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ASCEND WASTE AND ENVIRONMENT

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Abbreviations and glossary

The definitions in this list are mostly taken from the *Australian Standard for Waste and Resource Recovery Data and Reporting – second edition* (DCCEEW 2024a). Some have been summarised.

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
APCO	Australian Packaging Covenant Organisation
Biosolids	stabilised organic solids produced by wastewater treatment processes
Bottom ash	ash produced by burning coal or other materials that remains in the furnace or incinerator.
CAGR	compound annual growth rate
Capita	person
C&D waste	construction and demolition waste – waste produced by demolition and building activities, including road and rail construction and maintenance and excavation of land associated with construction activities, consistent with Australia and New Zealand Standard Industrial Classification Division E.
C&I waste	commercial and industrial waste – waste that is produced by institutions and businesses, including offices, schools, restaurants, retail and wholesale businesses, and industries such as manufacturing. Also includes waste from primary and secondary production, such as mining and minerals processing, encompasses waste from all Australia and New Zealand Standard Industrial Classification codes except Division E and Group 753.
CDS	container deposit scheme
CO_2-e	carbon dioxide equivalent (emissions)
Core waste	waste that is generally managed by the waste and resource recovery sector, comprising solid waste and liquid hazardous waste, and generated in the municipal, construction and demolition, and commercial and industrial sectors, and including biosolids
Cullet	recycled broken or waste glass used in glass–making.
Department	Department of Climate Change, Energy, the Environment and Water
Disaster waste	debris and other waste resulting from disaster events including floods, bushfires and cyclones.
Disposal	Processes through which wastes are collected and processed or placed in an approved facility without deriving significant productive use. Includes deposit in landfill (subject to the clarifications below) and incineration without energy recovery. For data reporting purposes, the quantity of waste allocated to the fate 'disposal': • *includes* waste used for landfill cover or capping • *excludes* landfill cover or capping materials not received as waste • *excludes* soil used for landfill construction • *excludes* building and demolition waste used for on-site roads if this material is not subject to a waste levy • *may exclude* (and does exclude from national reporting) landfill waste that produces methane gas used for energy recovery estimated using standard greenhouse gas measurement methods • is reported as wet weight.
Dry recycling	Packaging and paper products collected from households for recycling. Includes commingled material as well as separate collections of paper and glass that occur in some areas.
EfW	energy from waste
EPA	Environment(al) Protection Authority (name varies with jurisdiction)
EPS	expanded polystyrene

Energy recovery	Processes through which wastes are collected, sorted and processed to recover energy in usable form, for example process heat, steam or in electricity generation. For data reporting purposes, the quantity of waste allocated to the fate 'energy recovery': • *excludes* residuals from energy from waste facilities that are recycled or sent to landfill or otherwise disposed of • *may include* (and does include in national reporting) landfill waste that produces methane gas used for energy recovery estimated based on standard formulas used in greenhouse gas reporting • is reported as wet weight.
E-waste	electrical or electronic waste, comprising any equipment, device or thing that is no longer wanted or working and was in some way dependent on, or designed for, the generation, transfer or measurement of, an electric current and/or an electromagnetic field and designed for a supply voltage not exceeding 1000 volts for alternating current and 1500 volts for direct current
Fate	The ultimate destination of a waste. The possible fates are waste reuse, recycling, energy recovery, disposal, long–term storage and the open environment. The export of wastes is not a fate.
FY	Financial year (1 July to 30 June in the following calendar year)
FOGO	food organics and garden organics
GL	gigalitres
GO	garden organics
Gross domestic product	the total market value of goods and services produced in Australia within a given period after deducting the cost of goods and services used up in the process of production but before deducting allowances for the consumption of fixed capital
Hazardous waste	waste that, by its characteristics, poses a threat or risk to public health, safety or to the environment and comprising, in this report, waste that cannot be imported to or exported from Australia without a permit under the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*, or waste that a jurisdiction regulates as requiring particularly high levels of control
Headline (waste) data set	The values used in chapters 2, 3 and 5 to 9 for reporting: progress against national targets; quantities; trends; and recovery rates. Comprises core waste plus ash. When the word 'waste' is used in the report without qualification, it refers to the headline data set.
HDPE (2)	high–density polyethylene (the number in brackets is the plastics identification code)
kg	kilograms
kt	kilotonnes (thousands of tonnes)
LDPE (4)	low-density polyethylene (the number in brackets is the plastics identification code)
Long–term storage	pre-approved on-site (or near site) long–term accumulations of waste in designated areas
MBT facility	mechanical biological treatment facility
Mechanical biological treatment	a type of waste and resource recovery facility that processes mixed putrescible waste and includes a biological treatment process
MRF	Materials recovery facility. Sorts, aggregates and bales mixed recovered materials (comprising mainly packaging) for further sorting or reprocessing. MRFs may be said to undertake primary sorting of these materials.
MSW	Municipal solid waste. Waste produced by households or collected by, or on behalf of, a municipal council. Excludes waste from businesses and road works undertaken by, or on behalf of, a municipal council.
Mt	megatonnes (millions of tonnes)
Non-core waste	waste that is not core waste (see Section 1.1 for further detail)
NGER	National Greenhouse and Energy Reporting

