerang Alliance, *Committee Hansard*, 2 July 2008, pp 8–9.

27 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends*, Report no. 4613.0, 2007, p. 43.

2.19 The 'goods' side of the Australian economy tends to involve a linear extraction-production-consumption-disposal model rather than a closed-loop resource efficiency model, which results in vast quantities of used materials ending up in landfill. National- and state-level trends in waste disposal to landfill are considered in more detail in chapter 3.

Increasing rate of recycling

2.20 At the same time as waste generation is increasing, the rate of recycling is also increasing. Recycling waste materials reduces the volume of waste disposed in landfills. According to the ABS the amount of waste recycled in Australia has increased both in absolute terms and as a proportion of total waste generated. Overall, the recycling rate was estimated by the ABS to be 46 per cent in 2002–03. This figure represents the amount that has been reprocessed into a usable production input and not just the amount collected for recycling.[28]

2.21 However despite the increased rate of recycling, the overall amount of waste being disposed of in landfill is increasing due to the overwhelmingly rapid rate of waste generation. As Figure 2.1 demonstrates, the increased recycling rate has not kept pace with overall waste generation rates, resulting in an increasing amount of 'end-use' material being landfilled. Trends in recycling rates within the various waste sectors is discussed in detail in chapter 3.

Deficient information on waste

2.22 A recurring theme throughout this inquiry was the lack of consistent and complete waste data. This is partly a consequence of the different regulatory structures of different states and territories which apply different definitions to waste and therefore report data differently. Gaps in geographical coverage and types of waste streams and materials also exist. The end result is that any attempt to compare waste management challenges and performance across states and territories is problematic, as are comparisons of performance against policy objectives. The complexity of Australia's waste data issue was articulated by the ABS:

> Quantifying waste data, and trends in waste production, requires compiling information from throughout the economy, from the originating sources of the waste, to the organisations and government agencies that manage the waste once it leaves the point of production, and potentially to the end users of the waste or associated by-products. The flow of waste involves individuals, industry, not-for-profit organisations and all levels of government. Currently waste data sources are many and varied, as is the quality and frequency of availability of the data.[29]

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28 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends*, Report no. 4613.0, 2007, p. 43.

29 Australian Bureau of Statistics, *Submission 74*, p. 1.

2.23 Not only is the comparison data between states and territories problematic, but there are also complexities around the data obtained within individual jurisdictions given that definitions of waste and waste categories, as well as regulatory structures change over time. The New South Wales Government, for example, noted that a tightening of its regulatory regime has led to a greater volume of material being defined as 'waste' which is reflected in a numerical increase in the waste volume. In general terms, evidence provided by representatives of the New South Wales Government indicated that disposal data is the 'firmest' because it is easier to establish what is going into landfill.[30]

2.24 The ABS acknowledges that there is currently no 'comprehensive, reliable and on-going source of waste information in Australia' and notes caution in the use of a single statistic. However, available data are cited in this report to provide an indication of the volumes of waste that are produced and therefore must be managed in Australia.[31] The need for a national data gathering mechanism is discussed further in chapter 4.

International comparisons

2.25 Whilst it is difficult to establish precisely the total amount of waste generated in Australia, it is also difficult to compare statistics on waste generation and waste management between countries for similar reasons.[32] Nevertheless, on a per capita basis, Australians are reported to be among the highest producers of waste in the world.[33] In 2004, the Organisation for Economic Co-operation and Development (OECD) estimated that Australians each generated approximately 690 kilograms of municipal waste (based on late 1990s statistics), which was at the time, the third-highest in the OECD and well above the per capita average of 590 kilograms.[34]

Waste streams

2.26 Of the total 32.4 million tonnes of solid waste generated in Australia in 2002–03, the Productivity Commission estimated that approximately 27 per cent (or about 8.7 million tonnes) was municipal waste, 29 per cent (or 9.4 million tonnes) commercial and industrial (C&I) waste, and 42 per cent (or 13.6 million tonnes) was construction and demolition (C&D) waste.[35] Such estimates which are represented in

30 Mr Mark Gorta, Manager, Waste Management, Department of Environment and Climate Change, New South Wales Government, *Committee Hansard*, 3 July 2008, p. 15.

31 Australian Bureau of Statistics, *Submission 74*, p. 1.

32 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 15.

