Government of South Australia
Zero Waste SA

SA Recycling Activity Report

2009-10

rawtec

In association with

infraPlan Life Cycle Strategies

June 2011

- IMPORTANT NOTES-

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ABN 59 127 176 569

PO Box 1159,

Glenelg South SA 5045

ph: +61 8 8294 5571

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Executive Summary

Resource Recovery & Diversion

1. SA recycling industries reported 2.76 million tonnes of material were diverted to resource recovery during 2009–10 (Table 1 below and Figure 1 overleaf).
2. This 2009-10 value is an increase of 8.2% on the 2.56 million tonnes reported for 2008–09. The increase has occurred despite a year where international recycling markets and economic activity were still recovering from the global financial crisis.
3. An additional 380,000 tonnes of other material being recycled in South Australia (and not reported in previous years) was identified during the 2009-10 survey. This other material included meat and wine industry by-products and biosolids being recycled by regional and agricultural industries.
4. Whilst this other material has not been included in reported recycling activity for this year, this situation may change when new national guidelines[1] for reporting of recycling activity are introduced.
5. During 2009-10, waste accepted by SA landfills decreased to 1.04 million tonnes (a drop of 3.5% from 2008-09).
6. These factors have combined to increase the diversion rate for South Australia to 72.7% (up from 70.4% in 2008-09) – the highest value recorded by this recycling activity survey since it commenced in 2003-04.

Table 1 Annual South Australian resource recovery, landfill quantities and diversion performance since 2003-04

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	Change	
								08-09 to 09-10	*03-04 to 09-10*
Reported Diversion[1] (tonnes)	2,042,000	2,623,000	2,396,000	2,434,000	2,611,000	2,552,000	2,760,000	8.2%	35%
Other Diversion (tonnes)							380,000		
Waste to landfill (tonnes)	1,278,000	1,180,000	1,158,000	1,144,000	1,130,000	1,072,000	1,035,000	-3.5%	-19%
Total waste generation[2] (tonnes)	3,320,000	3,803,000	3,554,000	3,578,000	3,741,000	3,624,000	3,795,000	4.7%	14%
SA diversion rate (%)	**61.5%**	**69.0%**	**67.4%**	**68.0%**	**69.8%**	**70.4%**	**72.7%**	**3.3%**	**18%**
South Australian population	1,534,000	1,542,000	1,550,042	1,584,500	1,601,800	1,622,700	1,644,600	1.3%	7.2%
Per capita diversion (kg/person)	1,330	1,700	1,550	1,540	1,630	1,570	1,680	7.0%	26%
Per capita landfill (kg/person)	830	770	750	720	710	660	630	-4.5%	-24%
Per capita total waste (kg/person)	2,160	2,470	2,300	2,260	2,340	2,230	2,310	3.6%	6.9%

Notes:
1. 2009-10 Value is rounded to 4 significant figures
2. Total waste generation value does not include Other Diversion quantity

[1] These new national uniform guidelines are currently being developed by the Australian Government (DSEWPC 2010), which are expected to come into effect for 2010-11 or 2011-12 reporting years.

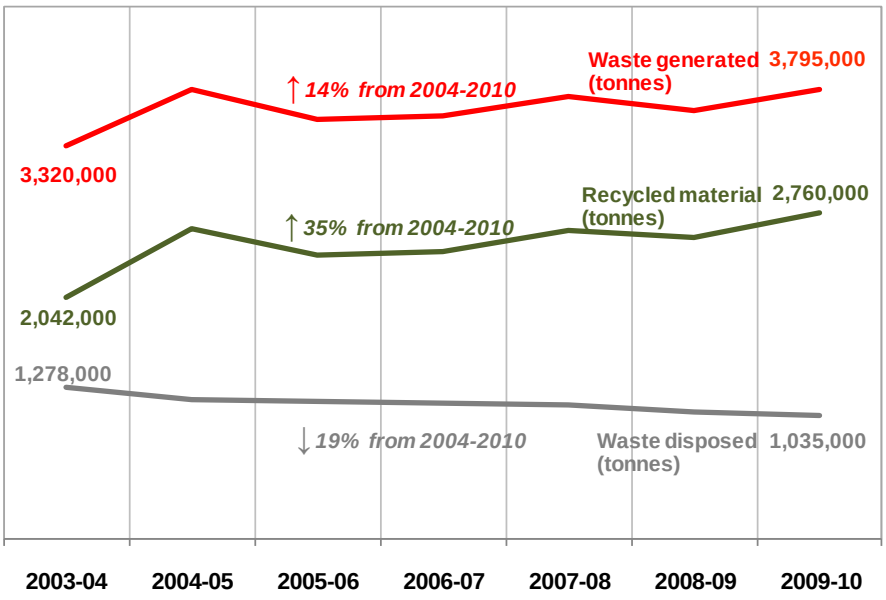

Figure 1 Trend in annual SA resource recovery and landfill disposal since 2003-04

7. Higher resource recovery for 2009-10 has increased the SA per capita diversion/recovery rate to 1,680 kg per capita (up 7% from 2008-09).
8. When fly ash is excluded[3], the SA 2009-10 diversion rates (at 71.5% and 1,578 kg per capita) are second-only to that of the ACT for published values from other Australian states or territories (Figure 2 below).[2]

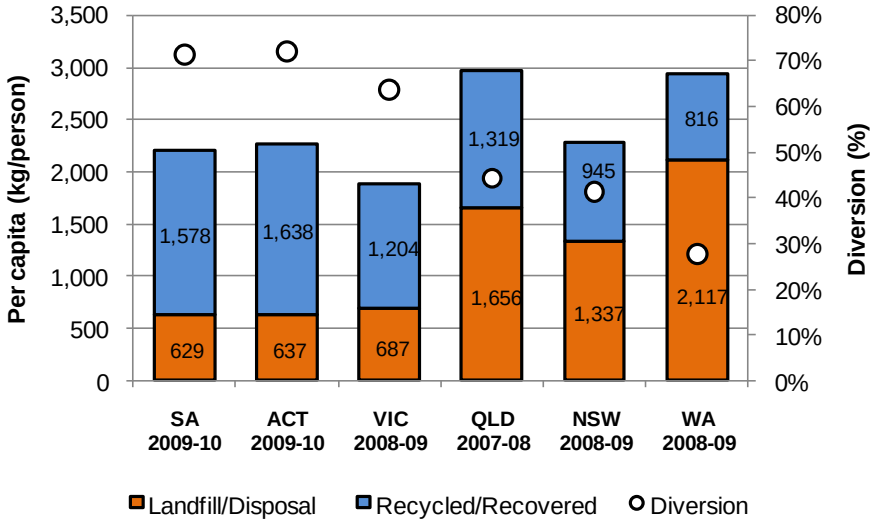

Figure 2 Comparison of reported per capita (kg/person/yr) resource recovery and landfill disposal and diversion (%) by State or Territory[3]

[2] Note: not all data for this comparison is current, and recycling activity data collection and reporting approaches between Australian states and territories are not uniform.

[3] Estimated waste generation, recycling and landfill disposal were based on most current and best available data for each State/Territory. Fly ash was excluded from SA and QLD recycling data for comparison purposes. All figures have been rounded. Further details explaining how SA data was benchmarked against recycling data reported by other states and territories are provided in the Methodology section of this report.

Material Recovery

9. Table 2 overleaf itemises SA 2009-10 reported values of resource recovery for each material category.
10. The highest recorded quantities, by weight and in decreasing order (Figure 3 below), were: Concrete (790,000 tonnes); Steel (334,000 tonnes); Timber (262,000 tonnes); Clay, fines rubble & soil (250,000 tonnes); Garden Organics (220,000 tonnes); and Fly ash (170,000 tonnes),
11. Lower reported recovery during 2009-10 occurred for a number of materials –the greatest decreases (by weight) were seen in Concrete (-194,735 tonnes or -20%) and Fly ash (-53,000 tonnes or -24%).
12. These lesser recoveries were out-weighed by rises in the recovery for other materials, e.g. Steel (+23%), Clay, fines rubble & soil (+ 1161%), Organics - other (+255%); Cardboard & waxed cardboard (+56%).

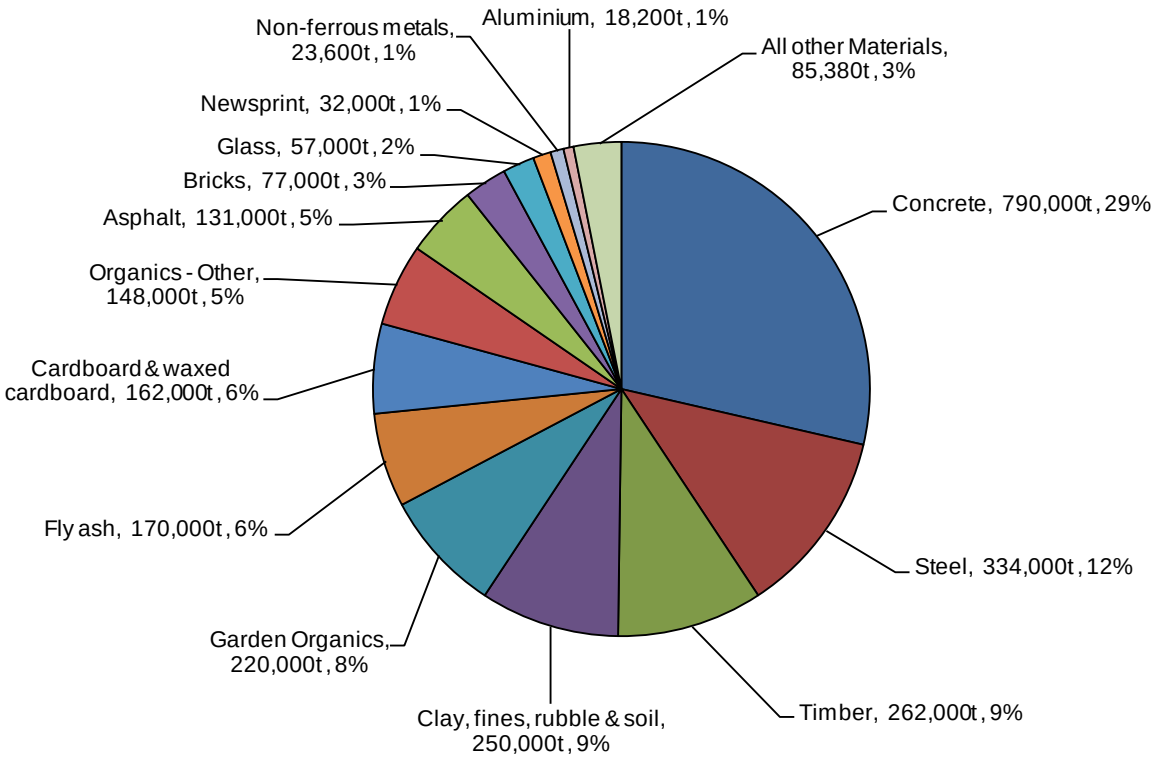

Figure 3 Composition of recovered materials (by weight, tonnes (t) and %), SA 2009-10

Table 2 Reported material quantities (tonnes) being diverted for resource recovery in SA since 2003-04

	Material	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	Change (%) 08-09 to 09-10
	Masonry								
1	Asphalt	100,000	92,000	85,900	83,640	103,070	101,484	131,000	29%
2	Bricks	165,000	85,700	102,475	43,962	90,846	113,993	77,000	-32%
3	Concrete	877,000	899,492	762,134	793,710	818,116	984,735	790,000	-20%
4	Plasterboard							0	N/A
5	Clay, fines, rubble & soil	162,400	132,400	70,989	63,251	90,837	19,831	250,000	1161%
	Sub-total	*1,304,400*	*1,209,592*	*1,021,498*	*984,563*	*1,102,869*	*1,220,043*	*1,248,000*	*2.3%*
	Metals								
6	Steel	264,200	247,840	278,028	323,850	365,391	271,277	334,000	23%
7	Aluminium	19,000	20,443	22,171	20,845	24,434	21,895	18,200	-17%
8	Non-ferrous metals	13,000	16,639	19,470	24,300	21,755	18,495	23,600	28%
	Sub-total	*296,200*	*284,922*	*319,669*	*368,995*	*411,580*	*311,667*	*375,800*	*21%*
	Organics								
9	Food Organics	0	10,540	6,005	3,981	5,796	4,820	5,800	20%
10	Garden Organics	130,100	188,610	222,499	209,725	202,397	203,558	220,000	8.1%
11	Timber	116,700	300,980	255,728	275,385	241,387	254,866	262,000	2.8%
15	Organics - Other	0	89,790	81,625	82,636	79,359	41,666	148,000	255%
	Sub-total	*246,800*	*589,920*	*565,857*	*571,727*	*528,939*	*504,910*	*635,800*	*26%*
	Cardboard & paper								
16	Cardboard & waxed cardboard	91,000	72,117	106,943	96,436	122,357	104,128	162,000	56%
17	Liquid Paperboard	0	971	1,239	1,373	1,476	1,475	3,900	164%
18	Magazines	0	4,650	5,918	4,680	5,728	7,313	5,500	-25%
19	Newsprint	31,398	35,917	40,607	40,000	41,393	40,219	32,000	-20%
20	Phonebooks	1,303	1,685	2,042	2,042	2,000	5,051	2,500	-51%
21	Printing & Writing Paper	12,300	12,593	18,803	30,574	42,745	45,877	16,400	-64%
	Sub-total	*136,001*	*127,933*	*175,552*	*175,105*	*215,699*	*204,063*	*222,300*	*8.9%*
	Plastics								
22	Polyethylene terephthalate	0	5,544	4,753	5,704	5,440	5,200	5,500	5.8%
23	High density polyethylene	0	2,728	3,026	2,779	2,821	2,685	4,900	82%
24	Polyvinyl chloride	0	329	365	363	317	408	80	-80%
25	Low density polyethylene	0	4,063	5,043	5,403	3,375	2,954	4,200	42%
26	Polypropylene	0	1,272	1,252	1,542	1,202	1,529	4,000	162%
27	Polystyrene	0	613	332	167	365	540	200	-63%
28	Mixed &/or Other plastics	8,607	792	1,107	922	1,755	462	1,600	246%
	Sub-total	*8,607*	*15,341*	*15,878*	*16,880*	*15,275*	*13,778*	*20,480*	*49%*
	Glass								
29	Glass	45,600	49,500	50,067	50,110	53,224	61,552	57,000	-7.4%
	Other Materials								
37	Fly ash	0	335,000	236,343	260,913	272,000	223,000	170,000	-24%
38	Foundry sands	0	9,006	6,755	2,000	0	0	11,900	N/A
39	Leather & textiles	4,080	1,564	2,419	2,348	2,376	3,052	3,900	28%
40	Tyres & other rubber	88	590	1,535	1,486	9,434	10,138	15,000	48%
	Sub-total	*4,168*	*346,160*	*247,052*	*266,747*	*283,810*	*236,190*	*200,800*	*-15%*
	Total[1]	**2,041,776**	**2,623,368**	**2,395,573**	**2,434,127**	**2,611,396**	**2,552,203**	**2,760,000**	

Note:

1. 2009-10 Total is rounded to 4 significant figures

Sector Origins of Recovered Material

13. Commercial and industry (C&I) and construction and demolition (C&D) activities (at 88%) constitute the main sources of resource-recovered material reported by SA recycling industries in 2009-10 (Table 3).
14. The principal contributors to C&D-sourced material were the masonry materials (Figure 4).
15. The majority of C&I-sourced materials were: Organics, Paper/Cardboard, Metals and Other materials.
16. Materials reported by industry as originating from Municipal sources for 2009-10 were less than in 2008-09 (reported at 419,000 tonnes).

Table 3 Sector origins (by weight, tonnes and %) of SA recovered materials, SA 2009-10

Sector Origin	Quantity	
	tonnes	(%)
Municipal	340,000	12%
C&I	1,120,000	41%
C&D	1,300,000	47%
Total	**2,760,000**	**100%**

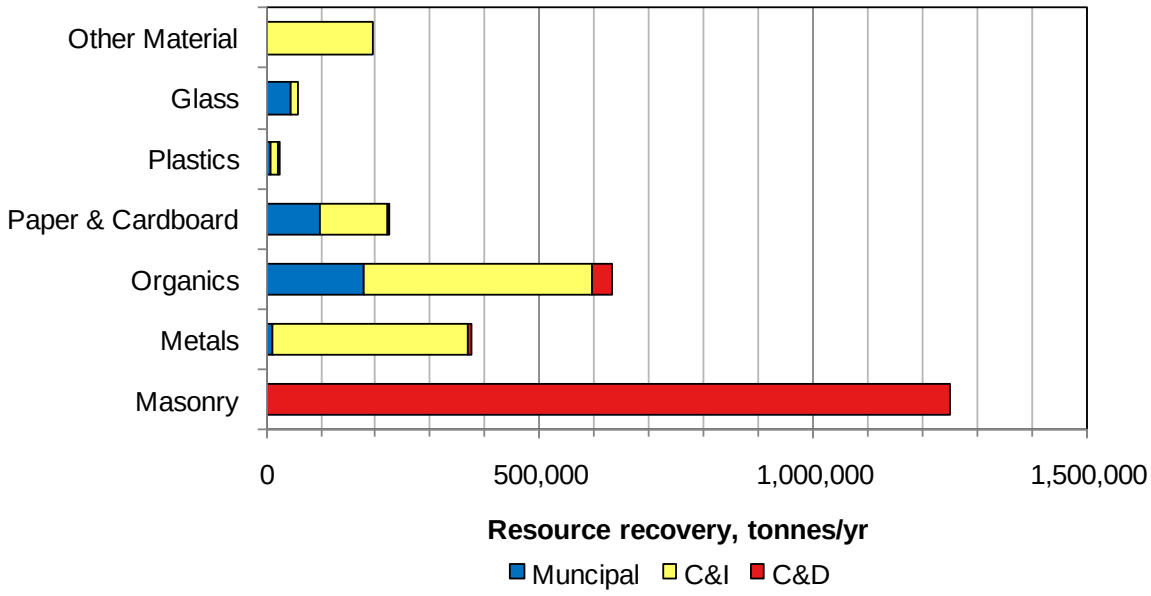

Figure 4 Sector origin of SA recovered materials according to material category (by weight, tonnes), SA 2009-10

Geographical Origin of Recovered Materials

17. The 2009-10 recycling activity survey asked the industry for the first time to report whether materials were sourced from metropolitan or regional areas (Table 4 below).
18. Survey responses to this question confirm regional areas contribute significantly to SA's recycling activity.
19. As many country towns and communities in SA do not yet have kerbside recycling systems, the key driver of this recycling activity is regional industries.