NPI	National Pollutant Inventory
NSW	New South Wales
NT	Northern Territory
NWR 2022	*National Waste Report 2022*
Organic waste	Waste that is derived from biotic processes, includes food, vegetation, wood and biosolids. Typically excludes paper and cardboard, textiles, natural latex–based rubber, leather, nappies and certified compostable plastics but may include them under some circumstances (for example, when considering methane emissions from landfills). Excludes standard plastics and synthetic rubbers.
Per capita	per person
Percentage point	a unit of one per cent (an increase from 10% to 15% is an increase of 5 percentage points)
PET (1)	polyethylene terephthalate (the number in brackets is the plastics identification code)
PFAS	per– and poly–fluoroalkyl substances
PP (5)	Polypropylene (the number in brackets is the plastics identification code)
Primary production	the conversion of natural resources into primary products, usually for use as raw materials by other industries
Product stewardship	an approach to managing the impacts of different products and materials which acknowledges that those involved in producing, selling, using and disposing of products have a shared responsibility to ensure that those products or materials are managed in a way that reduces their impact, throughout their full lifecycle, on the environment, and on human health and safety
PS (6)	polystyrene (the number in brackets is the plastics identification code)
PVC (3)	polyvinyl chloride (the number in brackets is the plastics identification code)
Qld	Queensland
Recycling	Activities that culminate in the reprocessing of wastes into products or secondary materials that are returned to productive use (excluding for energy). May include collection, sorting and/or reprocessing. For data reporting purposes, the mass of material allocated to the fate 'recycling': • *includes* all materials received by a reprocessing facility that are processed to the point of being suitable for manufacturing or return to productive use, whether immediately used or stored for later sale or use • *includes* weight losses to the atmosphere during the processing of wastes (for example, moisture, carbon dioxide from organics degradation) • *excludes* residuals that are sent to landfill or otherwise disposed of • *excludes* materials received at a recycling facility but not yet processed • is reported as wet weight.
Recycling rate	the weight of materials allocated to the fate recycling divided by the weight of waste generated
Residual waste	waste determined by its owner to be unsuitable for recovery
Resource recovery	Activities that culminate in the reprocessing of wastes into products or secondary materials that are returned to productive use, including for energy. May include collection, sorting, reprocessing and/or energy recovery. For data reporting purposes, the quantity of waste allocated to the fate 'resource recovery' is the sum of the quantities allocated to waste reuse, recycling and energy recovery.
Resource recovery rate	the weight of materials allocated to the fates waste reuse, recycling or energy recovery divided by the weight of waste generated
Return to productive use	use of recovered materials for a beneficial purpose, including energy recovery