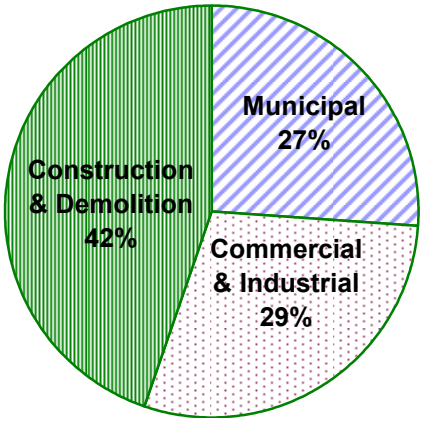
33 Organisation for Economic Co-operation and Development 2007 *Fact Book: Economic, Environmental and Social Statistics*, *Municipal Waste Generation,* ocde.p4.siteinternet.com/publications/doifiles/302007011P1T079.xls (accessed 8 July 2008).

34 Department of the Environment, Water, Heritage and the Arts, *Submission 78*, p. 3.

35 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 16.

the following chart do not include waste generated and dealt with on-site by the waste generator.[36]

Figure 2.2—Solid waste generation in Australia by waste streams



Productivity Commission, *Waste Management*, Report no. 38, 2006, p. 16.

2.27 For the purposes of comparison, the WCS Market Intelligence & WME Environment Business Media estimated that of the total 38.2 million tonnes of waste generated in Australia in 2004–05, 10.7 million tonnes (or 28 per cent) was produced by the municipal sector, 12.5 million tonnes (or 33 per cent) by the C&I sector and 15.1 million tonnes (or 39 per cent) by the C&D sector.[37]

2.28 The increasing generation of waste across the country poses a sizeable challenge to our waste management infrastructure. Unless the resource recovery rate surpasses the rate of waste generation, more material (including valuable recyclables) will loose their productive capacity by ending up in landfill. In the Australian Capital Territory, as one case in point, a 2006–07 survey revealed that whilst 566 633 tonnes of waste (or 74 per cent of waste generated) was recovered for recycling, the amount of waste disposed to landfill had risen by 5 112 tonnes to 197 425 tonnes or 2.7 per cent from the previous year.[38] At the same time, waste generation was estimated to have risen over the same period to 815 000 tonnes.[39]

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36 The on-site treatment of waste is common in the mining and mineral processing, agriculture, and manufacturing sectors. Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 17, footnote 1.

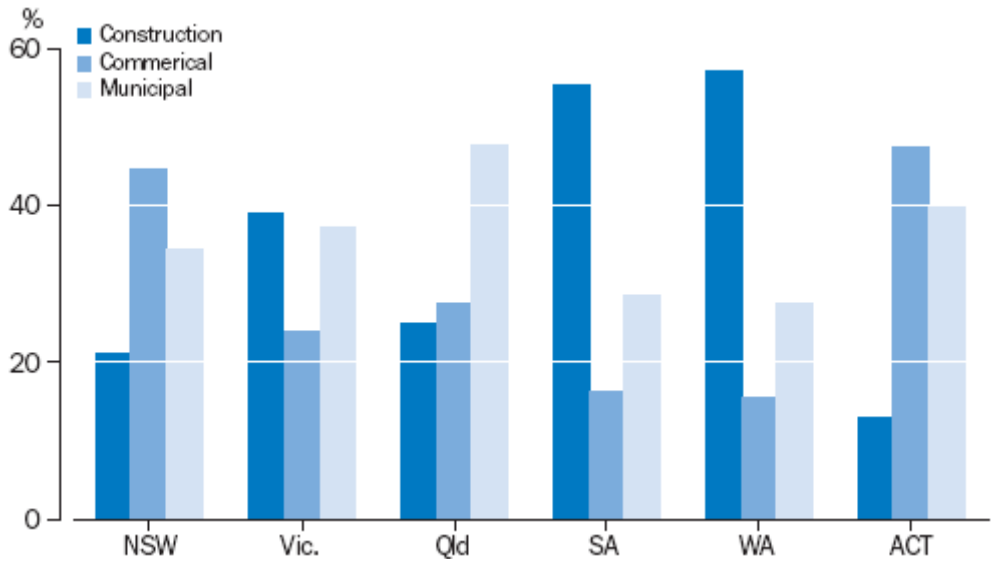
37 WCS Market Intelligence & WME Environment Business Media, *The Blue Book – Australian Waste Industry,* 2008, p. 8.

38 Territory and Municipal Services, *2008 Progress Towards No Waste by 2010*, www.tams.act.gov.au/live/Recycling_and_Waste/The_No_Waste_Strategy/statistics (accessed 15 July 2008).

39 Territory and Municipal Services, *Annual Report 2006–07*, Volume One, p. 40, www.tams.act.gov.au/__data/assets/pdf_file/0005/69251/TAMS_Annual_Report_V1_Screen.pdf (accessed 15 July 2008).