Table 4 Geographical origins (by weight, tonnes and %) of SA recovered materials, SA 2009-10

Sector Origin	Quantity	
	tonnes	(%)
Metro	2,120,000	77%
Regional	640,000	23%
Total	**2,760,000**	**100%**

Destination of Recovered Materials

20. At least 2.3 million tonnes or 81% of all recovered material reported for 2009-10 was sent for re-processing within South Australia (Table 5 below). These recovered materials were converted into:
    - Recycled Product – Material feedstock to replace virgin material;

      or

    - Manufactured Product – Final consumer or market product.
21. Consequently, most recycling activity in SA directly leads to production of a manufactured product.
22. These findings confirm that SA has achieved well-developed recycling industries in most material sectors with the exception of Paper and Cardboard (Figure 5 overleaf).

Table 5 Final reported destination (by weight, tonnes and %) of SA sourced materials, SA 2009-10 – see footnote for explanatory remarks[4].

Destination		Quantity	
		tonnes	%
SA	*Manufactured Product*	2,245,000	81%
	Recycled Product	25,000	0.9%
	Material Recovery	1,000	0.04%
Interstate		238,000	8.6%
Export		251,000	9.1%
Total		**2,760,000**	**100%**

[4] SA Destinations: Manufactured product – material re-processed to final consumer product and sold to market; Recycled Product – material re-processed to feedstock to replace a virgin material; Material Recovery – Material reported as sent to recyclers in SA but which could not be attributed to another specific SA destination category. Interstate – material sent interstate for re-processing or export overseas. Export – material exported directly from SA to overseas destination

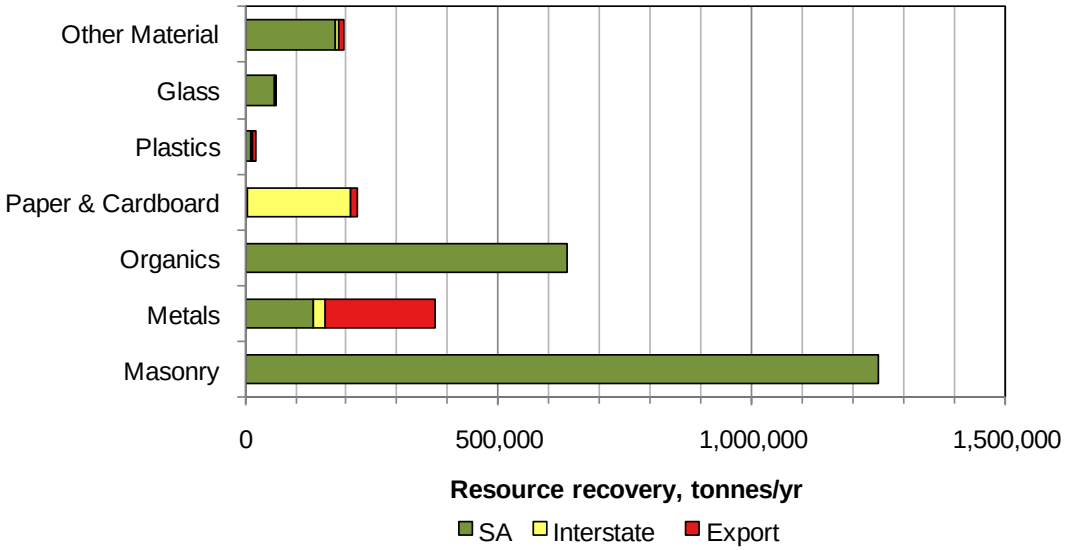

Figure 5 Destination of SA recovered materials according to material category (by weight, tonnes), SA 2009-10

E-waste Recycling

23. For the first time, SA's recycling activity survey collected industry data on e-waste recycling (Table 6 overleaf).
24. This data suggests that significant quantities (at least 1,805 tonnes) of e-waste were collected in SA during 2009-10.
25. The source of this e-waste was split approximately 50%/50% between municipal and C&I sectors (respectively).
26. The majority of collected e-waste (97%) was:
    - Aggregated – then sent interstate or overseas for re-processing;

      and/or additionally,

    - Sorted & Disassembled – Material recovery of metals, plastics and/or glass components, with these materials and residual components then sent to local aggregators or directly interstate or overseas[5].
27. This initial report of e-waste provides a useful baseline for future surveys. Demand for e-waste recycling is projected to increase substantially due to commencement of landfill bans in SA and introduction of a national product stewardship scheme for televisions and computers (DEHWA 2010).

[5] For this reason, e-waste is reported separately to other materials as the majority of the recovered constituents are already included in industry-reported data for metals, plastic and/or glass.

Table 6 Industry reported e-waste recovery (by weight, tonnes and %) for SA, 2009-10

Item	Quantity	
	tonnes	%
Printer cartridges	90	5.0%
Compact fluorescent lamps	25	1.4%
Batteries	20	1.1%
Computers	1,060	59%
Televisions / Monitors	440	24%
Mobile phones	20	1.1%
Other e-waste	150	8.3%
Total	**1,805**	**100%**

Packaging Recovery

28. Total packaging recovery for 2009-10 was estimated at 220,900 tonnes, up 20% on packaging recovery reported in 2008-09.
29. The substantial portion of this increase was due to greater quantities of post-consumer cardboard reported for 2009-10 (up 40% from 2008-09).
30. Container deposit recovery also increased 6% (by weight) during 2009-10 from an improvement in return rates of recyclable bottles and containers. The increase in the SA container deposit from 5¢ to 10¢, which commenced on 1 September 2008, could be responsible for this improvement in return rates.

Environmental Benefits Assessment

31. Environmental benefits for recycling of resource-recovered materials from SA during 2009-10 were assessed (Table 8 overleaf):
    - Greenhouse Gas Savings – 970,000 tonnes of CO_2-e
    - Energy Savings – 13,530 Terajoules (TJ) [Note: 1 TJ = 1,000 Gigajoules (GJ)]
    - Water Savings – 12 Gigalitres (GL)
32. Greenhouse gas savings estimated for 2009-10 were 9% greater than that reported in 2008-09. This increase is due to greater material recovery.

Table 7 Environmental benefits projected from resource recovery and recycling for SA, 2009-10

Environmental Benefit	Value		Equivalent Measure	
GHG Emissions Saved	970,000	tonnes CO2-e	223,100	Equivalent cars off the road (1 year)
Energy Saved	13,529	TJ LHV	2,374,000	Barrel of Oil Equivalents (BOE)
Water Saved	12,032	ML	4,810	Olympic Swimming Pools

Contents

1 Introduction

Since 2003-04, Zero Waste SA has undertaken a recycling activity survey of the South Australia's recycling industries.

The objective of this survey has been to collect industry statistics on resource recovery of materials which might otherwise be sent to landfill.

These statistics have been used by Zero Waste SA to monitor and report the performance of South Australia against sustainability targets for resource recovery in the State's Waste Strategy[6].

This report summarises the findings of the 2009-10 Recycling Activity survey for South Australia.

- Section 2 – Describes the methodology that was used
- Section 3 – Summarises selected survey statistics relating to industry participation
- Section 4 – Presents the final survey results by each material category
- Section 5 – Gives a separate analysis of packaging materials derived from the survey data
- Section 6 – Assesses the environmental benefits of recycling for South Australia based on its 2009-10 recycling performance
- Section 7 – Gives a glossary of some common terms used in this report which may aid the reader
- Section 8 – Lists the references used in compiling this report
- Appendices –
    - Appendix 1 – Gives a copy of the questions used in the 2009-10 Recycling Activity Survey
    - Appendix 2 – Lists the emission and conversion factors that were adopted for the environmental benefits analysis of the 2009-10 recycling activity data.

[6] The current version of this strategy document is South Australia's Waste Strategy 2005-2010 (Zero Waste SA, 2005a). A draft version of South Australia's Waste Strategy 2010-2015 (Zero Waste SA, 2011) has been released for public consultation.

2 Methodology

Rawtec was engaged by Zero Waste SA to undertake the Recycling Activity (survey) in South Australia for the financial year 2009-10. Input was provided by Infra-Plan and Life Cycle Strategies for the environmental benefits analysis conducted on the reported recycling activity data. This section summarises the approach and methodology used to conducting the 2009-10 recycling activity survey.

2.1 Selection of Materials

The materials to be surveyed for recycling activity was agreed with Zero Waste SA – see Appendix 1 for a complete list.

This list was considered to include the majority (at least >95%) of the material types recovered in South Australia for re-processing.

Included in this list for the first time in 2009-10 were:

- Plasterboard;
- E-waste – including computers, televisions & monitors, printer cartridges, compact fluorescent lights (CFLs), batteries and mobile phones; and
- Several re-use items: auto-parts, clothes and food. [Furniture was also considered but initial feedback from industry suggested there were currently no reliable means of quantifying this item.]

2.2 Survey Design & Delivery

2.2.1 Survey Respondents

All known local (South Australian based) and interstate companies or organisations involved with recycling were identified. The final list included over 150 companies or organisations. In broad terms, these companies and organisations can be classified as follows.

1. Industry-based Recycled Material Collectors, Aggregators and/or Re-processors

Companies or organisations in South Australia or interstate involved with collecting, aggregating, transporting, exporting and/or re-processing materials recovered in South Australia.

2. Representative or Industry Bodies

Representative organisations for industry or material sectors involved with resource recovery or recycling that conduct their own surveys or collect data on recycling performance of these sectors.

- Ash Development Association of Australia (ADAA) – Data for fly ash generation and recycling
- Compost Australia – Data for organic materials recycled by composting
- Plastics and Chemicals Industries Association (PACIA) – Data on plastics production and recycling by the plastics industry
- Publishers National Environment Bureau (PNEB) – Data on newsprint consumption and recycling by the publishing industry

3. Government agencies/bodies

Commonwealth or South Australian government agencies concerned with collecting data or other statistics on recycling activity in South Australia.

- South Australian Government Environment Protection Authority (EPA) –
  - Data for recycled deposit containers and bottles collected in South Australia
  - Landfill disposal data
- Australian Department of Foreign Affairs & Trade (DFAT) Statistical Information Service – Australian Customs Export Data

2.2.2 Confidentiality

It was agreed with Zero Waste SA that the names of, and data provided by industry-based recycling companies or organisations would be kept confidential in the public reporting of data except where the survey respondent indicated otherwise. Providing this assurance of confidentiality was deemed important to encouraging survey participation by the recycling industry.

2.2.3 Survey Questionnaire

A survey questionnaire was developed and agreed with Zero Waste SA.

The 2009-10 Questionnaire was modified to that used in previous years and included several additional questions. One of these additional questions was whether materials collected for recycling were sourced from metropolitan or regional areas.

Appendix 1 lists the questions that were included in the 2009-10 Questionnaire.

2.2.4 Survey Deployment

The survey was deployed to the survey respondents during March and early April 2011.

The deployment method was by email except in several instances where it was faxed to respondents without internet access.

Prior to survey deployment an attempt was made to contact all survey respondents by phone to confirm the relevant contact and give advance notice. In a number of instances it was discovered that the relevant company or organisation no longer existed or recycling activity had not occurred during 2009-10.

Each respondent was given several weeks to complete and return the survey. Outstanding survey returns were followed up by phone at least once, to encourage completion and submission by the respondent of the survey.

2.2.5 Consultation

A selected number of recycling industry companies were given the opportunity to participate in direct face-to-face consultation as part of the 2009-10 Recycling Activity survey. These companies were usually key players in specific material categories. The more detailed information obtained from these consultations were used to guide survey data analysis and interpretation.

2.3 Data Analysis

2.3.1 Materials Analysis & Reporting

Data collected by the survey was analysed to determine the following for each material.

- Quantity – The total reported quantity of that material recovered in South Australia for recycling or reuse
- Destination – Where the material was sent for recycling
    - SA – Including what degree of re-processing occurred:
        - Manufactured Product – Incorporated into a final consumer or market product.
        - Recycled Product – Re-processed to a feedstock material to replace a virgin material used for manufacture.
    - Interstate – Where the material might be re-processed or exported overseas
    - Export – Where the material was directly exported from SA to an overseas destination for re-processing
- Sector Origin –The reported sector origin from where the material was recovered:
    - Municipal – From kerbside collection, general public and/or via Council or other Municipal authority
    - Commercial & Industrial (C&I) – Collected from business or industrial activities (but excluding C&D)
    - Construction & Demolition (C&D) – Collected from construction or demolition activities involved with building and construction
- Geographical Origin – The reported geographical origin for recovered materials:
    - Metropolitan area – From the metropolitan Adelaide area
    - Regional – From other areas outside the metropolitan Adelaide area

In conducting the above analysis, the following principles were applied.

- Any materials imported into South Australia from other states and territories or overseas for reprocessing were excluded.
- Great care was taken to avoid double counting of recovered materials which can occur where same material is handled multiple times by different parties before reaching its eventual destination.
- In almost all cases direct industry estimates were relied upon to estimate the splits where reported data for materials were aggregated. The only exceptions to this approach were:
    - Metal, Cardboard & paper and Plastics material data from Adelaide Material Recovery Facilities (MRFs) where SA LGA packaging[7] and metropolitan kerbside collection data were used to interpolate material compositions
    - 2009-10 material data for recycled organic materials in South Australia reported publicly by

[7] SA Government (2010a), Report to the NEPC on the implementation of the National Environment Protection (Used Packaging Materials) Measure for South Australia

Compost Australia[8], where 2008-09 data[9] was used to interpolate some (not all) constituent compositions

2.3.2 Accuracy of reported data

In 2009-10, survey respondents were asked to report on the accuracy of the data they were providing. This accuracy data was used to determine an estimated reporting accuracy for each material[10].

The estimated reporting accuracy for each material was used to select an appropriate number of significant figures that should reasonably apply to presentation of the reported data.

2.3.3 Per capita analysis & National benchmarking

Metrics for per capita waste and recycling by South Australia and benchmarking of these metrics against similar data from other states and territories is only presented in the Overview to this report. These metrics were calculated using the following data and assumptions.

- Population statistics were sourced from the Australian Bureau of Statistics (ABS) (2011).
- The relevant reporting periods and sources of recycling activity data were:
  - SA: 2009-10, as reported in this survey;
  - ACT: 2009-10, as sourced from: ACT Rubbish and Recycling Statistics (ACT DTMS, 2011);
  - VIC: 2008-09, as reported by: Victorian Recycling Industries Annual Survey, 2008–2009 (Sustainability Victoria, undated);
  - WA: 2008-09, as reported by: Recycling Activity in Western Australia, 2007-08 & 2008-09 (WA Waste Authority, 2010);
  - NSW: 2008-09, as reported by: Waste Avoidance and Resource Recovery Strategy Progress Report, 2010 (NSW DECCW, 2010);
  - QLD: 2007-08, as reported by: The State of Waste and Recycling in Queensland 2008 – Technical Report (QLD DERM, 2009).
- Adjustments were made for comparative purposes:
  - Fly ash data was excluded from SA 2009-10 data;
  - For QLD 2007-08 data, the following material categories were excluded from the Queensland figure to improve comparability with other state data: ash, mineral processing waste and materials indefinitely stored;
  - All other data was taken directly from the relevant source.

[8] Inside Waste (2011), News report on results of Compost Australia's Industry Survey of Recycled Organics in Australia

[9] Compost Australia (2009), COMPOST AUSTRALIA - ORGANICS INDUSTRY SA Survey 2008/09 Financial Year

[10] Standard error propagation techniques were applied for calculating errors when adding or subtracting data for reported resource recovery of materials

2.3.4 Packaging Recovery Analysis & Reporting

Packaging data was taken directly from Recycling Activity Survey data:

- Container deposit bottle and can packaging:
  - From 2009-10 CDL data reported by industry to the South Australian EPA.
- Cardboard packaging:
  - Derived from cardboard material recovery data which was adjusted to account for pre-consumer material.
- Other plastic packaging:
  - Derived from industry data for plastic packaging materials recovered by Adelaide MRFs
- Other glass packaging:
  - Determined from balance between CDL data and industry-reported glass recovery and re-processing data.

2.3.5 Environmental Benefits Analysis

2.3.5.1 General Approach

The methodology for this analysis was aligned as much as possible to the approach applied in previous recycling activity surveys developed for South Australia.

However, the opportunity was taken to review and update relevant conversion and emission factors[11]. Some new conversion and emission factors were also required for materials added to the 2009-10 recycling activity survey.

In addition, the scope of environmental benefits analysis was expanded to include the following metrics.

- ***Greenhouse Gas Savings*** (quantified as tonnes of CO_2-e) – The reduction in greenhouse gas emissions achieved by replacing virgin materials with recycled materials.
- ***Cumulative Energy Demand Savings*** (as Terajoules (TJ) – The amount of energy saved, including all fossil, renewable, electrical and embodied energy, by using recycled materials.
- ***Water Savings*** (as Megalitres (ML) H_2O) – The reduction in water consumption by substituting recycled materials that would otherwise be required if virgin materials had been used.

2.3.5.2 Assumptions & Data Sources

The conversion and emission factors used to assess the benefits of recycling materials have been widely studied and established methods are developed to calculate them. These methods are based on Life Cycle Analysis (LCA) techniques.

Figure 2.1 overleaf gives a useful illustration of how LCA techniques approach the assessment of resource recovery and recycling activities in order to calculate the benefits that can be achieved.

[11] 'Conversion or emission factors' convert the tonnes of material recycled into the equivalent amount of environmental benefit achieved.