Reuse	reallocation of products or materials to a new owner or purpose without reprocessing but potentially with some repair (for example, repair of pallets for resale, tyre retreading)
SA	South Australia
Secondary materials	recovered materials that have been processed to the point of being suitable for use in manufacturing or other return to productive use
Soft plastics	plastics that can be scrunched into a ball, unlike 'rigid' plastics such as bottles and tubs, which are moulded and hold their shape
Solid waste	waste that can have an angle of repose of greater than 5 degrees above horizontal, or does not become free–flowing at or below 60 degrees Celsius or when it is transported, or is generally capable of being picked up by a spade or shovel
Source stream (or 'stream')	either municipal solid waste (MSW), commercial and industrial (C&I) waste or construction and demolition (C&D) waste
Standard	*Australian Standard for Waste and Resource Recovery Data and Report – second edition*
t	tonne(s)
Tas	Tasmania
Treatment (of hazardous waste)	the removal, reduction or immobilisation of hazardous characteristics to enable the waste to be sent to its final fate or further treatment
UK	United Kingdom of Great Britain and Northern Ireland
USA	United States of America
Vic	Victoria
WA	Western Australia
WARRP	Waste and Resource Reporting Portal (NSW)
Waste	Materials or products that are unwanted, surplus, discarded, rejected, abandoned or left over, including those materials or products intended for or managed by recycling, energy recovery, treatment, storage and disposal. Waste-derived materials cease to be waste and transition to being 'secondary materials' when the following conditions are met: • they are to be used for a specific purpose • a market or demand exists • they fulfil the technical requirements for the specific purposes and meet the existing legislation and standards applicable to products • their use will not lead to overall adverse environmental or human health impacts.
Waste and resource recovery (WRR) facility	a site at which the primary function is waste management
Waste generation	The process of producing waste. For data reporting purposes, the quantity of waste generated is the sum of the quantities of materials allocated to waste reuse, recycling, energy recovery, disposal, stockpiles and the open environment.
Waste hierarchy	a preferential order of waste management options based on environmental benefit, often framed to include, in descending order of preference: avoid/reuse, recycle, energy recovery, then disposal
Waste prevention	any deliberate action taken that stops an item, component or material from entering a waste management facility or system
Waste reuse	reuse of a product or material that has entered a waste or resource recovery facility (e.g. the sale of goods from a landfill or transfer station 'reuse shop')
Waste stockpile	an accumulation of waste, whether or not reprocessed and whether or not in infrastructure approved for this purpose

At a glance

During the financial year 2022–23 Australia generated an estimated 75.6 million tonnes (Mt) of waste. This included 26.8 Mt of building and demolition materials, 14.6 Mt of organics, 10.3 Mt of ash, 6.5 Mt of hazardous wastes, 6.0 Mt of metals, 4.9 Mt of paper and cardboard and 3.0 Mt of plastics. This is equivalent to 2.88 tonnes (t) per capita.

Headline waste

	Waste generation (Mt)	Waste reuse (Mt)	Waste recycling (Mt)	Waste to energy (Mt)	Waste disposal (Mt)	Resource recovery rate	Recycling and waste reuse rate
2022–23	76	0.1	47	2.3	26	66%	63%
2020–21	75	0.1	45	2.3	28	63%	60%
2018–19	75	45 [1]		2.3	28	63%	60%
2016–17	70	41 [1]		2.2	27	61%	58%