2.29 Figure 2.3 provides a sectoral and jurisdictional breakdown of the various waste streams discussed below. It demonstrates the diversity in the proportions of municipal, C&I and C&D waste going to landfill in each jurisdiction.

Figure 2.3—Waste disposed to landfill by type and jurisdiction, 2002–03



Department of the Environment and Heritage, *Submission to the Productivity Commission Inquiry into Waste Generation and Resource Efficiency*, 2005, cited in Australian Bureau of Statistics, *Australia's Environment: Issues and Trends, Solid Waste in Australia*, Report no. 4613.0, 2006.

2.30 Solid waste can be managed in different ways and the method of management will depend on the location, source and type of waste involved and the financial viability of different management methods and policies. The most common method in Australia is landfill but others include material recovery facilities and advanced waste treatment. The method of management will also determine its environmental impact. Moreover, the form of waste management will influence additional effects including littering and illegal dumping which have their own environmental and social impacts.

Municipal waste

2.31 Municipal waste includes domestic solid waste and other municipally-collected waste from schools, street litter bins, parks etc., which are non-hazardous.[40] According to the ABS, the materials in municipal waste are reasonably consistent

40 Municipal waste is predominantly household waste including food and kitchen waste, recyclable material including paper, glass, bottles, cans, metals and plastics and green waste. For the purposes of this report, hazardous municipal waste comprising products that contain corrosive, toxic, ignitable or reactive ingredients such as fertilizer, pesticides and batteries are not included in its consideration of municipal waste.

across the country with organic materials (originating from food scraps and garden waste) making up the 47 per cent of household waste by weight.[41]

2.32 Hyder Consulting established that, based on trend data, in all jurisdictions except Tasmania and the Northern Territory, approximately 8.9 million tonnes of municipal solid waste was generated in 2002–03.[42] Of this total, 6.2 million tonnes were disposed to landfill and 2.7 million tonnes was recycled.[43]

2.33 A slightly different result was published in a report of WCS Market Intelligence & WME Environment Business Media, which found that an estimated 10.6 million tonnes of municipal waste was generated 2004–05 of which the main discard materials are contained in the following table.

Table 2.1—Municipal Waste Management in Australia

Main Discard Materials	Tonnes/Year	% of waste generated
Recycled (paper, plastic, glass, metal cans)	1.8 million	17
Garden waste processed	1.8 million	17
Mixed residual waste processed	0.2 million	2
Residual waste disposed	6.8 million	64

WCS Market Intelligence & WME Environment Business Media, *The Blue Book – Australian Waste Industry,* 2008, p. 8.

2.34 The Productivity Commission found that municipal waste comprised 47 per cent food and garden waste, 23 per cent paper, 7 per cent glass, 5 per cent metals, 4 per cent plastics, 1 per cent building rubble and timber respectively, and 12 per cent 'other'.[44]

2.35 Differences in the composition of materials in the municipal waste stream influence the way that such materials are managed. The Productivity Commission

41 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends*, *Solid waste in Australia*, 2006.

42 The trend data was based on data from Sydney, Victoria and the Australian Capital Territory. Department of the Environment, Water, Heritage and the Arts, *Submission 78*, pp 3–4.

43 Hyder Consulting, *Waste and Recycling in Australia,* Paper prepared for the Department of Environment and Heritage, Short Paper, Report no. 4, 6 February 2006, p. 8, www.environment.gov.au/settlements/publications/waste/pubs/waste-recycling.pdf (accessed 15 July 2008).

44 Municipal waste data are for all states and territories except South Australia, the Northern Territory and Tasmania. Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 19.

noted that the prevalence of food and garden waste in municipal waste can make it difficult to extract other recyclable materials which have greater value to recyclers without first having it sorted by householders.[45] Without adequate sorting, a substantial volume of such materials goes to landfill due to contamination. Moreover, food and garden waste in the municipal waste stream are a significant source of greenhouse gases from the waste industry, as such wastes biodegrade in landfill. Greenhouse gas emissions emanating from the waste sector are discussed later in this chapter.

Commercial and industrial waste

2.36 Commercial and industrial (C&I) waste is comprised of a diverse range of waste materials. According to the Productivity Commission the main components of C&I waste are: paper 22 per cent; metals 22 per cent; food and garden 13 per cent; timber 9 per cent; and plastics 6 per cent.[46] The C&I sector is made up of diverse range of small businesses without dedicated waste services through to large operators with substantial waste management issues.