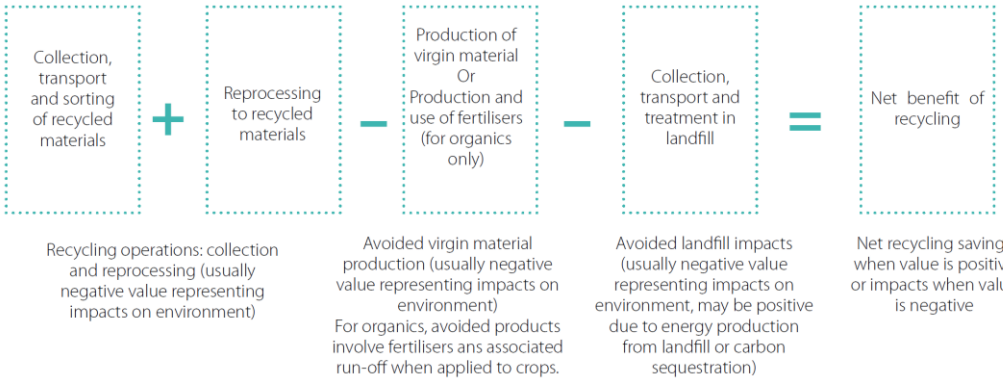

Figure 2.1 Method for calculating the net environmental impacts in the recycling process. Source: NSW DECCW (2010)

LCA techniques have previously been used to estimate conversion and emission factors for Australian situations including for South Australia. For the purpose of this study, the following sources were used to infer or obtain relevant conversion and emission factors for environmental benefits of recycling in South Australia.

- Benefits of Recycling in South Australia study (Zero Waste SA, 2009)
- Life Cycle Impact Data for Resource Recovery for Commercial and Industrial and Construction and Demolition Waste in Victoria (EcoRecycle Victoria 2005)
- Environmental benefits study of recycling for NSW (NSW DECCW, 2010)
- SA Recycling Activity survey, 2008-09 (Zero Waste SA, 2010)

These sources often provided or suggested separate conversion and emission factors relevant to materials recovered for recycling from Municipal, C&I and C&D sectors. The conversion and emission factors between these different sectors were generally found to be similar.

In view of this, a single material conversion and emission factors for each material was usually adopted. SA specific or source values were adopted first. Otherwise, conversion or emission factors from another source were used. In this situation, where there were multiple values available, the lower value was normally adopted in order to be conservative in the estimate of environmental benefits.

Sufficiently comprehensive and/or reliable conversion or emission factors data could not be identified for the following materials.

- Industry organics
- Foundry sands
- Leather & textiles
- Alternative Fuel
- E-waste
- Reuse items

As a consequence, these materials were not included in the environmental benefits analysis.

The final values adopted for conversion and emission factors using in the 2009-10 recycling activity survey are listed in Appendix 2. Some brief notes on the sources and key assumptions made in deriving these conversion and emission factors are included in Appendix 2.

2.3.5.3 Qualifications & Limitations

The following qualifications and limitations should be recognized about the environmental benefits analysis presented in this report. These qualifications and limitations are not unique to the 2009-10 Recycling Activity survey and would also have applied to similar assessments conducted in previous Recycling Activity surveys.

1. Many of the conversion and emission factors adopted are not specifically calculated for SA, and in most cases, are derived from interstate studies, i.e. Victoria, NSW.
2. It is important to recognize that not all environmental benefits reported directly accrue to SA, because:
    - Some of the virgin materials that are replaced by recycling are not manufactured in SA, e.g. metals, plastics, cardboard & paper; and/or
    - The material recovered from SA for recycling is used to manufacture products that end up being consumed outside of the State, e.g. metals, plastics, cardboard & paper.
3. In view of the above, the assessment in this study represents a generalized estimate of the life cycle benefits involved with recycling of these materials and does not precisely depict the environmental benefits of recycling activity in SA.

3 Selected Survey Statistics

The following presents some survey statistics that may provide a useful insight into the recycling activity occurring in South Australia and the types of data and information sets that were returned and analysed in 2009-10.

3.1 Survey Participation & Reported Data

Table 3.1 below summarises the survey participation and reported data points for 2009-10.

- The survey questionnaire was successfully deployed to approximately 110 or 72% of the original list of greater than 150 companies or organisations potentially involved with recycling activity.
- The survey returns produced recycling activity data or information sets for 81 of these companies or organisations.
- Of these 81 data or information sets, the following types of activity were classified. Note: the activity type classifications are not mutually exclusive as many companies or organisations reporting data were involved with multiple activities and/or aspects of the resource recovery and/or recycling industry.
    - 6 were reference data sets from industry bodies or government agencies
    - 26 data sets came from companies or organisations that generated the material that was being recovered for recycling
    - 57 data sets were companies or organisations involved in collection or aggregation of recovered material
    - 52 data sets were for companies or organisations undertaking re-processing activities
    - 45 of these companies or organisation were also involved in manufacturing products from the recovered or re-processed material.

Table 3.1 Industry reported reuse items for South Australia, 2009-10

Statistic		No.	(%)	% Basis
Sample Size		152		
Surveys Deployed*		110	72%	of Sample Size
Survey Data Sets		81	74%	of Surveys Deployed
Activity Type	Industry Reference Data	6	7%	of Survey Data Points
	Source	21	26%	of Survey Data Points
	Aggregator/Collector	57	70%	of Survey Data Points
	Recycler	52	64%	of Survey Data Points
	Manufacturer	45	56%	of Survey Data Points

3.2 Industry Data Segmentation

Table 3.2 below summarises the reported industry data (excluding reference data) points or sets from companies or organisations by the following classifications. Again, these classifications are not mutually exclusive.

- Material Activity – The materials and/or industry sector the company or organisation was handling
- Material Destination – Where were recovered materials sent
- Waste Hierarchy[12] – At what level of the waste hierarchy were materials being handled

Table 3.2 Industry reported reuse items for South Australia, 2009-10

Statistic		No.	(%)
No. Industry-Sourced Data Points/Sets		75	100%
Material Activity	Masonry	20	27%
	Metals	24	32%
	Organics	21	28%
	Cardboard & paper	21	28%
	Plastics	12	16%
	Glass	8	11%
	Other Materials	11	15%
	E-waste	10	13%
	Reuse Materials	4	5%
Material Destination	SA	58	77%
	Interstate	22	29%
	Export	6	8%
Waste Hierarchy	Reuse	18	24%
	Recycle	42	56%
	Material Recovery	57	76%
	Energy Recovery	4	5%

[12] The waste hierarchy is an internationally recognised aspirational framework for managing waste generation and disposal that is a guiding principle of South Australia's Waste Strategy (ZWSA 2011). The levels presented here are not necessarily given in any particular order of preference but it is widely accepted that the precedence should be: Reuse > Recycling > Material or Energy Recovery

4 Material Activity Reports

This section presents the key findings from analysis of Recycling Activity Survey data for each material. These material recycling activity reports are presented according to commonly accepted material sectors as follows.

1. **Masonry**
   - Asphalt
   - Bricks
   - Concrete
   - Plasterboard
   - Clay, fines, rubble & soil
2. **Metals**
   - Steel or ferrous metals
   - Aluminium
   - Non-ferrous metals (exc. Aluminium)
3. **Organics**
   - Food Organics
   - Garden Organics
   - Timber
   - Industry Organics
   - Grease Trap & Waste Sludge
   - Bio-solids
   - Other Organics
4. **Cardboard & Paper**
   - Cardboard and waxed cardboard
   - Liquid paperboard
   - Magazines
   - Newsprint
   - Phone books
   - Printing & writing paper
5. **Plastics**
   - Polyethylene terephthalate (PET) – Plastic bottles
   - High density polyethylene (HDPE)
   - Polyvinyl chloride (PVC)
   - Low density polyethylene (LDPE)
   - Polypropylene (PP)
   - Polystyrene (PS)
   - Mixed &/or Other plastics (MIX)
6. **Glass**
7. **Other Materials**
   - Fly Ash
   - Foundry sands
   - Leather & Textiles
   - Tyres & Rubber
   - Alternative Fuel
8. **E-waste – Waste or scrap electronic or electrical equipment items**
9. **Reuse Items – Auto-parts, clothes & food**

4.1 Masonry

4.1.1 Typical Source & End Products

Tables 4.1.1 and 4.1.2 below give the source and end products that have been typically identified with resource recovery and recycling of masonry materials (ZWSA 2010). In SA,

- Masonry material is usually recovered by building and construction companies.
- Some building and construction companies source separate and/or re-process the C&D waste at or off site, directly reusing the end products for their own C&D activity (on the same site or elsewhere).
- Others deliver or arrange for transport of the material to specialised C&D material aggregators, collectors and/or reprocessors, either directly or via drop-off points and/or transfer stations, where it is then transformed into manufactured products for reuse by the C&D industry. In this situation, this material may be handled several times by different parties before reaching its final re-processing destination.

Table 4.1.1 Typical sources of recovered masonry materials

Material	Source products
Asphalt	Roads, footpaths, car parks and kerbing
Bricks	Mainly walls and other general C&D activity
Concrete	Slabs, footings, kerbing, channel and walls
Clays, fines, rubble & soil	General C&D

Table 4.1.2 Typical end-products for recycled masonry materials

Material	End Products
Asphalt	Road base, quarry rehabilitation material
Bricks	Primarily crushed for road base, drainage or fill but also directly reused
Concrete	Crushed as aggregate for road base, drainage or construction fill
Clays, fines, rubble & soil	Road base, batters/bunds, compost (bulking agent), quarry rehabilitation material or construction fill

4.1.2 Quantities & Trends

The quantity of masonry materials reported as recovered in South Australia during 2009–10 is presented in Table 4.1.3 below. The Table includes the estimated reporting error for each material.

Figure 4.1.1 overleaf illustrates the relative composition of the masonry materials that were reported.

Figure 4.1.2, also on the same page, shows the changes in recycling activity of masonry materials that have occurred since 2003-04.

Key comments and observations about reported quantities and trends in masonry materials are summarised below.

- The quantity recovered of masonry materials in 2009-10 was approximately 1,250,000 tonnes. This value represents a slight increase on 2008-09 (up by 2.6%)
    - Bricks and concrete recovery have dropped –
        - There was a significant decrease in 2009-10 for concrete (by approximately 190,000 tonnes or 20%) and bricks (by about 37,000 tonnes or 33%).
        - This decrease was confirmed by the industry and attributed to continuing low construction activity arising from the global financial crisis.
        - Recovered quantities for these materials are expected to return to "normal" levels in 2009-10.
    - Asphalt recovery has risen –
        - 2009-10 saw a rise in the quantities of asphalt being recycled in South Australia
        - This rise can be attributed largely to major road infrastructure projects that were occurring during this period, in particular the Northern Expressway project
    - No plasterboard material was separately reported as recovered for reprocessing (all plasterboard material quantities were reported back by industry in the recycling activity data for other material streams).

Table 4.1.3 Masonry materials recovery and destination, SA 2009–10

Item	Net recovery[1]	Estimated Reporting Error, ±		Reprocessing location (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Asphalt	131,000	8,000	6%	100%	0%	0%
Bricks	77,000	8,000	10%	100%	0%	0%
Concrete	790,000	37,000	5%	100%	0%	0%
Plasterboard						
Clay, fines, rubble & soil[2]	250,000	97,000	39%	100%	0%	0%
Total	**1,248,000**	**150,000**	**12%**	**100%**	**0%**	**0%**

1. Net recovery excludes reprocessing losses

2. The 'clay, fines, rubble & soil' material category does not include stockpiled material which may not be recycled and also only relates to material that has been diverted from landfill

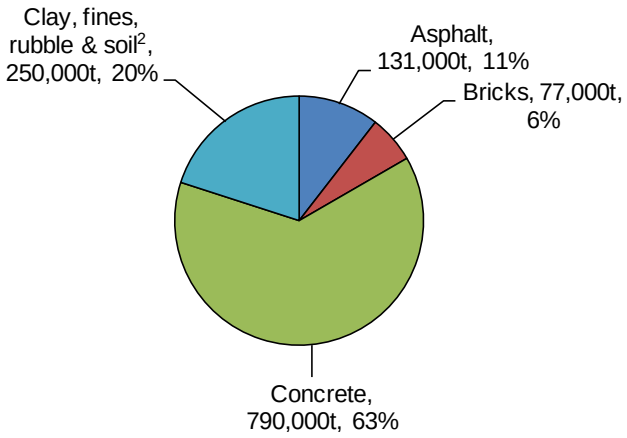

Figure 4.1.1 Composition of recovered masonry materials (by weight), SA 2009–10

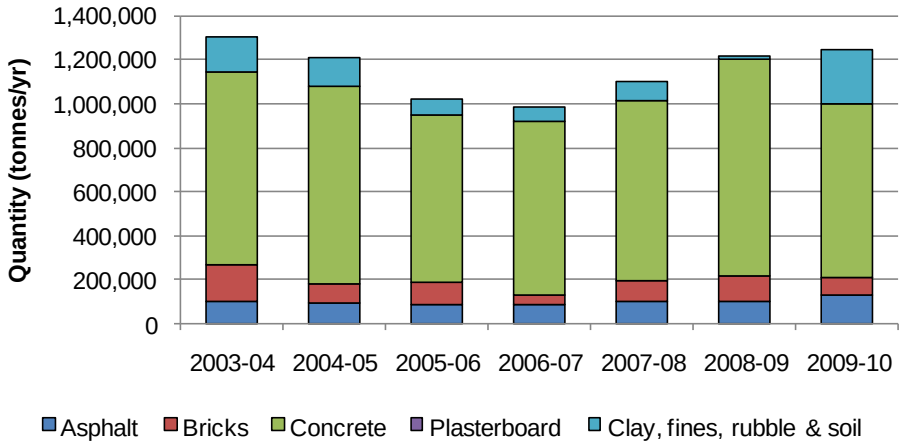

Figure 4.1.2 Changes in reported masonry material quantities since 2003-04

- Clay, fines, rubble & soil recovery have increased –
  - Reported recovery of clay, fines, rubble & soil was up from 2008-09 (by 230,000 tonnes)
    - The reported recovery does not include substantial soil stockpiles (up to 130,000 tonnes) retained from above-mentioned road infrastructure projects, which may be recycled in the future
    - It also does not include other substantial quantities of fill diverted to landfills and used in daily cover or rehabilitation works
  - This 2009-10 value may only reflect a fraction of the total quantities of soil and fill being directly reused in building and construction projects across South Australia – which could be up to 1 million tonnes annually. For example, many C&D companies remove soil or make rubble at one site from concrete and bricks, then use it at on the sane or another site for fill. Much of this recycling activity for C&D material does not appear to have been captured in this (and also previous) recycling activity surveys.

- Beneficial reuse of soils for development of industrial land appears to have increased in this period

- The observed change in reported quantities for masonry materials between 2008-09 and 2009-10 (Figure 4.1.2) seen consistent with annual variability in reported data that has occurred since 2003-04
  - They probably reflect cycles in construction and building activity that normally occur
  - Furthermore, not every company or organisation involved with resource recovery of masonry materials may have consistently reported or provided complete data sets in every survey year.

4.1.3 Re-processing Destinations

Table 4.1.3 includes the final destination reported in 2009-10 for re-processing of each material.

- All of the masonry materials recovered were re-processed and ultimately sold or recycled in South Australia in the final form of a manufactured product, e.g.
  - Recovered asphalt was mixed with fresh asphalt to lay new bituminous road or paved surfaces
  - Concrete and bricks were crushed into fine rubble and sold or reused as aggregate or fill for road or construction projects
  - Whole bricks were re-processed and re-used for paving or building houses
  - Clay, rubble, fines & soil were re-processed and sold or directly reused as fill in construction projects

4.1.4 Sector & Geographical Origin

Table 4.1.4 (below) shows the reported sector and geographical origins for each masonry material.

- The sector origin of the reported resource recovery is 100% C&D, which is what would be expected by virtue of the definition for C&D waste
- The split between metropolitan and regional areas of 92% and 8%, respectively, is about what should be expected given the levels of construction activity occurring in these respective areas of South Australia

Table 4.1.4 Masonry materials sector and geographical origins, SA 2009–10

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Asphalt	0%	0%	100%	90%	10%
Bricks	0%	0%	100%	96%	4%
Concrete	0%	0%	100%	92%	8%
Plasterboard					
Clay, fines, rubble & soil	0%	0%	100%	93%	7%
Total	**0%**	**0%**	**100%**	**92%**	**8%**

4.1.5 Industry Barriers

The following were identified by the masonry reprocessing industry as some of the barriers to increasing recovery rates.

- Regulatory restrictions on use or stockpiling of materials on sites, which often seemed arbitrary or were impractical given the large quantities that are required for large construction projects within short periods of time.
- Compliance with material specifications on inputs to destination products. It was reported that many customers still specify or adopt Australian standards for materials that are biased towards virgin materials or unintentionally exclude potential for recycled material use.

4.1.6 Market Expectations

The majority of re-processors were optimistic that the market would rebound in 2009-10 as the global financial crisis receded and construction activity picked up. In this respect, there were a number of major infrastructure projects scheduled to occur in 2010-11, including the Adelaide Desalination Plant, Royal Adelaide Hospital and Adelaide Oval Re-development.

4.2 Metals

4.2.1 Source & End Products

Tables 4.2.1 and 4.2.2 below give the source and end products commonly identified with resource recovery and recycling of metals (ZWSA 2010). In SA,

- Metals in South Australia are recovered primarily through:
  - Commercial collections direct from industrial manufacturers or via scrap-metal merchants
  - Household and container recycling collections
  - Commercial salvage operations that recover metals from collection or drop-off of consumer products, industrial equipment and/or C&D sources.
- There are some substantial local re-processors for steel, e.g. steelworks and foundries.
- Apart from this local recycling activity, most of the recovered metals are largely sent interstate or exported for re-processing.

Table 4.2.1 Typical sources of recovered metals

Material	Source products
Steel	Pre- and post-consumer, automotive (car bodies), general heavy steel and structural steel, whitegoods, appliances, iron roofing, steel packaging
Aluminium	Windows and doors, automotive engines, assorted industrial scrap and production scrap, aluminium cans, commercial electrical cable, electronic and electrical waste
Non-ferrous metals	Copper pipe, automotive batteries and cable, general industrial and production scrap, electrical cable

Table 4.2.2 Typical end-products for recycled materials

Material	End Products
Steel	Many, including car parts, general rod and sheet, foundries.
Aluminium	Valves and extrusions, consumer products, automotive parts, building industry and aluminium cans.
Non-ferrous metals	Many, including batteries, cables, valves and extrusions.