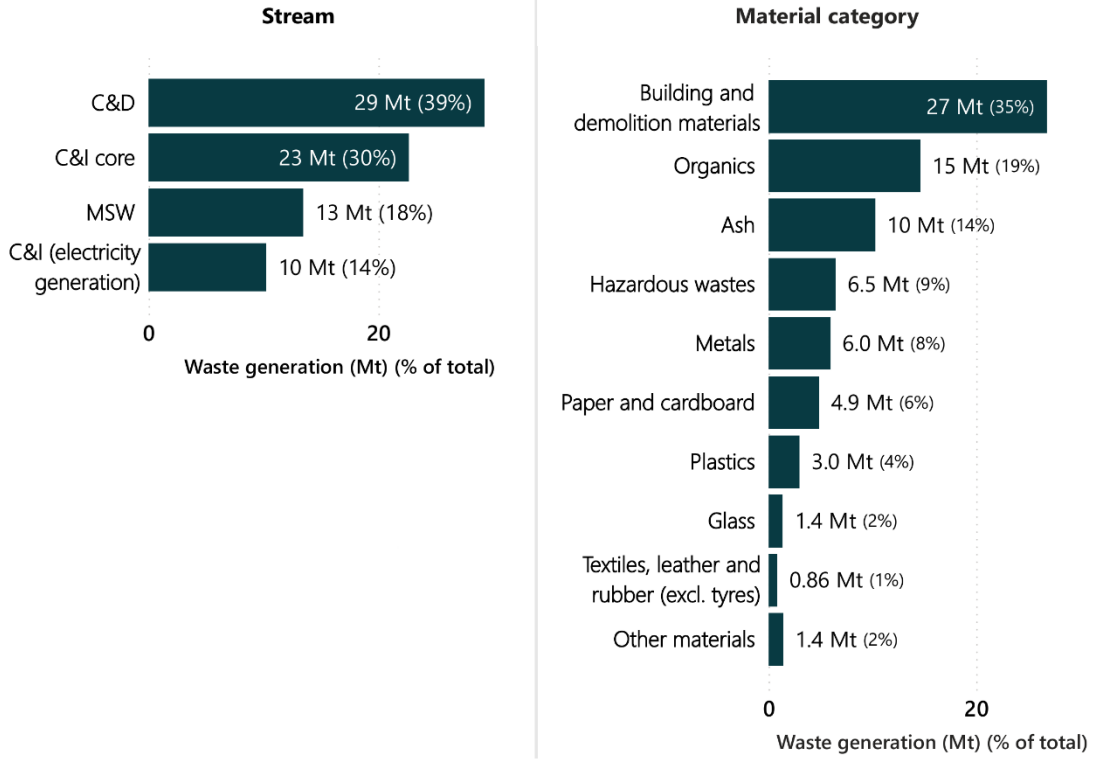
'Mt' means megatonnes (millions of tonnes)

Figure 1 shows the sources of waste generated in 2022–23 were:

- 13.5 Mt of municipal solid waste (MSW) from households and local government activities (512 kg per capita and 18% of the total)
- 32.9 Mt from the commercial and industrial (C&I) stream including ash (44% of the total)
- 29.2 Mt from the construction and demolition (C&D) stream (39% of the total).

In 2016–17 there were 12.9 Mt of MSW, 33.6 Mt of C&I waste and 23.6 Mt of C&D waste.

Figure 1 Waste generation by source stream and waste category, Australia 2022–23



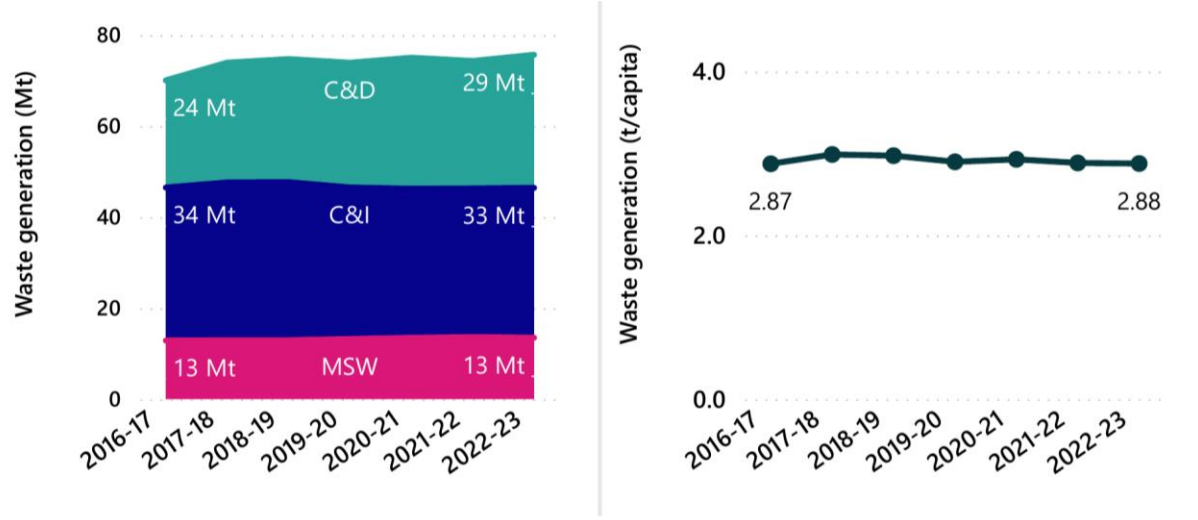
Link to Data table.