2.37 According to the Productivity Commission, in 2002–03, of the 32.4 million tonnes of solid waste generated in Australia, 29 per cent comprised C&I waste.[47] Hyder Consulting established that, based on trend data, in all jurisdictions except Tasmania and the Northern Territory, just over 9.4 million tonnes of C&I was generated in 2002–03 of which 5.3 million (56 per cent) was disposed of to landfill and 4.1 million tonnes (43 per cent) recycled.[48]

2.38 According to WCS Market Intelligence & WME Environment Business Media, of the 12.5 million tonnes of waste generated in the C&I sector in 2004–05, the main discard materials are contained in the following table.

45 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 20.

46 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 19.

47 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 16.

48 Hyder Consulting, *Waste and Recycling in Australia*, Paper prepared for the Department of Environment and Heritage, Short Paper, Report no. 4, 6 February 2006, p. 8.

Table 2.2—Commercial and Industrial Waste Management in Australia

Main Discard Materials	Tonnes/Year	% of waste generated
Recycled (paper/cardboard, plastics, glass, metals, timber)	4.4 million	35
Garden waste processed	1.7 million	14
Food waste processed	0.1 million	0.8
Residual waste disposed	6.3 million	50.2

WCS Market Intelligence & WME Environment Business Media, *The Blue Book – Australian Waste Industry,* 2008, p. 8.

2.39 In New South Wales, C&I waste is the biggest waste stream, comprising nearly 50 per cent of all waste generated in the state and yet only 35 per cent of the stream is recycled.[49] It is also the state's biggest waste challenge as it is the most diverse in nature and in terms of the size of generators who vary from small businesses without waste services to large operations with substantial waste management issues.[50] However, the volume of biodegradable waste in the stream, particularly paper and cardboard, offers real opportunities for greenhouse gas and material recovery.[51]

2.40 In other states, statistics are provided in terms of the amount of C&I waste going to landfill or reprocessed. In South Australia, as one case in point, where the C&I waste stream is the biggest challenge, of the one million tonnes of waste going into landfill each year, around 40 0000 tonnes are from the C&I sector. In 2005–06, C&I waste accounted for 36.4 per cent of materials sourced for reprocessing in the state.[52]

2.41 In the Australian Capital Territory, commercial waste was the major contributor to the increase in waste to landfill in 2006–07 with waste from such sources increasing by almost 10 000 tonnes or 12 per cent over the year. The practice of sending mixed waste to landfill rather than using recycling alternatives was identified as the key factor in this growth.[53]

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49 WSN Environmental Solutions, *Submission 31*, p. 8

50 Mr Timothy Rogers, Executive Director, Departmental Performance Management and Communication, Department of Environment and Climate Change, New South Wales Government, *Committee Hansard*, 3 July 2008, pp 3–4.

51 Mr Timothy Rogers, Executive Director, Departmental Performance Management and Communication, Department of Environment and Climate Change, New South Wales Government, *Committee Hansard*, 3 July 2008, p. 4.

52 South Australian Government, *Submission 83*, p. 6.

53 Territory and Municipal Services, *2008 Progress Towards No Waste by 2010*.

Construction and demolition waste

2.42 Construction and demolition (C&D) waste comprising primarily timber, bricks, plaster off cuts, concrete, rubble, steel and excavated earth.[54] The Productivity Commission established that 82 per cent of the C&D waste stream is building rubble (concrete, brick, rubble and soil).[55] According to WCS Market Intelligence & WME Environment Business Media, the main discard materials of the 15.1 million tonnes of C&D waste generated in 2004–05 comprises 7.6 million tonnes of recycled materials (timber, steel, concrete, rubble, soil) and 7.5 million tonnes of residual waste.[56]

2.43 Hyder Consulting established that, based on trend data, in all jurisdictions except Tasmania and the Northern Territory, approximately 13.7 million tonnes of C&D waste was generated in 2002–03 of which 5.9 million was sent to landfill and 7.8 million tonnes recycled.[57] The extent of the generation of C&D waste is largely reflective of the expansions and contractions in the building industry.

2.44 Whilst C&D waste makes up approximately 26 per cent of Queensland's waste, in Western Australia, it is by far the largest component of the waste disposed to landfill and represents a substantial proportion of waste recycled in the state.[58]

Economic, social and environmental impacts of waste

2.45 The impacts of waste remain a key environmental issue for Australia 'because of potential greenhouse and water impacts, resource conservation concerns, inappropriate disposal (e.g. through dumping and littering along with associated environmental and health impacts) and disposal in landfill facilities which do not meet best practice principles'.[59] Indeed the Environment Department recognises that the changing nature of the waste stream, emerging recovery, disposal and treatment technologies, and evolving community expectations all present challenges for future policy on waste management.[60]

2.46 The Productivity Commission report identified harm to the environment and human health as a primary reason cited in evidence as to why waste is a problem. In

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54 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends, Solid waste in Australia*, Report no. 4613.0, 2006

55 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p.18.