4.2.2 Quantities & Trends

The quantity of recovered metals reported for South Australia during 2009-10, including the estimated reporting error and final reprocessing destination for each material, are presented in Table 4.2.3 below. Figure 4.2.1 overleaf also summarises the relative proportions of metals recovered in 2009-10.

Figure 4.2.2, also on the same page, shows the trend in recycling activity of metals that have occurred since 2003-04.

The following key points or observations can be made about the reported recycling activity for metals.

- The reported quantity recovered of metals in 2009-10 was approximately 376,000 tonnes, an increase of 21% on 2008-09
    - This rise occurred across all of the metal materials except Aluminium –
        - Steel was up by 23%
        - Aluminium down by 2%
        - Non-ferrous metals by 28%
    - The increase in metal recovery can be attributed to several factors, all generally related to the passing of the global financial crisis.
        - Resumption of economic and industrial activity has increased consumption and industrial outputs of scrap metal
        - Both demand and market prices for scrap metals have substantially recovered
    - Quantities of recovered metals have now largely returned to levels seen prior to 2008-09.
    - However, higher reported recovery in 2009-10 could, in part, be a result of greater survey participation compared with 2008-09.

Table 4.2.3 Metals recovery and reprocessing location, SA 2009–10

Item	Net recovery[1]	Estimated Reporting Error, ±		Reprocessing location (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Steel	334,000	57,000	17%	40%	3%	57%
Aluminium	18,200	900	5%	0%	53%	47%
Non-ferrous metals	23,600	1,400	6%	0%	16%	84%
Total	**375,800**	**59,300**	**16%**	**36%**	**6%**	**58%**

1. Net recovery excludes reprocessing losses

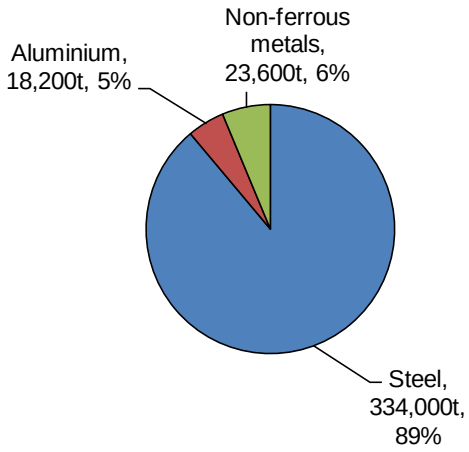

Figure 4.2.1 Composition of recovered metals (by weight), SA 2009–10

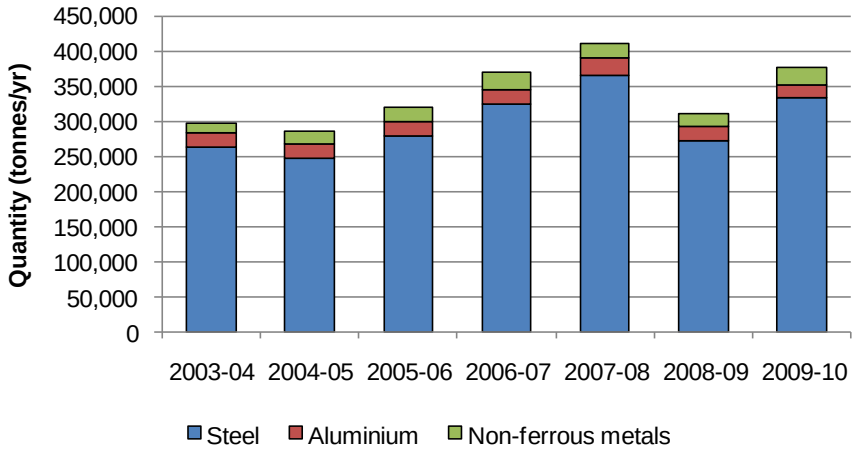

Figure 4.2.2 Changes in reported metal quantities since 2003-04

4.2.3 Re-processing Destinations

Table 4.2.3 includes the final destination reported in 2009-10 for re-processing of metals.

- The destination for re-processing of metals was split approximately 36% and 64% between re-processors in SA and those interstate and overseas.
    - SA has a local steelworks and metal foundries that accept substantial amounts (40%) of scrap steel for re-processing.
    - Virtually all Aluminium was reported as being sent for re-processing at smelters overseas or interstate.
    - There was only a minor amount (1%) of non-ferrous metals reported as being re-processed in SA, with the rest being shipped interstate or overseas.

4.2.4 Sector & Geographical Origin

Table 4.2.4 below shows the reported sector and geographical origins for metals recovered during 2009-10.

- The sector origin for reported metal recovery was largely (>95%) C&I. This is different to the sector origin split reported in 2008-09, where up to 25% and about 10% was reported as originating from C&D and Municipal sources, respectively.
    - In the case of C&D, this could suggest that C&D companies are conducting greater source separation on-site and selling the recovered metals directly to C&I scrap metal merchants (as opposed to sending it to companies who re-process C&D waste and would otherwise undertake separation and recovery of the metals).
    - The lower Municipal value could arise from different assumptions for material splits of metals constituents in data reported for Adelaide MRFs.
- The reported split between metropolitan and regional areas was 97% and 3%, respectively.

Table 4.2.4 Metals sector and geographical origins, SA 2009–10

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Steel	2%	96%	2%	97%	3%
Aluminium	25%	75%	0%	94%	6%
Non-ferrous metals	1%	98%	1%	96%	4%
Total	**3%**	**95%**	**2%**	**97%**	**3%**

4.2.5 Industry Barriers

Similar issues to those identified in 2008-09 were raised in 2009-10 by the metals reprocessing industry.

- Available supply and competition for source materials were perceived as barriers to increasing recovery rates
- Maintaining quality of post-consumer scrap metals, i.e. keeping contamination rates low
- Demand and price fluctuations in local and international markets, which can impact on industry stability
- The capacity and competitiveness of local metal re-processors to accept and pay international prices for scrap metals.

4.2.6 Market Expectations

- The concerns expressed by many survey respondents during the 2009-09 previous survey as the global financial crisis impacted on the metals market appear to have relaxed.
- The recovery and relative stability in metal prices seen since mid 2009 in both the local and export markets have led to increasing optimism about growth and financial prospects for the industry sector.
- Local re-processors are concerned about the rapid rise in the Australian dollar and their ability to remain competitive.

4.3 Organics

4.3.1 Source & End Products

Tables 4.3.1 and 4.3.2 below give the source and end products usually identified for resource recovery and recycling for organics (ZWSA 2010). In SA,

- The majority of food and garden organics are recovered through kerbside collection systems in metropolitan areas and from drop off sites at transfer stations or delivered directly to composting facilities.
- Commercial food organics collections in metropolitan areas from offices and businesses for composting are increasing.
- Timber derived from C&D waste in the Adelaide metropolitan area is being re-processed and converted into an alternative fuel.
- Timber derived from forestry and timber processing operations in some regional areas is being collected and composted.
- For other organics, sources are largely C&I and not all of this material is initially sent for composting but may be subject to an intermediate re-processing step. For example, organics produced by the food processing industries are often first re-processed to extract valuable by-products or create another manufactured product.
- Some operators have also started re-processing bio-solids by composting, to make them more suitable for use by SA farmers and irrigators for soil improvement of agricultural land.

Table 4.3.1 Typical sources of recovered organic materials

Material	Source products
Food Organics	Kerbside collected and commercial food wastes
Garden Organics	Kerbside collected, other municipal, commercial garden organics
Timber	Timber bark, sawdust, wood/timber packaging, general wood/timber
Organics - Other	Organic-derived by-products from food processing industries; Commercial and/or industrial grease trap waste and other organic-based sludges; Bio-solids from sewage treatment plants or STEDS schemes; Paper pulp, miscellaneous agricultural organics, animal bedding, paunch, animal mortalities (or otherwise not classified above)

Table 4.3.2 Typical end-products for recycled organic materials

Material	End Products
Food Organics	Composted soil conditioners, potting mixes and mulches
Garden Organics	Composted soil conditioners, potting mixes and mulches
Timber	Composted soil conditioners, potting mixes and mulches; alternative fuel source
Organics - Other	By-product extraction or processing to other manufactured product; Composted soil conditioners, potting mixes and fertilisers; Animal feed; Direct land appliction for soil improvement

4.3.2 Quantities & Trends

The quantity of recovered organic materials reported for South Australia during 2009-10, including the reporting error and final reprocessing destination for each material, are presented in Table 4.3.3 below.

Figure 4.3.1 overleaf summarises the relative proportions of organic materials recovered in 2009-10.

Figure 4.3.2, also on the same page, shows the changes in recycling activity for organics since 2003-04.

The following key points or observations can be made about the reported recycling activity for organic materials included in Table 4.3.3.

- The reported quantity recovered of organics in 2009-10 was 636,000 tonnes, an increase of about 25% on that reported in 2008-09
    - This rise has occurred due mainly due to a substantial rise in Organics – other (which has nearly tripled since 2008-09).
        - This increase was largely driven by nearly an extra 100,000 tonnes in grease trap and waste sludge organic material being accepted by SA composters.
    - Reported quantities for other organic material categories also increased during 2009-10:
        - Food organics – Up 20%
        - Garden organics – Up by 8%
        - Timber – Up by 3%

Table 4.3.3 Organic material recovery and reported re-processing destination, SA 2009–10

Item	Net recovery[1]	Estimated Reporting Error, ±		Reported Destination (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Food Organics	5,800	700	12%	100%	0%	0%
Garden Organics	220,000	29,000	13%	100%	0%	0%
Timber	262,000	5,000	2%	100%	0%	0%
Organics - Other[2]	148,000	1,500	1%	100%	0%	0%
Total	**635,800**	**36,200**	**6%**	**100%**	**0%**	**0%**

1. Net recovery excludes reprocessing losses
2. Organics - Other predominantly included: grease trap waste, organics sludges and biosolids

The data in Table 4.3.3 above, however, does not include several areas of recycling activity for organic materials in SA believed to have been newly identified during the 2009-10 survey. These newly identified areas included:

- Industry Organics –
    - These are waste organic materials or by-products arising from food production by SA industry, mainly from wine production and meat processing.
    - These materials are not necessarily composted, and thus, are believed not have been captured in previous recycling activity surveys. Instead, the waste organic materials are re-processed to extract or create valuable by-products, with residuals recycled as animal feed or for agricultural soil improvement by land application.

- Biosolids –
  - This refers to waste sludge that is re-processed at sewage treatment plants.
  - Whilst small but increasing amounts of this material are being composted (and therefore included in the recycling activity reported here), large amounts are being directly reused in SA for agricultural soil improvement by land application.

The quantities of these other materials above were substantial, up to 330,000 tonnes.

This additional quantity of organic material has not been included in the comparative data reported for the 2009-10 survey to ensure that the recycling activity data set was consistent with that adopted in previous years. Previous recycling activity surveys appear to have only included recycling activity involved with composting of organics, with the exception of timber that was being used for alternative fuel.

This situation may change when new national guidelines (DSEWPC 2010) for reporting of recycling activity by States and Territories are introduced. The draft version of these guidelines currently recommends that these types of materials are included in the reported recycling activity.

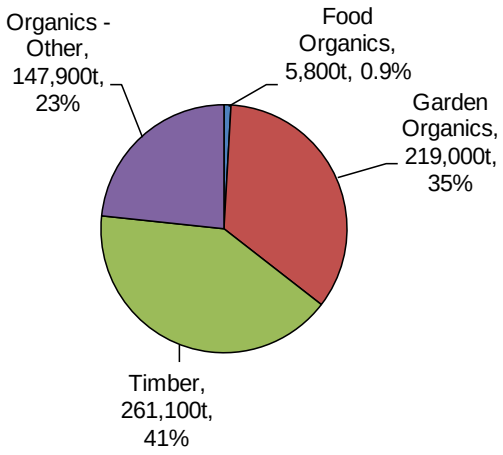

Figure 4.3.1 Composition of recovered organics (by weight), SA 2009–10

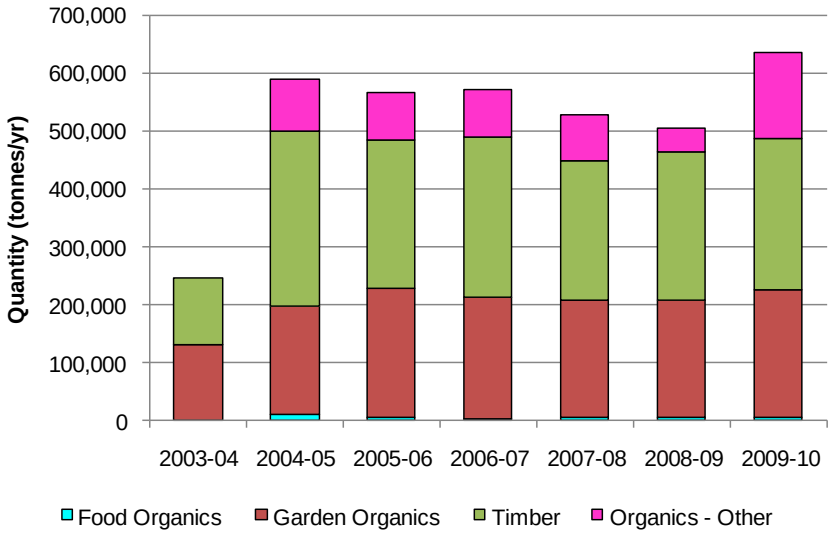

Figure 4.3.2 Changes in reported organic material quantities since 2003-04

4.3.3 Re-processing Destinations

Table 4.3.3 includes the final destination reported in 2009-10 for re-processing of organics.

- South Australia was the reported destination for re-processing for all (100% of) organics recovered for recycling.

4.3.4 Sector & Geographical Origin

Table 4.3.4 below shows the reported sector and geographical origins for organic material recovered during 2009-10.

- The sector origin for organic recovery was majority (>80%) C&I. This is different to the sector origin split reported in 2008-09, where up to 50% was reported as originating Municipal sources.
    - This outcome can be mainly attributed to reporting of newly identified organic materials which by definition originate from C&I sources
    - However, it also appears that many industries reporting data in 2009-10 attributed greater proportions of recovered organic materials, particularly for garden organics and timber categories, to C&I as opposed to Municipal (i.e. kerbside collection)
- The split between metropolitan and regional areas was 42% and 58%, respectively.
- The greater contribution of regional areas to recovered organic materials can be largely credited to timber and industry organic materials, which originate from industries based in regional South Australia.

Table 4.3.4 Organic material sector and geographical origins, SA 2009–10

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Food Organics	50%	50%	0%	93%	7%
Garden Organics	79%	16%	5%	86%	14%
Timber	1%	88%	11%	20%	80%
Organics - Other	0%	100%	0%	40%	60%
Total	**28%**	**66%**	**6%**	**48%**	**52%**

4.3.5 Industry Barriers

Some of the key issues and barriers impacting upon the market identified by survey respondents were similar to those reported in 2008-09 and appear to have occurred consistently since recycling activity surveys commenced.

- Contamination of raw materials, particularly for composters or where residual organic material was used as animal feed or agricultural soil improvement.
- High hurdle costs of collection, principally for lower-volume prospective customers not located in areas where there were already sufficiently high geographical density of existing customers.
- Increasingly onerous regulatory requirements for design and operation of sites, especially for sites being impinged on by urban sprawl.
- Application of more stringent standards for contaminants in organic material used for agricultural soil improvement.
- Market will only pay low gate fees for organics recycling given relativity to landfill disposal options available.
- Generating market demand for products is an ongoing challenge, particularly when wetter seasonal conditions reduce demand for moisture retention products.

4.3.6 Market Expectations

- SA has a dynamic organics recycling industry.
- As the population for the State is expected to continue growing, and with the introduction of more kerbside-collection services, more and more organic material will be produced and expected to be absorbed by the recycling industry.
- The food waste stream from municipal and commercial collections is expected to increase significantly over the next few years.
- This uptake of organic material will only be feasible, however, if markets exist to accept these organics and contamination of source material is prevented.
- However, recent problems in the wine industry are causing concerns about future market weaknesses.
- On one hand, the drought has encouraged greater use of compost or organic materials to improve soil conditions and reduce water use for irrigation.
- On the flip side, the wine industry could rationalise significantly over the next decade, reducing demand for compost materials.
- Most organic re-processors are generally positive and expect steady growth in the industry to continue.

4.4 Cardboard & paper

4.4.1 Source & End Products

Tables 4.4.1 and 4.4.2 below give typical source and end products identified for resource recovery and recycling of cardboard and paper (ZWSA 2010). In SA,

- Cardboard and paper materials are recovered from a diverse range of sources.
- Cardboard is sourced substantially from kerbside collection and packaging used by commercial and industrial organisations.
- Liquid paperboard originates principally from container deposit recycling and kerbside collection.
- Newsprint and magazines are largely picked up in the kerbside collection or returned waste material from the publishing industry.
- Phone books are also picked up by the kerbside collection.
- Printing & writing paper are generally the result of commercial collections with some material also picked up by kerbside collection.
- There is very little SA-based re-processing of cardboard & paper materials except via composting or vermiculture, with most material sent to interstate mills or exported overseas for re-processing.
- The quantities that are sent interstate as opposed to overseas usually depend on the demand and price fluctuations in the Australian and international markets for these materials.