[1] Waste reuse is not separately calculated before 2019–20 so, in older values, is combined with recycling.

In 2022–23 there were about 65.4 Mt of 'core waste' (those wastes managed by the waste and resource recovery sector)[2], or 2.49 t per capita. This is up from 57.8 Mt in 2016–17.

Over the 6-year period for which data is reported, headline waste generation increased by 5.6 Mt (8.0%). Assessed on a per capita basis, waste increased by 0.1% over this timeframe. Figure 2 shows that over the 6-year period, MSW generation fell by 2.8% per capita and C&I waste by 9% per capita, while C&D waste grew by 15% per capita. The increase in C&D waste is due to major development projects.

Figure 2 Trends in headline waste generation by source stream in total (left) and per capita (right), Australia 2016–17 to 2022–23



Link to Data table.

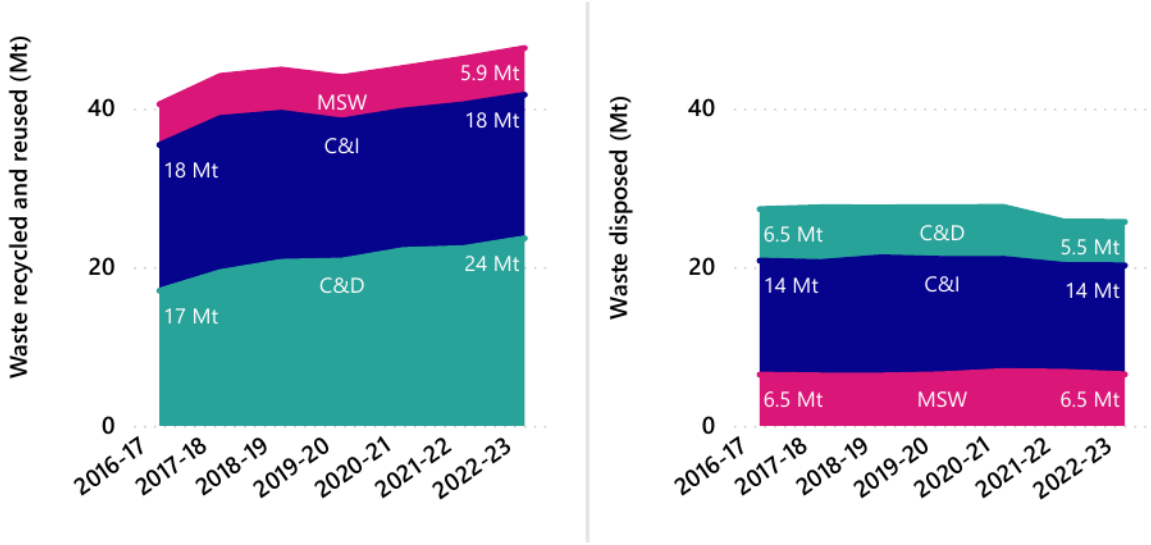
Figure 3 shows that quantities of recycling and waste reuse have continued to increase. The value in 2016–17 of 40.5 Mt grew to 47.6 Mt in 2022–23. Over the 6-year period, waste reuse and recycling of:

- C&D grew by 39% to 23.6 Mt.
- C&I levelled off and then declined on a per capita basis. This suggests the easiest-to-recycle materials are dealt with and future gains in recovery will be more difficult.
- MSW grew by 15%, due mostly to the growth of services that collect and process organics (see Section 10.3).

Waste disposal dropped over the 6-year data period. In 2022–23, 25.7 Mt of waste were disposed of, representing 34% of waste generated. In 2016–17, 27.3 Mt were disposed of, representing 39% of waste generated.

[2] Headline waste includes core waste and ash. Ash is residues of coal-fired electricity generation in the C&I stream. Core waste does not include ash as this is not managed by the waste and resource recovery sector. See Section 1.1 for further detail.