56 WCS Market Intelligence & WME Environment Business Media, *The Blue Book – Australian Waste Industry,* 2008, p. 8.

57 Hyder Consulting, *Waste and Recycling in Australia*, Paper prepared for the Department of Environment and Heritage, Short Paper, Report no. 4, 6 February 2006, p. 8.

58 Queensland Government Environmental Protection Agency, *Submission 80*, p. 2; Western Australian Department of Environment and Conservation, *Submission 76*, p. 2.

59 Department of the Environment, Water, Heritage and the Arts, *Submission 78,* p. 1.

60 Department of the Environment, Water, Heritage and the Arts, *Submission 78*, p. 1.

addition, the fact that waste is an end product of a life cycle process that can have upstream environmental and resource depletion implications was also an oft-cited concern.[61] Indeed, waste generation and disposal can have significant impacts at various stages in the product's life cycle from extraction of raw materials to processing, marketing, transport and consumption, as well as the direct impacts associated with disposal.

2.47 Due to a range of market failures as well as institutional and regulatory barriers, not all of these environmental costs are reflected in the market prices. According to the ABS, the failure of some markets to achieve cost-reflective pricing can result in ineffective use of resources, lower economic growth than would otherwise be the case, and adverse environmental and social impacts.[62] The following sections discuss the economic, social and environmental impacts of Australian waste management practices.

Economic impacts

2.48 The waste industry comprises waste management operators who deal with the collection and transportation, consolidation and transfer, material sorting, material recycling and processing, and disposal activities. Estimates suggest that waste management services sales are approximately $4.8 billion a year and that the infrastructure of the waste management industry has a current value in excess of $2 billion.[63]

2.49 Of other sources, the ABS estimated that in 2002–03, the income generated by private and public trading businesses providing waste management services in Australia generated an income of just under $2.7 billion contributing 0.2 per cent to the GDP for that year. Of this, 20 per cent, or $0.5 billion, was accrued from the treatment, processing and/or disposal of waste. At the end of June 2003, there were 1 092 private and public trading businesses providing waste management services in Australia. These businesses employed 14 386 people.[64]

2.50 The Boomerang Alliance puts the total combined cost of waste collection, recycling and disposal at $2.68 billion per year of which it estimates about

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61 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. xxvii.

62 Australian Bureau of Statistics, *Australia's Environment: Issues and Trends, Solid waste in Australia*, Report no. 4613.0, 2006.

63 WCS Market Intelligence & WME Environment Business Media, *The Blue Book – Australian Waste Industry,* 2008, pp 9–11. Infrastructure includes waste collection and transfer vehicles, waste transfer stations, landfill facilities, material recycling facilities, and waste processing facilities.

64 Australian Bureau of Statistics, *Waste Management Services, Australia, 2002-03,* Report no. 8698.0, 2004, www.abs.gov.au/ausstats/abs@.nsf/ProductsbyReleaseDate/ED9DD3A0166C50D9CA2568A9001393B7?OpenDocument (accessed 7 August 2008).

$750 million is derived from the sale of recyclate. However, lost commodity values resulting from the failure to recover materials that could otherwise be recycled amounts to $1.1 billion.[65]

2.51 In terms of the economic benefits of recycling, the Australian Council of Recyclers stated that the economic benefits include employment, infrastructure investment, and the value-added to recovered materials. Indirect economic benefits are identified as the use of accounting, legal and other services, industry and employee spending on other consumer goods and services; and payment of taxes, rates and fees. According to the Australian Council of Recyclers, in 2006 the Australian recycling industry had a turnover of $11.5 billion, contributing 1.2 per cent of Australia's GDP and a capital investment of over $6 billion. That year, about 10 900 people were employed by the industry directly and an additional 27 700 indirectly. The Australian Council of Recyclers estimated that the direct and indirect benefits of this investment and employment in recycling were estimated at $55 billion.[66]

Social impacts

2.52 Growing community awareness of the adverse impacts of waste, including the depletion of natural and often limited resources, has encouraged greater focus on waste avoidance and recovery. Such concerns are reflected in government targets such as zero waste and the development of state and territory waste management strategies guided by the waste hierarchy, under which waste avoidance is preferred over the reuse of waste and reuse preferable to recycling with disposal as the least desirable option. Whilst such initiatives have led to a significant increase in recycling as opposed to landfill, of the 32 million tonnes of waste generated in Australia in 2002–03, approximately 15 million tonnes or 46 per cent were recycled.[67] The remaining 54 per cent were sent to landfill.[68]

2.53 The challenge facing waste management policy makers is to address the nexus between growing GDP and increasing consumerism and resource consumption. Part of this challenge implies addressing of community attitudes to waste which are contradictory. On the one hand, the overwhelming attitude is that materials at the end of their life are of little or no value and can therefore be managed as cheaply as possible, typically involving landfill. This is largely due the exclusion of environmental and social externalities in waste management cost structures.