Table 4.4.1 Typical sources of recovered cardboard & paper materials

Material	Source products
Cardboard & waxed cardboard	Mostly corrugated cardboard use for the packaging of industrial and consumer goods
Liquid Paperboard	Liquid paperboard LPB packaging, both container deposit (CD) and non-CD. CD LPB packaging (includes flavoured milk beverages and fruit juice flavoured beverages). Non-CD packaging includes milk and fruit juice packaging.
Magazines	Pre-consumer waste and post-consumer magazine material
Newsprint	Both pre- and post-consumer newsprint and some magazine material. Includes magazines and TV guides printed on newsprint or improved newsprint. Reuse for fire-lighting or animal bedding
Phonebooks	Phone books
Printing & Writing Paper	Office paper and a small amount of packaging paper from office sources

Table 4.4.2 Typical end-products for recycled cardboard & paper materials

Material	End Products
Cardboard & waxed cardboard	Packaging
Liquid Paperboard	Printing and writing paper
Magazines	Composted soil conditioners, potting mixes and mulches
Newsprint	Newsprint, packaging, cat litter, insulation, building products and composting
Phonebooks	Newsprint and packaging
Printing & Writing Paper	Packaging and writing paper

4.4.2 Quantities & Trends

The quantity of recovered cardboard and paper material reported for South Australia during 2009-10, and final reprocessing destination for each material, are presented in Table 4.4.3 below.

Figure 4.4.1 overleaf summarises the relative proportions of each material recovered in 2009-10.

Figure 4.4.2, also on the same page, shows the changes in recycling activity of cardboard and paper that have occurred since 2003-04.

The following key points or observations can be made about the reported recycling activity.

- The reported quantity recovered of Cardboard & paper in 2009-10 was approximately 223,000 tonnes. This is an increase of 9% on the quantity reported in 2008-09
  - The 2009-10 data suggests a marked increase in reported recovery of:
    - Cardboard & waxed cardboard – up by about 60,000 tonnes or 56%
    - Liquid Paperboard (LPB) – up by1,500 tonnes or 162%
  - However, the above increases were accompanied by marked decreases in the reported quantities for:
    - Magazines – down 25%
    - Newsprint – down 20%
    - Phone books – down 51%
    - Paper – down 64%
- The reasons for these fluctuations between this and last year are not known but the comments below are considered relevant.
  - Cardboard up but paper down, both substantially.
    - Cardboard collections often include quantities of paper but these are often only reported as cardboard. Paper material may have been hidden in the cardboard quantity reported by industry
  - LPB up substantially.
    - Most of the LPB quantity was derived from kerbside collection processed at Adelaide MRFs. The quantity, but not composition, of cardboard and paper material from the MRFs was reported this year. A material split for cardboard and paper materials therefore had to be assumed. This material split was based on SA LGA Packaging data for 2009-10 (SA Government 2010a). This data is not considered precise.

Table 4.4.3 Cardboard & paper material recovery and reported destination, SA 2009–10

Item	Net recovery[1]	Estimated Reporting Error, ±		Destination (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Cardboard & waxed cardboard	162,000	13,000	8%	2%	88%	10%
Liquid Paperboard	3,900	420	11%	0%	100%	0%
Magazines	5,500	570	10%	0%	100%	0%
Newsprint	32,000	3,100	10%	0%	100%	0%
Phonebooks	2,500	500	20%	0%	100%	0%
Printing & Writing Paper	16,400	900	5%	0%	100%	0%
Total	**222,300**	**18,490**	**8%**	**1%**	**91%**	**7%**

1. Net recovery excludes reprocessing losses

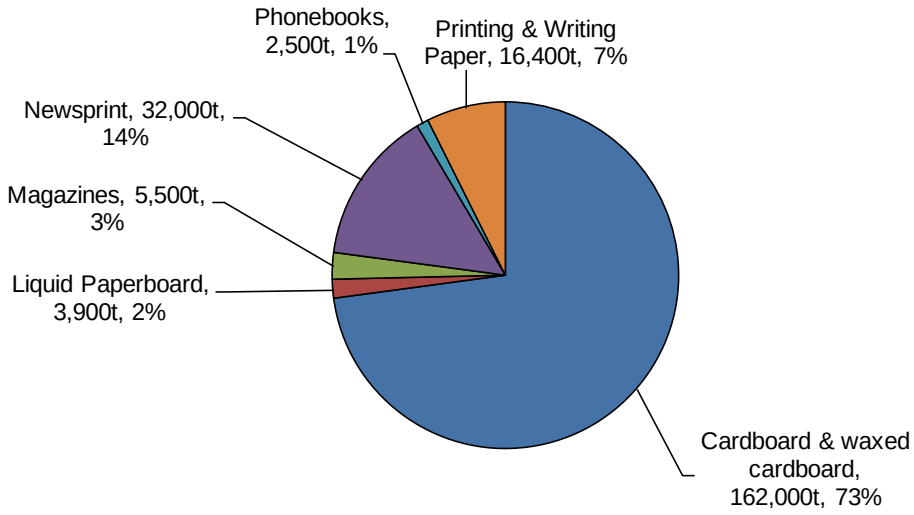

Figure 4.4.1 Composition of recovered Cardboard & paper (by weight), SA 2009–10

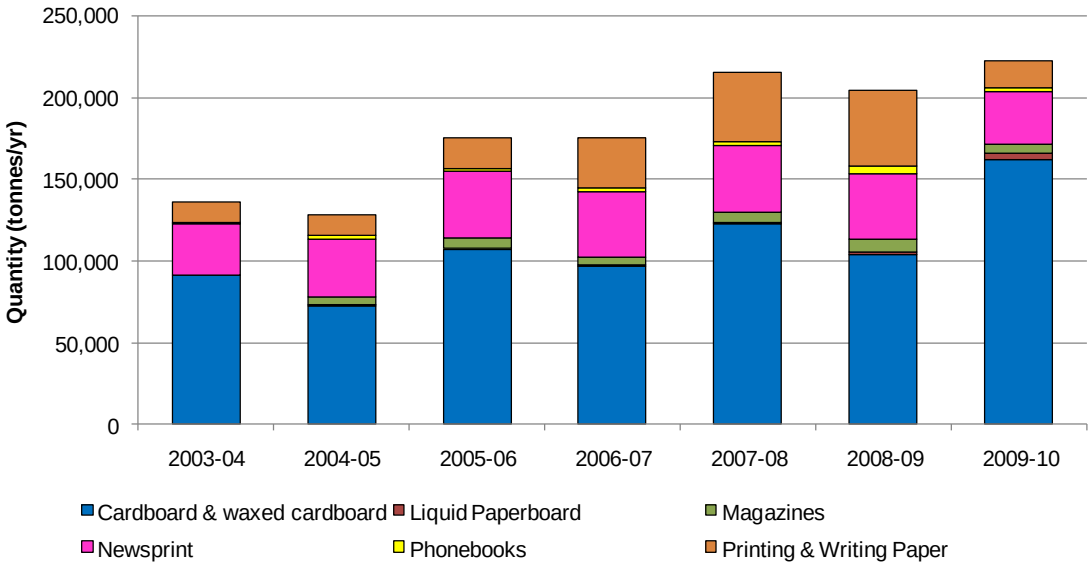

Figure 4.4.2 Changes in reported Cardboard & paper quantities since 2003-04

- This previous comment for LPB also applies, but not as significantly, to variations seen in quantities reported for other cardboard and paper materials during 2009-10.
- Newsprint, Magazines & Phonebooks down.
  - Whilst Newsprint quantity was down, the 2009-10 value is not inconsistent with quantities reported in years preceding 2008-09.
  - This same comment applies to 2009-10 quantities reported for magazines and phone books.
  - The publishing industry has been “light-weighting” its publications, to consume less paper. The extent that this played a role in reduced quantities seen in 2009-10 cannot be determined however.

4.4.3 Re-processing Destinations

Table 4.4.3 includes the final destination reported in 2009-10 for re-processing of Cardboard & paper material.

- Virtually all cardboard & paper material was reported as being sent interstate or exported overseas for re-processing
- There was some local re-processing of cardboard material (approx. 3000 tonnes) for vermiculture.

4.4.4 Sector & Geographical Origin

Table 4.4.4 shows the reported sector and geographical origins for cardboard & paper material recovered during 2009-10. In general, the sector origin for cardboard & paper recovery was split relatively evenly between Municipal and C&I.

- Municipal sources through kerbside collection were dominant for LPB, Magazines, Newspapers and Phonebooks
- C&I sources were foremost for cardboard and waxed cardboard and printing & writing paper

The metropolitan to regional areas split was 89% and 11% respectively.

Table 4.4.4 Cardboard & paper material sector and geographical origins, SA 2009–10

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Cardboard & waxed cardboard	37%	63%	1%	89%	11%
Liquid Paperboard	95%	5%	0%	83%	17%
Magazines	86%	14%	0%	87%	13%
Newsprint	78%	22%	0%	87%	13%
Phonebooks	67%	33%	0%	92%	8%
Printing & Writing Paper	13%	87%	0%	93%	7%
Total	**44%**	**56%**	**1%**	**89%**	**11%**

4.4.5 Industry Barriers

- Recycling activity for cardboard and paper in SA is essentially limited to material recovery.
- It is difficult to see how this might change as significant capital investment is required to build and achieve sufficiently competitive economies of scale in facilities for the re-processing and manufacture of cardboard and paper products.
- These types of facilities can also bring with them significant environmental challenges in terms of water consumption, chemicals and the disposal of waste effluent.
- The key industry barriers therefore lie in effective source separation, collection and transport or waste cardboard and paper materials.
- Very efficient infrastructure and industry arrangement exist in metropolitan areas for cardboard and paper recovery.
- However, regional areas are underprovided:
    - Kerbside collection services for source separate recycled materials are scarce or do not exist.
    - There is limited or no access to MRFs to recover cardboard and paper from comingled material streams that could be collected.

- Low population density and greater transport distances result in higher recovery costs which do not encourage recycling of paper and cardboard which is a much lower-value commodity.

- In view of this, there should be more investigation of local alternatives that could be used for recycling of cardboard and paper at a regional level.

4.4.6 Market Expectations

- The recovery of cardboard and paper is expected to remain relatively stable and slowly expand with population growth in SA, although resumption of growth in C&I economic activity during 2010-11 may increase recovery of cardboard packaging materials from C&I sources.
- In 2008-09 international demand and prices for cardboard and paper materials softened markedly. These conditions are now returning towards pre-GFC levels. This improvement in international conditions may encourage more exporting of cardboard material.

4.5 Plastics

4.5.1 Source & End Products

Tables 4.5.1 and 4.5.2 below give common source and end products identified for resource recovery and recycling of plastics. In SA,

- Large quantities of PET and HDPE and lesser amounts of other plastics originate from consumer packaging obtained from kerbside collection and container deposit recycling.
- Outside of these municipal contributions, the remainder of plastics is largely recovered from industrial sources
- Some mixed plastic material is also recovered from C&D sources.
- There is also high level of reuse of plastic freight packaging in the forms of crates, drums and pallets – this data was not captured by this recycling activity survey.
- SA has some relatively substantial plastics re-processors that take most types of recovered plastic materials and turns them into substitute feedstock to replace virgin materials or manufactured products.
- The exception to this is PET, where there are no local reprocessors and all materials are sent interstate or exported overseas.
- The plastics not used locally are sent interstate or overseas.
- The split between materials sent interstate or overseas strongly depends on demand and price fluctuations in the Australian and international markets for these materials.

Table 4.5.1 Typical sources of recovered plastics

Material	Source products
Polyethylene terephthalate (PET)	Soft drink bottles, fruit juice bottles
High density polyethylene (HDPE)	Milk bottles, sheet liners and covers, manufacturing scrap, other packaging bottles, mobile garbage bins, drums, pipes, crates and pallets
Polyvinyl chloride (PVC)	Manufacturing scrap
Low density polyethylene (LDPE)	Flexible film used as distribution packaging, packaging bottles and manufacturing scrap
Polypropylene (PP)	Manufacturing scrap, rigid packaging applications, pallet strapping and automotive parts
Polystyrene (PS)	Manufacturing scrap, pipe supports, EPS freight packaging and rigid food packaging
Mixed &/or Other plastics (MIX)	Manufacturing scrap and domestic durables

Table 4.5.2 Typical end-products for recycled plastic materials

Material	End Products
Polyethylene terephthalate (PET)	Soft drink bottles, other packaging applications, fibre applications
High density polyethylene (HDPE)	Pallets, agricultural pipes, bins, industrial film, water tanks, crates and mixed polymer timber replacement products
Polyvinyl chloride (PVC)	Floor coverings, pipes, electrical conduit, clothing, shoes, hose fitting and garden hoses
Low density polyethylene (LDPE)	Builders film, damp course linings, garbage bags, retail carry bags, mixed polymer timber replacement products, irrigation piping, timber replacement products and garden furniture
Polypropylene (PP)	Crates, boxes, plant pots, building materials, electrical cable cover, automotive parts, irrigation fittings and mixed polymer timber replacement products
Polystyrene (PS)	Waffle pods, produce boxes, building materials, concrete reinforcement stools, extruded polystyrene and mixed polymer timber replacement products
Mixed &/or Other plastics (MIX)	Various, including composite materials for bollards and posts

4.5.2 Quantities & Trends

The quantity of plastics reported for South Australia during 2009-10, including the reporting error and final reprocessing destination for each material, are presented in Table 4.5.3 below.

Figure 4.5.1 overleaf summarises the relative proportions of plastics recovered in 2009-10.

Figure 4.5.2, also on the same page, shows the changes in recycling activity for plastics since 2003-04.

The following key points or observations can be made about the reported recycling activity for plastics.

- The reported quantity recovered of plastics in 2009-10 was 20,480 tonnes. This is an increase of 48% on the quantity reported in 2008-09
  - The 2009-10 data suggests a marked increase since 2008-09 in reported recovery of HDPE (up 82%), LDPE (up 42%), PP (up 162%) and Mixed &/or other plastics (up 246%).
  - PET has stayed relatively stable since last year.
  - There were significant drops in PVC (-80%) and PS (-63%) in 2009-10.
- This increased plastics recovery is principally attributed to inclusion in the 2009-10 recycling activity survey of a major SA processor not previously reporting.
- However, the decreases seen in PVC and PS are unexplained.
  - One industry source suggested that there was less availability of recycling operations for PVC and PS in the Adelaide market and these materials could now ending up in mixed plastics.
  - However, it could be that the source for this data in previous years was not captured by the 2009-10 survey.

Table 4.5.3 Plastic material recovery and reported destination, SA 2009–10

Item	Net recovery[1]	Estimated Reporting Error, ±		Destination (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Polyethylene terephthalate (PET)	5,500	630	11%	0%	50%	50%
High density polyethylene (HDPE)	4,900	750	15%	91%	3%	6%
Polyvinyl chloride (PVC)	80	16	20%	0%	50%	50%
Low density polyethylene (LDPE)	4,200	140	3%	74%	3%	23%
Polypropylene (PP)	4,000	130	3%	91%	5%	4%
Polystyrene (PS)	200	37	19%	8%	50%	42%
Mixed &/or Other plastics (MIX)	1,600	180	11%	28%	7%	65%
Total	**20,480**	**1,880**	**9%**	**57%**	**17%**	**26%**

1. Net recovery excludes reprocessing losses

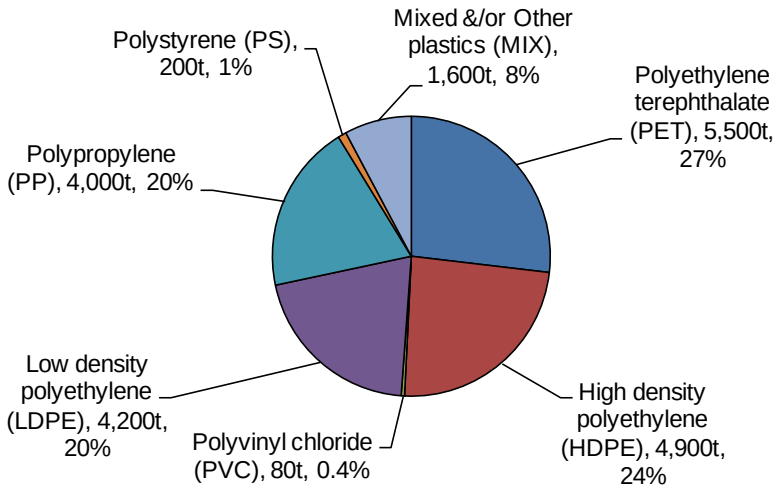

Figure 4.5.1 Composition of recovered plastics (by weight), SA 2009–10

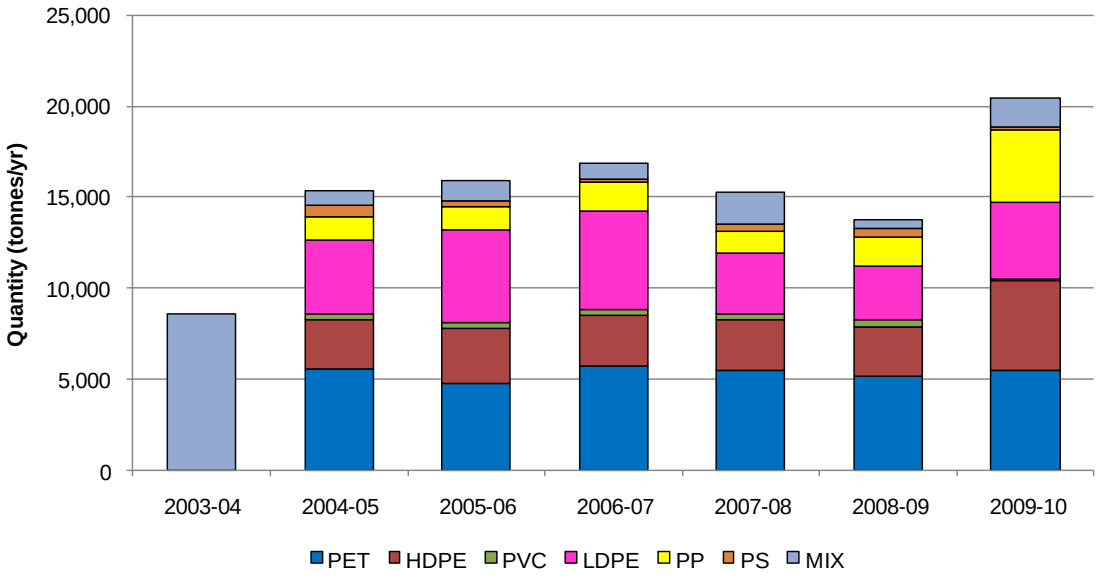

Figure 4.5.2 Changes in reported plastics since 2003-04

4.5.3 Re-processing Destinations

Table 4.5.3 includes the final destination reported in 2009-10 for re-processing of plastics.