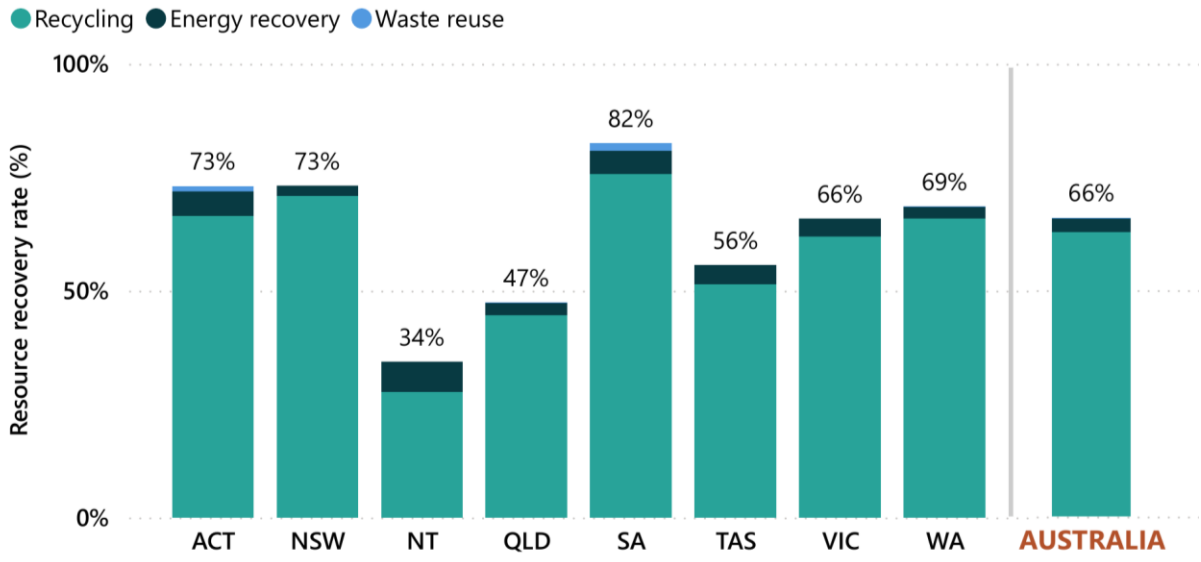
Figure 3 Trends in recycling and waste reuse (left) and disposal (right) of waste by source stream, Australia 2016–17 to 2022–23



Link to (left) Data table and (right) Data table.

Figure 4 shows that in 2022–23, Australia's resource recovery rate (including waste reuse, recycling and energy recovery) was 66% and the recycling rate was 63%. Resource recovery rates are trending upwards. SA had the highest recovery rate at 82%. Following were the ACT and NSW (73%), WA (69%), Vic (66%), Tas (56%), Qld (47%) and NT (34%). The energy recovery component is mostly associated with the use of landfill gas for generating electricity.