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65 Boomerang Alliance, *Submission 46*, p. 5.

66 Australian Council of Recyclers Inc, *Submission 81*, p. 2.

67 This figure does not take Tasmania and the Northern Territory into account due to the unavailability of data. Department of the Environment, Water, Heritage and the Arts, *Submission 78*, p. 3.

68 Such figures are largely indicative as the rate of recycling varies considerably from one material to another.

2.54 On the other hand, there is growing interest in minimising the environmental impact of waste by way of reuse and recycling. A 2008 Zero Waste South Australia survey revealed that 63 per cent of the 1 206 individuals surveyed indicated that they were aware of the greenhouse gas benefits of recycling including less waste to landfill. At the same time, 94 per cent of the sample indicated that as a society, we are consuming too much and producing too much waste.[69] Narrowing the gap, between community aspirations for environmental sustainability, and inappropriate consumer practices, is the key challenge.

Environmental impacts

2.55 The growth in waste generation in Australia has major consequences for the environment, through increased greenhouse gas emissions (GHGE), natural resource depletion, water use and leachate contamination. Each of these issues is discussed below.

Greenhouse gas emissions

2.56 In 2006 Australia's net GHGE totalled 576 million tonnes of carbon dioxide equivalent (Mt CO_2-e) under the accounting provisions of the Kyoto Protocol.[70] The waste sector represented around 3 per cent or 16.6 Mt CO_2-e of the national total. These figures do not include emissions from the transportation of waste (which are included under 'transport' in the national greenhouse accounts).

2.57 By far the largest contributor to waste sector GHGE is the decomposition of organic waste in landfill including paper and cardboard, food and garden organics, and wood and timber. As the organic carbon of such materials in landfill decomposes, it produces a waste gas which comprises approximately 50 per cent methane and 50 per cent CO_2.

2.58 An estimated 9.5 million tonnes of organic material (or approximately 67 per cent of the 14.1 million tonnes of organic waste generated) is disposed of in landfill each year across the country.[71]

2.59 In New South Wales alone, 4.3 million tonnes of food, garden, paper and wood waste is generated annually of which 59 per cent ends up in landfill.[72] The

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69 Zero Waste South Australia, *Community and Industry Attitudes, General Public Survey*, March 2008, pp 5 and 12, www.zerowaste.sa.gov.au/pdf/reports/General%20Public%20Survey%20March%202008.pdf (accessed 16 July 2008).

70 Department of Climate Change, *Australia's National Greenhouse Accounts*, 2008, p. 1, www.climatechange.gov.au/inventory/2006/pubs/inventory2006.pdf, (accessed 22 July 2008).

71 Warnken ISE, *Potential for Greenhouse Gas Abatement From Waste Management and Resource Recovery Activities in Australia*, Prepared for SITA Environmental Solutions, March 2007, p. 3, submitted by Boomerang Alliance, *Submission 46*, Attachment F.

72 WSN Environmental Solutions, *Submission 31*, p. 6.

New South Wales Government recognises that landfill accounts for 90 per cent of the waste sector's emissions and that currently, New South Wales landfills emit approximately 5.4 Mt of CO_2-e per annum which is expected to increase to 6.1 Mt by 2050 without intervention.[73]

2.60 Unlike other sectors such as stationary energy and transport, emissions from the waste sector have reduced over time.[74] According to the most recent national greenhouse accounts, net waste emissions in 2006 (16.6 Mt CO_2-e) decreased by around 11 per cent since 1990 (from 18.8 Mt CO_2-e). Further reductions are expected during the Kyoto period with waste emissions expected to decrease by around 14 per cent (to 15 Mt CO_2-e) between 2008–12 compared to 1990 levels.[75]

2.61 The decrease in waste GHGE is largely due to the recovery of waste methane gas from landfills. In 2005, gross waste sector emissions were reduced by around 3.9 Mt CO_2-e (around 19 per cent) through the capture of methane emissions for electricity generation and flaring (burning) at landfills.[76] Rates of methane recovery from solid waste have increased substantially from a negligible amount in 1990 to around 16.8 per cent in 2005.