- Reprocessing in SA accounts for 57% of all plastic material collected, with most recovered HDPE, LDPE and PP being absorbed by the local reprocessors.
- The balance of the plastic materials is either sent interstate (17%) or overseas (26%). The splits between interstate and overseas destinations for individual plastic materials would depend on relative demand and prices available in local and international markets.

4.5.4 Sector & Geographical Origin

Table 4.5.4 overleaf shows the reported sector and geographical origins for plastic material recovered during 2009-10.

- C&I at 60% was the majority contributor to plastics recovery.
- Municipal sources through kerbside collection and deposit container recycling contributed nearly all of the remainder.
- The impact of kerbside recycling and deposit container recycling can be clearly seen for PET, where 68% of material comes from Municipal sources.
- It can also be observed that all plastic from C&D sources appears to be aggregated and recovered as mixed plastics.

The reported split between metropolitan to regional areas was 89% and 11% respectively.

Table 4.5.4 Plastic material sector and geographical origins, SA 2009–10

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Polyethylene terephthalate (PET)	68%	32%	0%	81%	19%
High density polyethylene (HDPE)	26%	74%	0%	90%	10%
Polyvinyl chloride (PVC)	67%	33%	0%	88%	12%
Low density polyethylene (LDPE)	29%	71%	0%	92%	8%
Polypropylene (PP)	15%	85%	0%	95%	5%
Polystyrene (PS)	83%	17%	0%	87%	13%
Mixed &/or Other plastics (MIX)	49%	24%	27%	87%	13%
Total	**38%**	**60%**	**2%**	**89%**	**11%**

4.5.5 Industry Barriers

The following general challenges to recovery and re-processing of plastic was reported by the industry.

- Continuing issues with contamination: product residues and labels where plastic was used for packaging.
- Rising prices and interstate and overseas competition for plastic materials are making it increasingly difficult for SA re-processors to source local plastic materials at commercially viable prices.
- There is a shrinking manufacturing base and market in Australia for local re-processing of recovered plastic materials.
- The rising Australian dollar which is making exports less competitive and imports cheaper.

4.5.6 Market Expectations

- The bounce-back in prices and economic activity post global financial crisis has improved prospects for consumption and recycling of plastics in the short to medium-term.
- Increasing quantities of plastics recovery are expected to occur as South Australia's population continues to grow.
- However, local re-processors are grappling with the issues raised above and are neutral about long-term future outcomes for their segment of the industry.

4.6 Glass

4.6.1 Source & End Products

Tables 4.6.1 and 4.6.2 below give the typical source and end products identified by industry for resource recovery and recycling of glass. In SA,

- Large quantities of glass are collected from kerbside collections and deposit container recycling
- This collected glass is generally sorted at a MRF, CDL depot or by other glass merchant into different types or grades (i.e. green, flint, amber).
- Unless sent interstate, the glass material is further beneficiated by local re-processor.
- Virtually all glass from South Australia is then re-processed locally into glass bottles and packaging.

Table 4.6.1 Typical sources of recovered glass

Material	Source products
Glass	Building glass, Packaging – beer, wine, food

Table 4.6.2 Typical end-products for recycled glass

Material	End Products
Glass	Bottle manufacture, reflective beads for road marking, aggregate for road base

4.6.2 Quantities & Trends

The quantity of glass reported for South Australia during 2009-10, including the reporting error and final reprocessing destination, are presented in Table 4.6.3 below.

Figure 4.6.1 overleaf shows the changes in recycling activity of glass that have occurred since 2003-04.

The following key points or observations can be made about the reported recycling activity for glass.

- The reported quantity recovered of glass in 2009-10 was 57,000 tonnes. This appears to be a decrease of 7% on the quantity reported in 2008-09.
  - Whilst this value is for glass recovered in SA, there was at least another 20,000 to 30,000 extra tonnes of glass imported from WA and Victoria into SA for re-processing into manufactured products.
  - There were some inconsistencies between reported values for glass beneficiated and re-processed into manufactured products, which means the 2009-10 value could be as high as 75,000 tonnes. The lower value was adopted to be conservative.
  - The 2009-10 value is not inconsistent to values reported prior to 2008-09 and year-to-year fluctuations are within the estimated reporting error.
- There is a growing trend to light weighting manufactured glass products. If this results in significant changes to glass content in manufactured products in Australia, this could eventually lead to lower quantities of glass being recovered.

Table 4.6.3 Glass material recovery and reported destination, SA 2009–10

Item	Net recovery[1]	Estimated Reporting Error, ±		Reprocessing location (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Glass	**57,000**	**10,000**	18%	99%	1%	0%

1. Net recovery excludes reprocessing losses

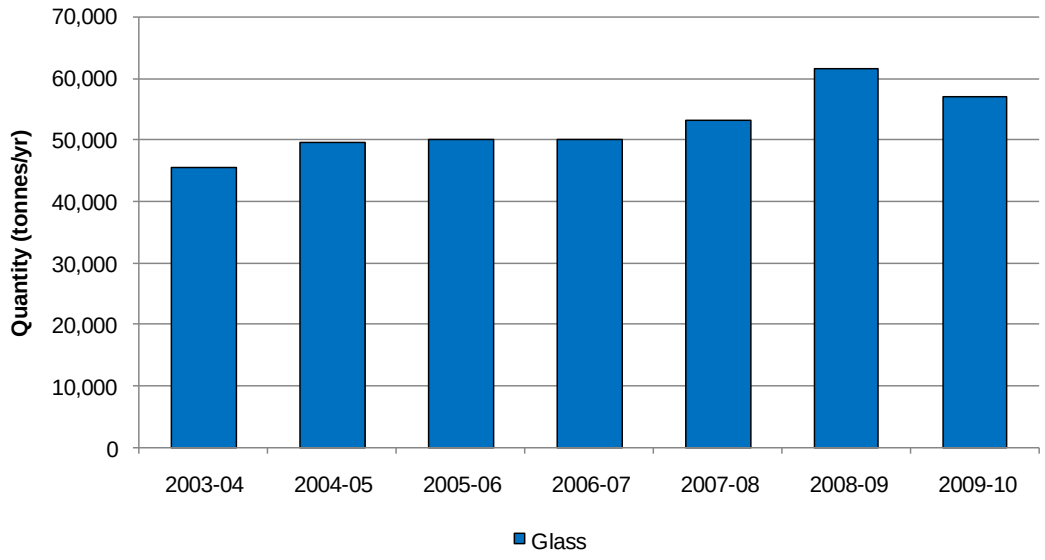

Figure 4.6.1 Changes in reported glass since 2003-04

4.6.3 Re-processing Destinations

Table 4.6.3 includes the final destination reported in 2009-10 for re-processing of glass.

- Virtually all glass material was re-processed in South Australia

4.6.4 Sector & Geographical Origin

Table 4.6.4 below shows the reported sector and geographical origins for glass material recovered during 2009-10.

- Nearly all (79%) glass recovered in South Australia originated from kerbside collections or container deposit recycling

Table 4.6.4 Glass sector and geographical origins, SA 2009–10

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Glass	79%	21%	0%	85%	15%

4.6.5 Industry Barriers

The following general challenges to recovery and re-processing of glass was reported by the industry.

- Securing more quantities of high-quality sorted glass and cullet with low contamination. [Locally-sourced glass was considered superior to imported interstate glass because of the high level source separation systems in SA.] Local re-processors of beneficiated glass have substantial additional demand should more high-quality sorted glass become available.
- Commercial arrangements between re-processors and glass merchants, which were locking out access to local glass supplies for some re-processors.
- Rising energy costs affecting the viability of glass manufacture altogether.

4.6.6 Market Expectations

- The currently strong market is expected to continue
- However, there are concerns about future demand for glass bottles by the local wine industry if this sector contracts. This may impact on the viability of local re-processors.
- The implementation of the NT container deposit legislation may provide additional high quality glass material for beneficiation in SA.

4.7 Other Materials

4.7.1 Source & End Products

Tables 4.7.1 and 4.7.2 below give the typical source and end products identified by industry for resource recovery and recycling of the materials included in the other category. In SA

- Fly ash
  - Sourced from coal-fired power generation.
  - Recycled for cement production.
- Foundry sands
  - Sourced from foundries.
  - Recycled in cement production and manufactured soils.
- Leather & Textiles
  - Sourced from waste clothing, usually obtained from charities.
  - Re-processed and recycled as cleaning clothes.
- Tyres & Rubber
  - Sourced from end-of-life car tyres or other waste rubber materials.
  - Tyres re-treaded, reprocessed to rubber mats or exported for energy production overseas.

Table 4.7.1 Typical sources for recovery of Other materials

Material	Source products
Fly Ash	Coal-fired power generation
Foundry sands	Foundries
Leather & textiles	Clothes, other textiles
Tyres & rubber	Tyres, other rubber products

Table 4.7.2 Typical end-products for recycling of Other materials

Material	End Products
Fly Ash	Cement manufacture, fill , soil stabilisation, fertiliser production
Foundry sands	Cement manufacture, fill , manufactured soils, blending with composts
Leather & textiles	Cleaning clothes
Tyres & rubber	Tyre re-treads, rubber matting, alternative rubber

4.7.2 Quantities & Trends

The quantity of other materials reported for South Australia during 2009-10, including the reporting error and final reprocessing destination for each material, are presented in Table 4.7.3 below.

Figure 4.7.1 overleaf summarises the relative proportions of other materials recovered in 2009-10.

Figure 4.7.2, also on the same page, shows the changes in recycling activity for other materials since 2003-04.

The following key points or observations can be made about the reported recycling activity for other materials.

- Fly ash
  - The reported quantity recovered of fly ash in 2009-10 was 170,000 tonnes. This is a decrease of about 24% on the quantity reported in 2008-09.
- Foundry sands
  - At nearly 12,000 tonnes, reporting of foundry sand has re-emerged in 2009-10. This has been used in cement production.
  - Part of this reported quantity is attributed to a local recycler reporting their data in the 2009-10 survey for the first time.
- Leather & textiles
  - The reported quantity of 3,900 tonnes in 2009-10 is an increase of 28% over 2008-09.
  - This increase is attributed to a new recycler that has emerged since the 2008-09 survey.
- Tyres & Rubber
  - Recovery of tyres has been gradually increasing since 2003-04 and did so again in 2009-10, up 48% to 15,000 tonnes.

Table 4.7.3 Other material recovery and reported destination, SA 2009–10

Item	Net recovery[1]	Estimated Reporting Error, ±		Reprocessing location (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Fly ash	170,000	50,000	29%	100%	0%	0%
Foundry sands	11,900	600	5%	100%	0%	0%
Leather & textiles	3,900	500	13%	0%	79%	21%
Tyres & other rubber	15,000	2,000	13%	8%	19%	73%
Total	**200,800**	**53,100**	**26%**	**91%**	**3%**	**6%**

1. Net recovery excludes reprocessing losses

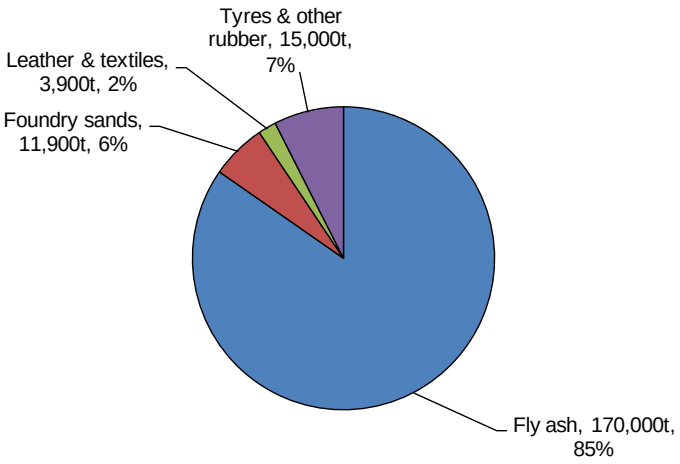

Figure 4.7.1 Composition of recovered other materials (by weight), SA 2009–10

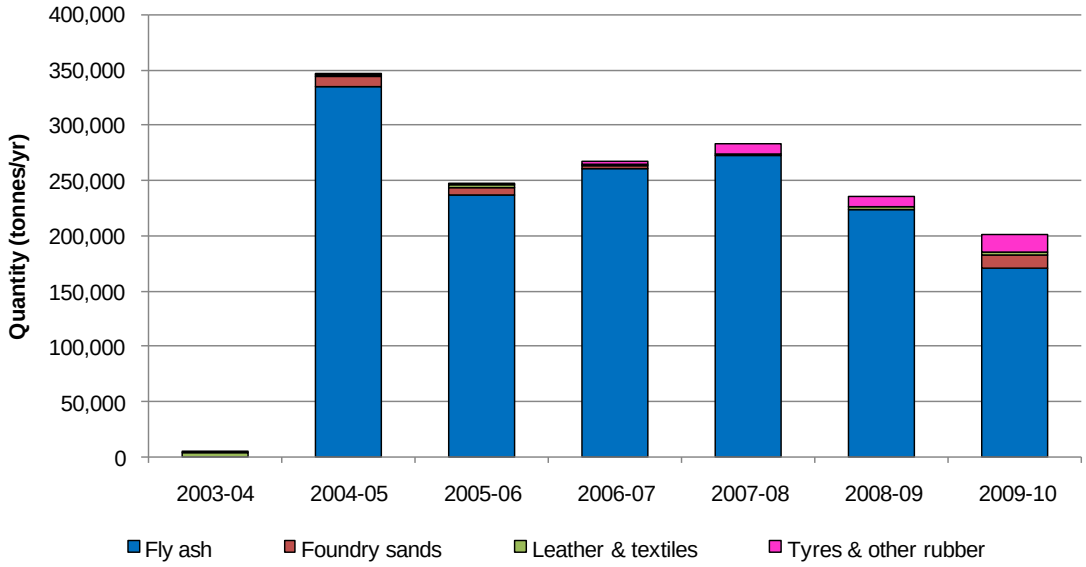

Figure 4.7.2 Changes in reported other materials since 2003-04

4.7.3 Re-processing Destinations

Table 4.7.3 includes the final destination reported in 2009-10 for re-processing of other materials.

- Fly ash and foundry sands – Were re-processed in South Australia, ending up part of manufactured products.
- Leather & Textiles – All of this material was sent interstate or overseas for re-processing into cleaning clothes. [All of this re-processing ends up taking place overseas.]
- Tyres & rubber – Most of this material (92%) was sent interstate or overseas. Part of the material sent interstate was being re-processed into a rubber-based product, with the rest was exported overseas from an interstate port. The rubber material exported from Australia usually ends up being recycled as a fuel for energy production.

4.7.4 Sector & Geographical Origin

Table 4.7.4 shows the reported sector and geographical origins for other materials recovered during 2009-10.

- C&I was the sole source reported for all of the other materials.
- All of the fly ash was sourced from a single source outside of Adelaide.

Table 4.7.4 Other material sector and geographical origins, SA 2009–10

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Fly ash	0%	100%	0%	0%	100%
Foundry sands	0%	100%	0%	100%	0%
Leather & textiles	0%	100%	0%	90%	10%
Tyres & other rubber	0%	100%	0%	90%	10%
Total	**0%**	**100%**	**0%**	**14%**	**86%**

4.7.5 Industry Barriers

The following general challenges to recovery and re-processing for several of the other materials was reported by the industry.

- Fly ash
  - The trend of decreasing quantities of fly ash may continue. Re-processors that use this material are already importing significant quantities from interstate.
- Foundry sands
  - The price for foundry sands re-processors can afford to pay is finely balanced with the cost of landfill disposal for foundries. This issue was considered responsible for the absence of foundry sands recovery reported in 2008-09.
  - Metal contaminants in foundry sand, making the material not suitable for recycling without costly treatment first.
- Tyres & rubber
  - Local re-processing is being inhibited because higher returns can be obtained by exporting the rubber material.

4.7.6 Market Expectations

- Fly ash
  - Available quantities from South Australia are anticipated to slowly decline and more material will need to be imported from interstate.
- Foundry sands
  - The increases in landfill levy will probably tip the balance in favour of recycling these materials.
  - However, the shrinking manufacturing base in South Australia may mean reduced local availability of this resource.

- Tyres & rubber
    - The landfill ban on tyres introduced in September 2010 under South Australia's new Waste-to-Resources EPP[13] will mean greater demand for recycling of these materials.

[13] SA Government (2010b); Environment Protection (Waste to Resources) Policy 2010

4.8 E-waste

4.8.1 Source & End Products

Tables 4.8.1 and 4.8.2 below give the typical source and end products identified for resource recovery and recycling of e-waste materials. In SA,

- Virtually all e-waste materials are dismantled and disassembled into their material constituents, such as metal, plastics and other materials/commodities, which are then sent for re-processing.
- However, common exceptions are:
  - Printer cartridges – which can be refilled and reused.
  - Computers – Where the whole computer or constituent components may also salvaged and or reused.
- There is currently considerable and growing interest and activity in e-waste recycling given the hazardous materials these items can contain.
  - Local government and Zero Waste SA have been jointly involved in organising e-waste collection events for the general public in metropolitan and regional areas.
  - A number of local commercial collectors are offering e-waste collection services.
  - A national Product stewardship scheme is being developed to manage end-of-life televisions / monitors.[14]
  - Several industries sectors or companies that sell electronic and electrical items already run their own voluntary product stewardship or return schemes.