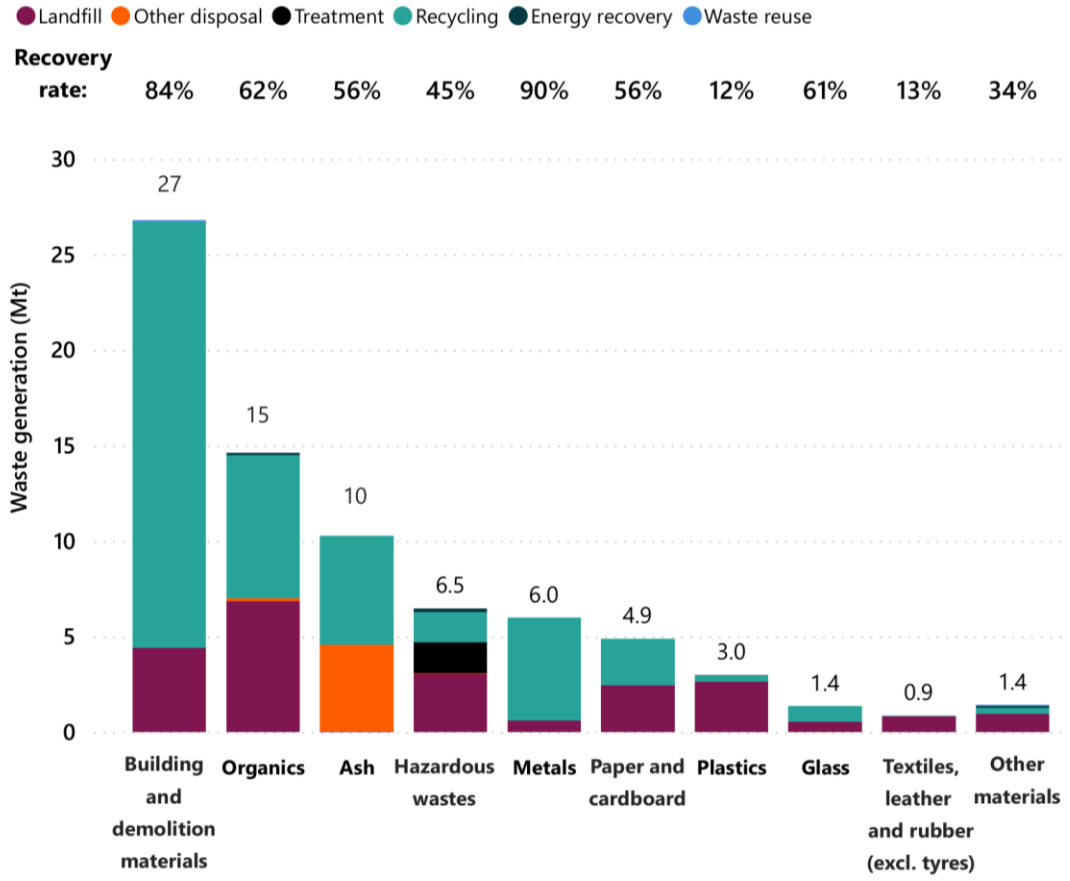
Figure 4 Resource recovery rates by jurisdiction, 2022–23



Link to Data table.

Figure 5 shows waste generation, management type and recovery rate by waste category. The estimated resource recovery rates were highest for metals (90%) and building and demolition materials (84%). The recovery rate for plastics was the lowest at 12%.

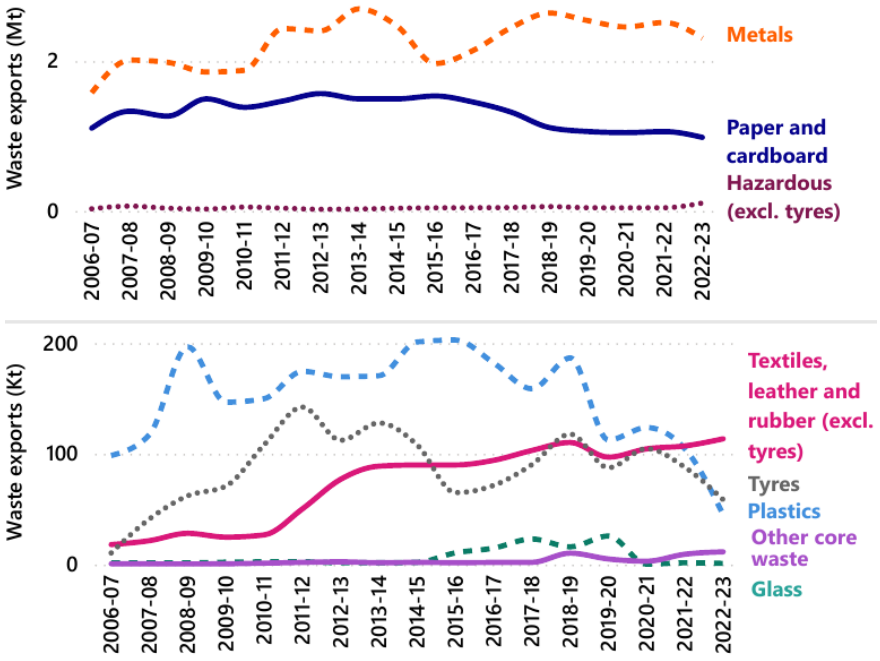
Figure 5 Waste generation and management by waste category, Australia 2022–23



Link to Data table.