2.62 Apart from GHGE resulting from landfilling organic material, the waste sector has the potential to abate GHGE by substituting recycled product for high embodied energy materials such as aluminium (also referred to as 'congealed energy'[77]). Ecos Corporation highlighted the environmental benefits of recycling aluminium:

> For example the manufacture of one tonne of aluminium requires 206 GJ of energy to transform bauxite into alumina, and then alumina into aluminium smelting. The associated greenhouse gas emission from one tonne of aluminium manufacture is 20.2 tonnes of CO_2e. By contrast the energy used to recycle one tonne of aluminium for reuse is 14.1 giga-joules, a net saving in embodied energy of 191.9 giga-joules, which equates to a greenhouse gas saving (carbon abatement) of 18.8 tCO_2e.[78]

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73 Department of Environment and Climate Change, New South Wales Government, *Submission 16*, p. 2.

74 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. Department of Climate Change, *Tracking to the Kyoto Target 2007*, 2008, p. 6, www.climatechange.gov.au/projections/pubs/tracking2007.pdf (accessed 22 July 2008).

75 Department of Climate Change, *Tracking to the Kyoto Target 2007*, 2008, p. 12, www.climatechange.gov.au/projections/pubs/tracking2007.pdf (accessed 22 July 2008).

76 Australian Greenhouse Office, *Analysis of recent trends and greenhouse indicators 1990 to 2005*, September 2007, p. 45, www.greenhouse.gov.au/inventory/2005/pubs/trends2005.pdf (accessed 22 July 2008).

77 Clean Up Australia, *Submission 55*, p. 11.

78 Ecos Corporation Pty Ltd, *Submission 42*, Attachment A, p. 1.

2.63 Clearly a key challenge for the waste industry in terms of tackling climate change is addressing its handling of organic waste. This issue as well as other opportunities to reduce Australia's GHGE are further considered in chapters 3 and 4 of this report.

Natural resource depletion

2.64 Disposal of waste, as opposed to reuse or recycling, implies that the existing resources that constitute the waste are lost to the economy and as a result virgin materials are required to manufacture new products. Given the overall recycling rate in Australia of 46 per cent, the potential to recover and utilise materials currently disposed of in landfill is considerable. The use of recycled materials in manufacturing processes enables a reduction in the amount of virgin materials and energy used. Waste disposal represents a loss of valuable resources to the economy.

2.65 A number of submissions highlighted the environmental benefits of recovering both renewable and non-renewable materials including paper, cardboard, metals, plastic and glass.[79] The Boomerang Alliance estimated that recovery of all such materials would save:

- 7.6 million tonnes of $C0_2e$ p.a. (about the same as switching 1.26 million Australian homes to 100% renewable energy);
- 173 gigalitres of water per annum (enough to permanently supply some 514,000 Australian homes with water); and
- Improved air quality in the vicinity of 19.9 billion units of Smog Precursors (gC_2H_4-e) (similar to permanently removing 4.6 million cars from Australian roads).[80]

2.66 E-waste contains rare and non-renewable resources, some of which are reaching their extraction peak, including gallium, which according to the Total Environment Centre is already running out.[81]

2.67 In terms of other non-renewable resources, evidence focused on aluminium and plastics. Mr Ian Kiernan, Chairman of Clean Up Australia, highlighted that landfilling aluminium containers represented a lost opportunity to reduce environmental damage through a saving in embodied energy:

> We know that, for the same amount of energy it takes to make an aluminium can out of new material, you can make seven aluminium containers out of recycled material. It is just plain good sense. Australia would save 5.6 gigalitres of drinking water per annum without producing

79 Boomerang Alliance, *Submission 46*, p. 6; Ecos Corporation Pty Ltd, *Submission 42*, Attachment A, p. 1; Australian Council of Recyclers Inc, *Submission 81*, p. 2.

80 Boomerang Alliance, *Submission 46*, p. 6.

81 Total Environment Centre, *Submission 67*, p. 3.

> new bottles through this scheme [a national container deposit scheme]. That is enough to supply 16,784 homes with water.[82]

2.68 The Australian Council of Recyclers identify the resource savings from recycling plastics as 60 000 tonnes of oil equivalent (toe) of polyethylene terephthalate or PET and 90 000 toe saving of high density polyethylene (HDPE), which equate to 430 000 and 650 000 barrels of oil equivalents respectively.[83]

2.69 Renewable resources can cause environmental externalities in both their extraction and transformation. In the case of paper and cardboard, 51 per cent of the environmental impact of using virgin material is avoided by recycling.[84] The Australian Council of Recyclers note additional environmental benefits of recycling paper and cardboard:[85]

> The resource saving as a result of the reprocessing of Australian post consumer paper/cardboard is equivalent to three million trees. In the order of 365,000 tonnes of sand, over four million tonnes of iron ore and 1.6 million tonnes of bauxite is being saved through these reprocessing activities.