Table 4.8.1 Typical sources of e-waste materials

Material	Source products
Printer cartridges	Empty or redundant ink-jet or laser printers
Compact fluorescent lamps	End-of-life lighting
Batteries	End-of-life lighting primary & secondary consumer batteries. Excludes automotive batteries
Computers	End-of-life computer equipment, accessories and peripherals
Televisions / Monitors	End-of-life CRT, LCD or LED televisions or computer monitors
Mobile phones	End-of-life mobile phones, including accesories and batteries
Other e-waste	All other end-of-life electrical and electronic equipment, including household electrical appliances

Table 4.8.2 Typical end-products for e-waste materials

Material	End Products
Printer cartridges	Re-filled cartidges, dissasembly to material constituents for re-processing
Compact fluorescent lamps	Dissasembly to various material constituents for re-processing
Batteries	Shredding and/or dissasembly to plastic, metal and other constituents for re-processing
Computers	Salvage and/or refubishment for reuse of components, Shredding and/or dissasembly to plastic, metal and other constituents for re-processing
Televisions / Monitors	Shredding and/or dissasembly to plastic, metal and other constituents for re-processing
Mobile phones	Shredding and/or dissasembly to plastic, metal and other constituents for re-processing
Other e-waste	Shredding and/or dissasembly to plastic, metal and other constituents for re-processing

[14] Environment Protection and Heritage Council (2009); Decision Regulatory Impact Statement: Televisions and Computers

- There are also not-for-profit environmental organisations, such as Planet Ark, running their own e-waste collection campaigns, usually in conjunction with industry and retail partners.
- There are companies, both in South Australia and interstate, which accept the collected e-waste from SA and dismantle it into its constituent materials, which can then be sent for re-processing or further resource recovery.
- Under its new Waste-to-Resources EPP (SA Government, 2010b), South Australia is to progressively moving towards banning landfill disposal of all e-waste items in the period between September 2011 and September 2013.

4.8.2 Quantities & Trends

The quantity of e-waste materials reported for South Australia during 2009-10, including the reporting error and final reprocessing destination for each material, are presented in Table 4.8.3 below.

As there were not many data points reported for each item, the destination analysis, as well as the sector and geographical origins analysis were aggregated.

Figure 4.8.1 overleaf summarises the relative proportions of the e-waste material recovered in 2009-10.

The following key points or observations can be made about the reported recycling activity for e-waste.

- The total quantity of e-waste reported in the 2009-10 survey was 1,805 tonnes.
- The major constituents by weight were computers (51%), televisions/monitors (26%) and other e-waste items (11%).
- However, printer cartridges also made a sizeable contribution (7%), reflecting its high use as a consumable item.

Table 4.8.3 E-waste material recovery and reported destination, SA 2009–10

Item	Net recovery[1]	Estimated Reporting Error, ±		Destination (%)		
	tonnes	tonnes	%	SA	Interstate	Overseas
Printer cartridges	90					
Compact fluorescent lamps	25					
Batteries	20					
Computers	1,060					
Televisions / Monitors	440					
Mobile phones	20					
Other e-waste	150					
Total	**1,805**	**280**	16%	47%	45%	8%

1. Net recovery excludes reprocessing losses

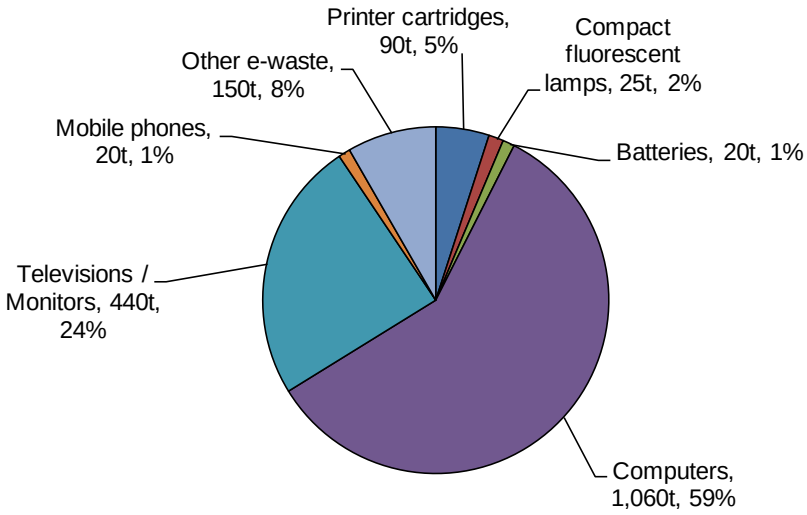

Figure 4.8.1 Composition of recovered e-waste (by weight), SA 2009–10

4.8.3 Re-processing Destinations

Table 4.8.3 includes the final destination reported in 2009-10 for re-processing of e-waste materials.

- Whilst the destination for 63% of the materials is reported as South Australia, this does not necessarily involve reprocessing.
  - This is the destination of dissembled metal, plastic and other material constituents, which are disposed of to local aggregators/merchants.
  - These local aggregators/merchants then determine where the material will be re-processed.
  - In this first assessment, it was not possible to discern the ultimate re-processing destination for all of these materials.

4.8.4 Sector & Geographical Origin

Table 4.8.4 below shows the reported sector and geographical origins for e-waste recovered during 2009-10.

- The majority (36%) of the e-waste originated from Municipal sources through e-waste or hazardous waste collections organised by Local Government and/or Zero Waste SA.
- The balance was e-waste came from C&I sources via commercial collections from government or business.

The estimate split between e-waste material sourced from metropolitan and regional areas was 91% and 9%, respectively.

Table 4.8.4 E-waste sector and geographical origins, SA 2009–10

Item	Sector Origin (%)			Geographical Origin (%)	
	Municipal	C&I	C&D	Metropolitan Area	Regional
Total	**64%**	**36%**	**0%**	**91%**	**9%**

4.8.5 Industry Barriers

The following general challenges to recovery and re-processing of e-waste materials was reported by the industry.

- In general the cost of resource recovery for e-waste exceeds the market value of the constituent materials that can be recovered.
- This means that gate fees need to be charged, which can deter disposal by recycling. This issue will be partially resolved through the introduction Product Stewardship schemes and landfill bans which oblige both producers and consumers to correctly dispose of e-waste items.
- Manual disassembly is safest and most efficient method for maximising resource recovery and minimising contamination, but high labour costs mean that some companies interstate are simply shredding e-waste items whole. Shredding is said to reduce resource recovery efficiency.
- The general public is still largely uneducated about correct disposal and the benefits of recycling e-waste
- Collection depots, systems and infrastructure are still largely undeveloped and inconvenient for the public to access.
- There are onerous and costly regulatory requirements for on-site storage of e-waste items. These requirements are perceived to be unevenly applied between licensed e-waste recyclers and scrap metal merchants, who also accept e-waste items but may not properly handle and dispose of them.

4.8.6 Market Expectations

- The e-waste resource recovery sector is rapidly expanding and this growth will accelerate when new product stewardship schemes and landfill bans in South Australia are introduced.
- A recent report for the Australian Department of the Environment, Heritage, Water and the Arts (2010) has projected that e-waste recovery in Australia could substantially increase, almost by a factor of 8 times current levels, within 5-10yrs.
- The perception of the future market potential is therefore very positive, so long as some of the above challenges/issue can be successfully overcome.

5 Packaging materials

5.1 Introduction

This section of the report provides a summary of packaging recovery that was achieved by South Australia in 2009-10. The packaging recovery data is extracted from both industry and reference data collected during the recycling activity survey.

As such, the quantities identified in this section are not in addition to material quantities reported in Section 4, but are a sub-set that provides more specific information on packaging recovery. The method for determining these packaging rates was outlined in Section 2.

5.2 Packaging recovery overview

Estimated packaging recovery in SA during 2009-10 is summarised in Table 5.1 below. Total packaging recovery was estimated at 220,900 tonnes, of which 50,090 tonnes (23%) was recovered through the container deposit system, and 170,780 tonnes (77%) was recovered from other sources.

This represents an increase of 20% on the packaging recovery of 183,700 tonnes reported in 2008-09. The substantial portion of this increase is attributed to the greater quantities (up 40%) of post-consumer cardboard that were reported in 2009-10. The container deposit recovery in 2009-10 has also increased (up 6%) over that reported in 2008-09.

Table 5.1 Estimated packaging recovery, SA 2009–10

Masonry	Origin (tonnes)		Total (tonnes)
	Container Deposit	Other	
Steel Cans		2,210	2,210
Aluminium Cans	3,900		3,900
Cardboard Packaging		145,800	145,800
Liquid Paperboard Cartons	830	2,900	3,730
PET Packaging	4,700	780	5,480
HDPE Packaging	160	820	980
PVC Packaging		80	80
LDPE Packaging		250	250
Polypropylene Packaging		340	340
Polystyrene Packaging		200	200
Other Plastics packaging		700	700
Glass bottles & jars	40,500	16,700	57,200
Total	**50,090**	**170,780**	**220,870**

5.3 Container deposit packaging

South Australia remains the only state or territory to have a container deposit system for return of recyclable bottles and cans.

Figure 5.1 below illustrates the relative proportions of the returned recycled deposit containers. The major constituent by weight was glass at 80%.

Table 5.2 below gives the return rates achieved for recycled deposit containers in 2009-10. The average return rate in 2009-10 was 83% (by weight) from approximately 770 million containers (estimated as used in SA during this period).

This return rate is a 6% improvement on the value (78%) seen in 2008-09 (for nearly the same number of containers used). The improvement in container deposit return rate seen in 2009-10 may reflect the change in container deposit from 5¢ to 10¢, which commenced on 1 September 2008 and therefore was operating over the full 2009-10 financial year.

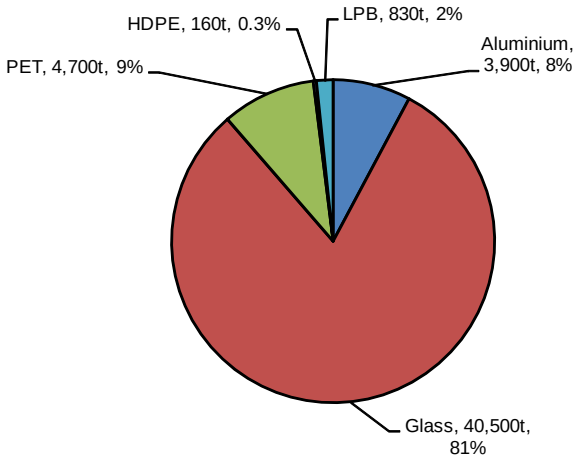

Figure 5.1 Relative proportions of returned recycled deposit containers (by weight), SA 2009–10

Table 5.2 Return rates for recycled deposit containers, SA 2009–10

	Recovered	
Material	**tonnes**	**%**
Aluminium	3,900	86%
Glass	40,500	84%
PET	4,700	74%
HDPE	160	61%
LPB	830	58%
Total	**50,090**	**83%**

5.4 Other packaging material

Other packaging material is collected through other routes such as kerbside recycling and commercial collections. Figure 5.2 below summarises the relative proportions of the other packaging materials. The major constituent of the other packaging material was cardboard materials.

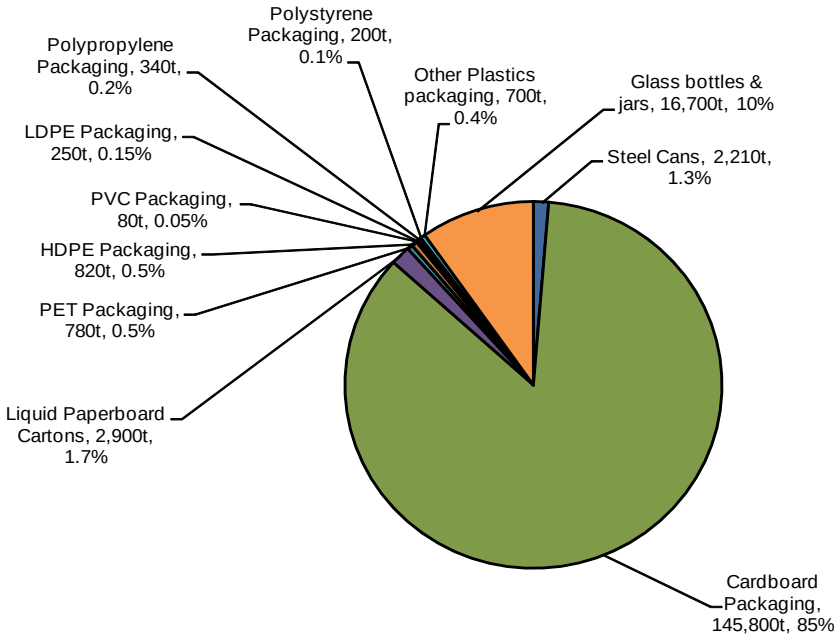

Figure 5.2 Relative proportions of recovered other packaging by weight, SA 2009–10

6 Environmental Benefits of Recycling

6.1 Introduction

This section quantifies the following environmental benefits of recycling based on the material data collected for the 2009-10 recycling activity survey and the conversion and emission factors given in Appendix 2. The environmental benefits have been calculated for each material except e-waste and reuse items.

- ***Greenhouse Gas Savings*** (quantified as tonnes of CO_2-e) – The reduction in greenhouse emission achieved by replacing virgin materials with recycled materials.
- ***Cumulative Energy Demand saved*** (as Gigajoules (GJ) – The amount of energy saved, including all fossil, renewable, electrical and embodied energy, by using recycled materials.
- ***Water Savings*** (as kL H2O) – The savings in water consumption by substituting recycled materials that would otherwise be required if virgin materials had been used.

The estimated environmental benefits achieved by recycling in South Australia, 2009-10, for each of the above are given in Table 6.1 overleaf.

6.2 Greenhouse Gas Savings (or avoided emissions)

Recycling reduces Greenhouse Gas (GHG) emissions primarily by:

- Decreasing the amount of energy used by industry to make products compared with using virgin raw materials. The majority of energy supplied to South Australia is still generated using fossil fuels, which produce greenhouse gas emissions.
- Reduced emissions of greenhouse gases achieved from diverting recovered materials from landfills (e.g. methane). This is particularly relevant to organics-based and putrescible materials which biologically decompose in landfill.

The estimated greenhouse gas savings (in tonnes CO_2-e) achieved by recycling of each material in South Australia for 2009-10 are included in Table 6.1 overleaf, and are also summarised by material category in Table 6.2 overleaf. Figure 6.1, two pages over, illustrates the relative contributions of each material category to these greenhouse gas savings.

- The total estimated greenhouse gas savings from recycling in South Australia during 2009-10 is about 1 million tonnes of CO_2-e.
  - This is an increase of about 9% on the value reported for 2008-09.
  - The higher estimated greenhouse gas savings is a combination of several factors:
    - An increase in reported material recovery.
    - Specifically, the large increases in reported recovery for metals and organic materials. [Note: The contribution for Industry Organics was not included in the environmental benefits analysis]
  - Metals (at 57%) contribute disproportionately to greenhouse gas savings over other recovered materials because a virgin metal is highly energy intensive to manufacture. The greenhouse gas savings per unit tonne delivered by recycling metals far outstrip the relative contributions made by other materials.

Table 6.1 Estimated environmental benefits as a result of recycling in SA, 2009-10

	Material	Material Quantity tonnes	GHG Emissions Saved tonnes CO_2-e	Energy Saved TJ LHV	Water Saved ML
	Masonry				
1	Asphalt	131,000	2,100	267	115
2	Bricks	77,000	700	9	97
3	Concrete	790,000	22,900	436	1,011
4	Plasterboard				
5	Clay, fines, rubble & soil	250,000	21,600	169	110
	Metals				
6	Steel	334,000	209,600	2,652	-788
7	Aluminium	18,200	268,900	3,114	3,308
8	Non-ferrous metals	23,600	80,100	852	141
	Organics				
9	Food Organics	5,800	3,000	9	4
10	Garden Organics	220,000	50,700	103	106
11	Timber	262,000	86,100	345	142
12	Organics - Other	148,000	71,200	320	34
	Cardboard & paper				
13	Cardboard & waxed cardboard	162,000	49,300	2,030	5,353
14	Liquid Paperboard	3,900	2,500	36	63
15	Magazines	5,500	2,600	50	122
16	Newsprint	32,000	14,900	290	709
17	Phonebooks	2,500	600	31	83
18	Printing & Writing Paper	16,400	9,500	213	510
	Plastics				
19	Polyethylene terephthalate	5,500	5,700	279	-116
20	High density polyethylene	4,900	3,400	274	-17
21	Polyvinyl chloride	80	100	3	5
22	Low density polyethylene	4,200	2,900	235	-15
23	Polypropylene	4,000	6,600	235	-52
24	Polystyrene	200	300	12	-4
25	Mixed &/or Other plastics	1,600	2,200	97	-28
	Glass				
26	Glass	57,000	34,000	366	138
	Other Materials				
27	Fly ash	170,000	4,900	94	214
28	Foundry sands	11,900			
29	Leather & textiles	3,900			
30	Tyres & other rubber	15,000	17,800	1,007	787
	Total	**2,760,000**	**974,200**	**13,529**	**12,032**

Table 6.2 Estimated greenhouse gas savings as a result of recycling in SA, 2009-10

Sector Origin	GHG Emissions Saved tonnes CO_2-e	Equivalent trees planted required for carbon absorption	Equivalent cars off the road (1 year)
Masonry	47,300	71,000	10,900
Metals	558,600	835,000	128,500
Organics	211,000	315,000	48,500
Cardboard & paper	79,400	119,000	18,300
Plastics	21,200	32,000	4,900
Glass	34,000	51,000	7,800
Other Material	22,700	34,000	5,200
Total	**974,200**	**1,457,000**	**224,100**

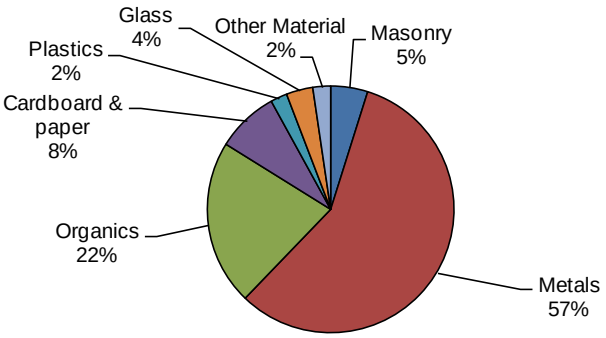

Figure 6.1 Avoided greenhouse gas emissions (by material category), as a result of recycling in SA 2009-10

- These greenhouse gas savings are considered approximately equivalent to:
  - 1.5 million trees that would have to be planted to absorb the same amount of CO_2.
  - The greenhouse gas emissions that 225,000 cars would produce in a single year[15].
- The greenhouse gas savings from SA recycling, 2009-10, equate to:
  - Approximately 11% of South Australia's total Community sector GHG emissions in 2007[16].

6.3 Energy Savings

The projected energy savings (in Terajoules or TJ[17]) achieved by recycling of each material in South Australia for 2009-10 are included in Table 6.1, and are also summarized by material category in Table 6.3 overleaf. Figure 6.2, also overleaf, illustrates the relative contributions of each material category to these energy savings.

- The total projected energy savings from recycling in South Australia during 2009-10 was 13,530 TJ.
  - Metals again contribute disproportionately, at 49%, to projected energy savings even though they represent only 12% of the material being recovered in SA.
  - Similarly, plastics contribute to 8% of energy savings even though <1% of the material recovered
  - Behind metals, Cardboard & paper (at 20%) is the next most significant contributor to energy savings
- These energy savings are considered approximately equivalent to:
  - Energy use by 263,000 average households in one year.[18]
  - The energy supplied by 2.4 million barrels of oil.
- The energy savings from SA recycling, 2009-10, equate to:
  - Approximately 4.3% of South Australia's total energy consumption reported for 2006-07.[19]

[15] Average car GHG emissions value ≈ 4.25 tonnes CO_2-e/yr; Source: SA 2008-09 Recycling Activity report (Zero Waste SA, 2010)

[16] The Community sector includes GHG emission associated with residential energy use, landfill and wastewater management, and passenger vehicle use; Source: SA DP&C (2009), Report on the operation of the 'Climate Change and Greenhouse Emissions Reduction Act 2007.

[17] 1 Terajoule or TJ = 10^{12} Joules (J) = 1,000 Gigajoules (GJ)

[18] Average household energy use value ≈ 51.4 GJ/yr; Source: National Appliance and Equipment Energy Efficiency Committee (1998)

[19] Source: DRET (2009), Energy in Australia, 2009

Table 6.3 Estimated energy savings as a result of recycling in SA, 2009-10

Sector Origin	Energy Saved TJ LHV	Equivalent households (1 year)	Barrel of Oil Equivalents (BOE)
Masonry	881	17,100	155,000
Metals	6,618	128,700	1,161,000
Organics	778	15,100	137,000
Cardboard & paper	2,650	51,600	465,000
Plastics	1,135	22,100	199,000
Glass	366	7,100	64,000
Other Material	1,101	21,400	193,000
Total	13,529	263,100	2,374,000

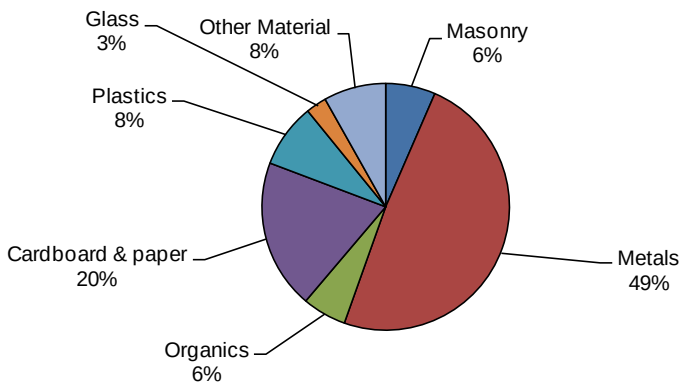

Figure 6.2 Avoided energy consumption (by material category) as a result of recycling in SA, 2009-10

6.4 Water Savings

The estimated water savings (in Megalitres or ML[20]) achieved by recycling of each material in South Australia for 2009-10 are included in Table 6.1, and are also summarized by material category in Table 6.4 overleaf. Figure 6.3, also overleaf, illustrates the relative contributions of each material category to these water savings.

- The total projected water savings from recycling in South Australia during 2009-10 was 12,032 ML.
  - Cardboard & paper contribute most significantly (at 55%) to water savings achieved from recycling. The manufacture of virgin cardboard and paper materials consumes large volumes of water.
  - Metals are also a significant contributor at 21%. These water savings principally result from recycling of aluminum which consumes substantial quantities of water in its manufacturing process
  - Recycling of some plastics consume more water than they save

[20] 1 Megalitre or ML = 10^6 Litres (J) = 1,000 kilo-Litres (kL)

Table 6.4 Estimated water savings as a result of recycling in SA, 2009-10

Sector Origin	Water saved ML	Equivalent households (1 year)	Olympic Swimming Pools
Masonry	1,334	7,020	530
Metals	2,661	14,000	1,060
Organics	285	1,500	110
Cardboard & paper	6,840	36,000	2,740
Plastics	-226	-1,190	-90
Glass	138	730	60
Other Material	1,001	5,270	400
Total	12,032	63,330	4,810

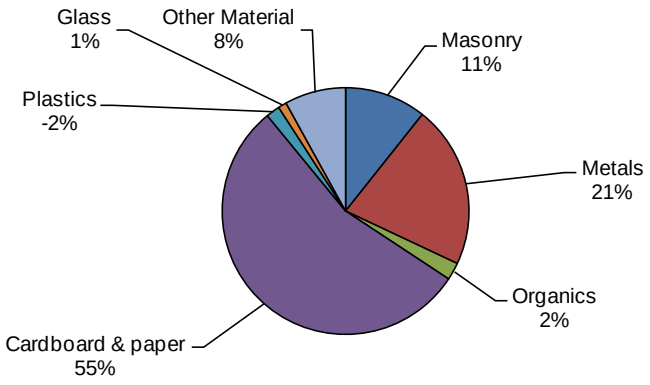

Figure 6.3 Avoided water consumption (by material category) as a result of recycling in SA, 2009-10

- These water savings are considered approximately equivalent to:
  - Water use by 63,300 average Adelaide households in one year.[21]
  - The water contained in 4,800 Olympic-sized swimming pools.[22]
- The water savings from SA recycling, 2009-10, equate to:
  - Approximately 9% of Metropolitan Adelaide's total water consumption reported for 2009.[23]

[21] Average household water consumption value ≈ 190 kL/yr; Source: SA Government (2009)

[22] Olympic-sized pool value ≈ 2,500 kL/yr

[23] Source: SA Government (2010); News Release, 2 January 2010: WATER CONSUMPTION REMAINS BELOW TARGET

7 Glossary[24]

Alternative fuel	A fuel usually derived from renewable sources, used as an alternative to fossil fuels.
Bio-solids	Waste organic solids derived from biological wastewater treatment plants.
Container deposit	Sometimes referred to as container deposit legislation or CDL. A refundable charge imposed on a range of recyclable beverage containers. The deposit is included in the retail price and refunded when the container is returned to a collection point.
Commercial and industrial waste (C&I)	Comprises solid waste generated by the business sector as well as solid wastes created by state and federal government entities, schools and tertiary institutions. Unless otherwise noted, C&I waste does not include waste from the construction and demolition (C&D) sector.
Construction and demolition waste (C&D)	Includes waste from residential, civil and commercial construction and demolition activities, such as fill material (e.g. soil), asphalt, bricks and timber. C&D waste excludes construction waste from owner/occupier renovations, which are included in the municipal waste stream. Unless otherwise noted, C&D waste does not include waste from the commercial and industrial waste stream.
e-waste	End-of-life electrical and electronic equipment, including computers, televisions, monitors, household electrical appliances, batteries (but not automotive), etc.
Ferrous metals	Metals with iron as the major constituent.
Fly ash	Inorganic residue of coal combustion in power stations.
Food organics	Organic waste derived from food preparation and/or surplus food.
Garden organics	Organics derived from garden sources e.g. grass clippings, tree prunings.
Greenhouse gasses (GHGs)	For the purposes of this report GHGs are the six gases listed in the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (NO), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6).
High density polyethylene (HDPE)	A member of the polyethylene family of plastics and is used to make products such as milk bottles, pipes and shopping bags. HDPE may be coloured or opaque.
Industry organics	Organic materials recovered as a waste by-product of industrial processing of organically materials, e.g. Wine, meat, dairy, etc.
Kerbside collection	Collection of household waste, recyclable materials (separated or co-mingled), and organic waste that are left at the kerbside for collection by local council collection services.
Liquid paperboard	Liquid paperboard is made from cardboard or paperboard with a liquid-proof wax, plastic or foil coating on one or both sides. It is commonly used for packaging of liquid materials, such as milk, fruit juice, cream and/or detergents or providing water resistance to other types of packaging.
Low density polyethylene (LDPE)	A member of the polyolefin family of plastics. It is a flexible material and usually used as film for packaging or as bags.
Municipal waste	Solid waste generated from domestic (household) premises and council activities such as street sweeping, litter and street tree lopping. May also includes waste dropped off at recycling centres, transfer stations and construction waste from owner/occupier renovations.
Non-ferrous metals	Those metals that contain very little or no iron, e.g. copper, brass, bronze, lead, etc.
Packaging	Material used for the containment, protection, marketing or handling of product.
Polyethylene terephthalate (PET)	A clear, tough, light and shatterproof type of plastic, used to make products such as soft drink bottles, film packaging and fabrics.
Polypropylene (PP)	A member of the polyolefin family of plastics. PP is light, rigid and glossy and is used to make products such as washing machine agitators, clear film.
Polystyrene (PS)	A member of the styrene family of plastics. PS is easy to mould and is used to make refrigerator and washing machine components. It can be foamed to make single use packaging, such as cups, meat and produce trays.
Polyvinyl chloride (PVC)	A member of the vinyl family of plastics. PVC can be clear, flexible or rigid and is used to make products such as fruit juice bottles, credit cards, pipes and hoses.
Post-consumer material	Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

[24] A number of the definitions in this Glossary were re-produced from the SA 2008-09 Recycling Activity survey (Zero Waste SA, 2010)

Pre-consumer material	Material diverted from the waste stream during a manufacturing processes for reprocessing at a different site. Excluded are waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap).
Recovered material	Material that would have otherwise been disposed of as waste, but has instead been collected and reclaimed as a material input, in lieu of a new primary material, for a recycling or manufacturing process.
Recycling	Material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product. The term recycling is used to cover a wide range of activities, including collection, sorting, reprocessing and manufacture into new products. Waste materials that are reclaimed and reutilised within the same manufacturing processes that generated it as a matter of course to the efficient operation of the site (i.e. process scrap) are not defined as recycling for the purpose of this study.
Reprocessing	Changing the physical structure and properties of a waste material that would otherwise have been sent to landfill, in order to allow it to be reused or re-incorporated into manufactured products.
Reuse	Reuse involves recovering value from a discarded resource in its original state without reprocessing or remanufacture.
Solid waste	Waste materials ranging from municipal garbage to industrial waste, but excluding gaseous, liquid, hazardous, clinical and intractable wastes.
Waste Hierarchy	An internationally recognised aspirational framework for managing waste generation and disposal that is a guiding principle of South Australia's Waste Strategy. Levels in order of precedence in the hierarchy include: Avoid, Reduce, Reuse, Recycle, Recover, Treat, Disposal.

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Appendix 1: 2009-10 Recycling Activity Survey Questionnaire

Government of South Australia
Zero Waste SA

Survey Questionnaire – Recycling Activity in SA, 2009-10

Issued:

1. Survey Company & Contact Details

Rawtec Pty Ltd (www.rawtec.com.au)

- Chris Colby, Principal Consultant, p: (08) 8294 5571, m: 0410 088 839, e: chris.colby@rawtec.com.au
- Mark Rawson, Principal Consultant, p: (08) 8294 5571, m: 0447 772 970, e: mark.rawson@rawtec.com.au

2. Survey Questions for Period 1 July 2009 - 30 June 2010

1.	Your company or organisation's contact address and details
2.	For each relevant material listed in the table overleaf:
	a. Estimated quantities of materials received for recycling from • SA-Metro & SA-Regional
	b. The quantities re-processed or re-used at your SA facilities?
	c. The quantities sent to facilities elsewhere for re-processing: • In SA, Interstate & Overseas
	d. The quantities stockpiled at beginning and end of financial year
	e. The estimated accuracy of the above data, e.g. ±10%
	f. The % waste by-product (if any) generated from recovery or re-processing to landfill
3.	Location(s) of your main facility(ies) for re-processing or handling of materials
4.	The approximate number of people employed by your operations
5.	The major sources of each material, e.g. Municipal, C&I, C&D, etc.
6.	The major destinations for each material, e.g. industry sector, recycled product, etc.
7.	Have there been any significant changes in quantities, sources or destinations from last financial year?
8.	The amount of material that was packaging-derived waste or is recycled for packaging
9.	Your opinion about the market strength/prospects for recycled materials
10.	Does your company or organisation intend to expand or contract its SA facilities? If yes, what will this involve
11.	Are there any significant barriers, e.g. market, regulatory, technology, for your SA operations?
12.	The other major players in your area of the SA recycling industry?

Scheduled Closing Date for Survey Returns:

Table: List of Materials for 2009-10 Recycling Activity Survey

Category	ID	Material
A	***Masonry***	
	1	Asphalt
	2	Bricks
	3	Concrete
	4	Plasterboard
	5	Clay, fines, rubble & soil
B	***Metals***	
	6	Steel
	7	Aluminium
	8	Non-ferrous metals
C	***Organics***	
	9	Food Organics
	10	Garden Organics
	11	Timber
	12	Meat Rendering
	13	Organics - Other
D	***Cardboard & paper***	
	14	Cardboard & waxed cardboard
	15	Liquid Paperboard
	16	Magazines
	17	Newsprint
	18	Phonebooks
	19	Printing & Writing Paper
E	***Plastics***	
	20	Polyethylene terephthalate [PIC 1]
	21	High density polyethylene [PIC 2]
	22	Polyvinyl chloride [PIC 3]
	23	Low density polyethylene [PIC 4]
	24	Polypropylene [PIC 5]
	25	Polystyrene [PIC 6]
	26	Mixed &/or Other plastics [PIC 7]
F	***Glass***	
	27	Glass
G	***Electronic Waste***	
	28	Printer cartridges
	29	Compact fluorescent lamps
	30	Batteries
	31	Computers
	32	Televisions / Monitors
	33	Mobile phones
	34	Other e-waste
H	***Alternative Fuels***	
	35	Alternative Fuel
I	***Waste Materials***	
	36	Waste Grease & Fat
	37	Waste Sludge & Bio-solids
G	***Re-use Materials***	
	38	Auto-Parts
	39	Home Furnishings & Goods
	40	Clothes
	41	Food Products
H	***Other Materials (exc. e-waste)***	
	42	Fly ash
	43	Foundry sands
	44	Leather & textiles
	45	Tyres & other rubber

Appendix 2: 2009-10 Environmental Benefits Conversion & Emission Factors

Table A2.1 Emission and conversion factors adopted for estimation of environmental benefits of recycling, SA 2009-10

	Material	GHG Emissions Saved		Energy Saved		Water Saved	
		Emission factor (t CO2-e/t)	*Note*	*Conversion factor (GJ LHV/t)*	*Note*	*Conversion factor (kL/t)*	*Note*
	Masonry						
1	Asphalt	0.02	(1)	2.04	(1)	0.88	(9)
2	Bricks	0.01	(1)	0.12	(1)	1.26	(9)
3	Concrete	0.03	(1)	0.55	(1)	1.28	(9)
4	Plasterboard	0.05	(1)	0.23	(1)	-0.03	(9)
5	Clay, fines, rubble & soil	0.09	(1)	0.68	(1)	0.44	(1)
	Metals						
6	Steel	0.63	(2)	7.94	(9)	-2.36	(9)
7	Aluminium	14.77	(2)	171.10	(8)	181.77	(8)
8	Non-ferrous metals	3.39	(3)	36.09	(9)	5.97	(9)
	Organics						
9	Food Organics	0.52	(3)	1.61	(1)	0.70	(1)
10	Garden Organics	0.23	(3)	0.47	(8)	0.48	(8)
11	Timber	0.33	(3)	1.32	(10)	0.54	(10)
12	Organics - Other	0.48	(3)	2.17	(1)	0.23	(1)
	Cardboard & paper						
13	Cardboard & waxed cardboard	0.30	(1)	12.53	(1)	33.04	(1)
14	Liquid Paperboard	0.64	(1)	9.19	(1)	16.22	(1)
15	Magazines	0.46	(1)	9.07	(1)	22.16	(1)
16	Newsprint	0.46	(1)	9.07	(1)	22.16	(1)
17	Phonebooks	0.24	(1)	12.31	(1)	33.12	(1)
18	Printing & Writing Paper	0.58	(1)	12.99	(1)	31.11	(1)
	Plastics						
19	Polyethylene terephthalate	1.03	(2)	50.70	(4)	-21.08	(4)
20	High density polyethylene	0.69	(2)	55.95	(4)	-3.51	(4)
21	Polyvinyl chloride	1.57	(4)	42.15	(4)	66.41	(4)
22	Low density polyethylene	0.69	(5)	55.95	(5)	-3.51	(5)
23	Polypropylene	1.64	(1)	58.63	(1)	-12.98	(1)
24	Polystyrene	1.37	(6)	60.66	(6)	-17.63	(6)
25	Mixed &/or Other plastics	1.37	(3)	60.66	(4)	-17.63	(4)
	Glass						
26	Glass	0.60	(1)	6.42	(1)	2.42	(1)
	Other Materials						
27	Fly ash	0.03	(7)	0.55	(7)	1.26	(7)
28	Foundry sands	NS		NS		NS	
29	Leather & textiles	NS		NS		NS	
30	Tyres & other rubber	1.19	(3)	67.16	(1)	52.43	(1)

Notes:

(1) Source: EcoRecycle Victoria (2005)
(2) Source: Zero Waste SA (2009); Municipal, C&I & C&D emission factors weighted by 2009-10 Sector Origin
(3) Source: Zero Waste SA (2010); 2008-09 Recycling Activity emission factor
(4) Source: NSW DECCW (2010); Kerbside and C&I/C&D emission factors weighted by 2009-10 Sector Origin
(5) HDPE value adopted per Zero Waste SA (2010)
(6) Mixed/Other plastics value adopted per Zero Waste SA (2010)
(7) Concrete value adopted per Zero Waste SA (2010)
(8) Source: NSW DECCW (2010); Kerbside value
(9) Source: NSW DECCW (2010); C&I/C&D value
(10) Source: EcoRecycle Victoria (2005); Sawdust value
(11) Organics - Other value adopted
NS Not specified as insufficient reference data identified