2.70 VISY Industries Australia noted that recycling 1000 tonnes of paper and cardboard would result in the following environmental benefits:

- energy saving of 18,000 gigajoules which is adequate to power 833 homes,
- a reduction of 3,231 cubic metres of landfill,
- 400 tonnes of CO_2 saved, equivalent to permanently removing 96 cars of the road, and
- water saving amounting to 23,700 litres of water, the equivalent of 9 Olympic size swimming pools.[86]

2.71 Whilst the current national recycling rate of paper and cardboard is difficult to ascertain, Mr Mike Ritchie, NSW President of the Waste Management Association of Australia stated that 89 per cent of office towel paper and 55 per cent of cardboard alone are going to landfill in Australia.[87] Providing consolidated figures across jurisdictions for 2002–03, the Boomerang Alliance maintains that of the 5 921 million

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82 Mr Ian Kiernan, Chairman, Clean Up Australia, *Committee Hansard*, 3 July 2008, p. 62.

83 Australian Council of Recyclers Inc, *Submission 81*, p. 2.

84 VISY Industries Australia Pty Ltd, *Submission 52*, p. 5.

85 Australian Council of Recyclers Inc, *Submission 81*, p. 2.

86 VISY Industries Australia Pty Ltd, *Submission 52*, p. 6.

87 Mr Mike Ritchie, New South Wales President, Waste Management Association of Australia, *Committee Hansard*, 3 July 2008, p. 27.

tonnes of paper, cardboard and pulp waste generated that year, 61 per cent was sent to landfill.[88]

Water consumption

2.72 Due to the severe drought conditions over the past decade, water conservation and security have become issues of considerable national importance. Opportunities to reduce and recycle water include the retrieval of water (along with energy and nutrients) from sewerage.[89] Recycling compared to the use of virgin materials generally requires far less water. According to the Boomerang Alliance, based on 2002–03 waste generation and recycling figures, the full recovery of recyclable material including paper, cardboard, metals, plastic and glass would save an estimated 173 gigalitres of water per annum which is enough to permanently supply about 514 000 houses with water.[90]

2.73 A reduction in organics to landfill not only reduces water pollutants substantially.[91] Once transformed into compost, its use in agricultural applications also improves the water retention capacity of soil thereby amounting to additional water savings.[92] Organic waste is discussed in greater depth in chapter 4.

Leachate contamination

2.74 A key aspect of the environmental management of landfill is leachate treatment systems. Leachate can damage human health and the environment if it comes into contact with surface or groundwater and enters the food chain or comes into contact with sensitive ecosystems. Contaminants in leachate considered to pose the greatest risks are heavy metals (such as lead, mercury, cadmium and copper), and metal oxoanions (including chromate, arsenate and selenate). Leachate can contain high amounts of ammonia and can have high biological oxygen demand, both of which can be harmful to aquatic life.[93]

2.75 The Productivity Commission recognised that estimates of the external costs of leachate damage should take into account the risk that leachate can damage human

88 This figure excludes the Northern Territory and Tasmania and Western Australia data relates to Perth only. Boomerang Alliance, *Submission 46*, p. 5.

89 Professor Stewart Burn, Stream Leader, CSIRO, *Committee Hansard*, 2 July 2008, p. 69.

90 Boomerang Alliance, *Submission 46*, p. 6.

91 Nolan-ITU, Global Renewables, *National Benefits of Implementation of UR-3R Process, A Triple-Bottom Line Assessment*, July 2004, p. 36 submitted by GRD Limited, *Submission 36*, Attachment A.

92 Nolan-ITU, Global Renewables, *National Benefits of Implementation of UR-3R Process, A Triple-Bottom Line Assessment*, July 2004, p. 36 submitted by GRD Limited, *Submission 36*, Attachment A.

93 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 74.

health and the environment. The level of risk will depend on the location of the landfill, its construction including landfill liners, and how leachate is managed.[94]

2.76 Nolan-ITU estimated that the long-term environmental costs of leachate and landfill gas emissions would be substantially more than $150 per tonne of municipal solid waste disposed of to best practice landfill.[95] As an environmental externality of landfill, leachate poses a risk that must be effectively managed and therefore costed into the landfill price.

2.77 Hyder Consulting calculated leachate generation (including contaminated run-off) to be 187.6 litres/tonne over 30 years based on weighted average rainfall for Australian capital cities.[96]

94 Productivity Commission, *Waste Management*, Report no. 38, October 2006, p. 74.

95 GRD Limited, *Submission 36*, p. 5.

96 Hyder Consulting, *Waste and Recycling in Australia*, Paper prepared for the Department of Environment and Heritage, Short Paper, Report no. 4, 6 February 2006, p. 64.