Figure 6 shows the trend in exports of recovered materials from 2006–07 to 2022–23. About 3.62 Mt of recovered materials were exported in 2022–23, down from 4.00 Mt in 2016–17. Between 2021 and 2024, Australia phased in regulation of its exports of recovered glass, paper and cardboard, plastics and tyres. The rules generally aim to ensure that exports are ready for use as a product and do not cause harm to environmental or human health overseas. The rules have significantly affected the quantities of recovered materials exported, as well as the processing undertaken prior to export.

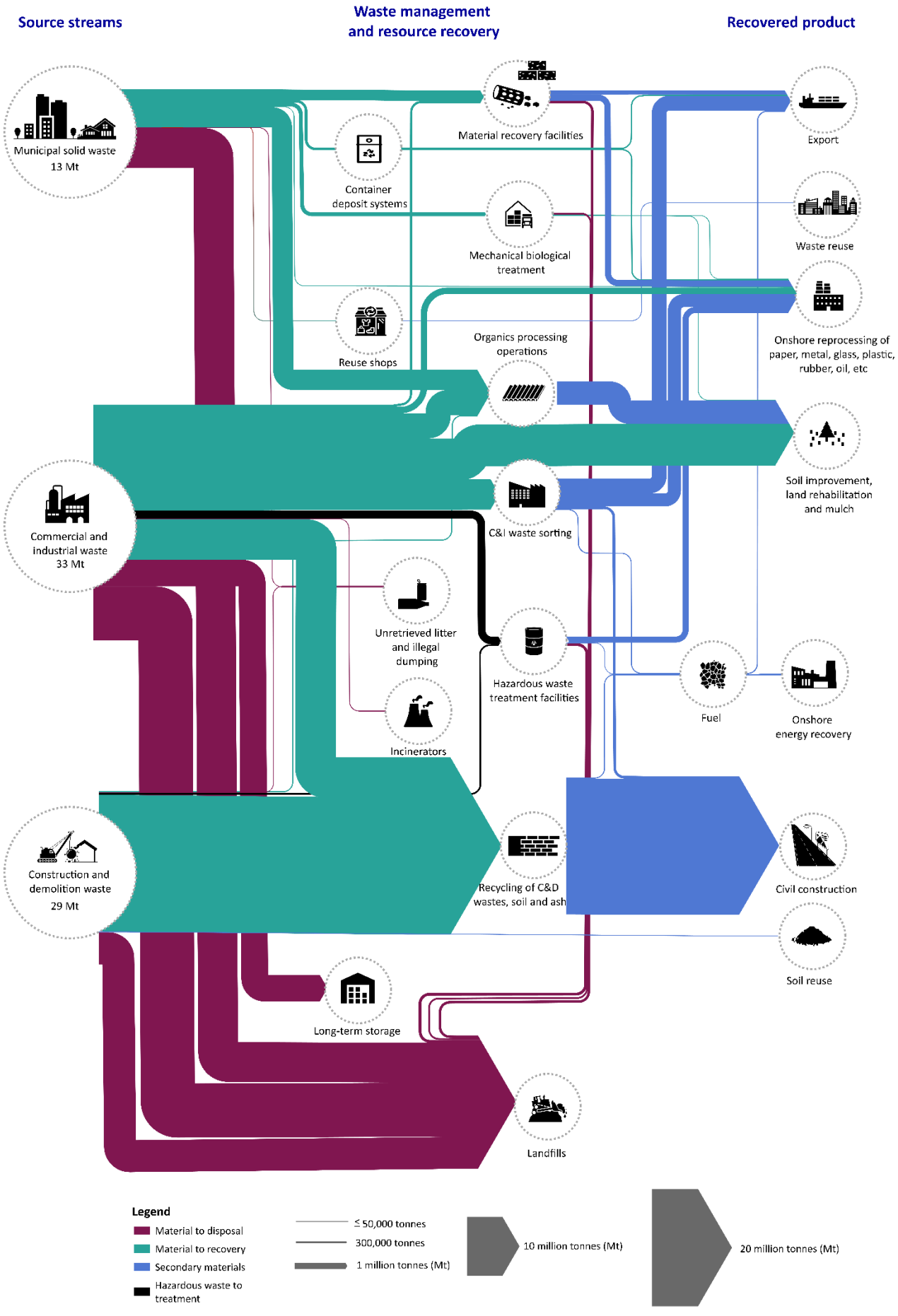
Figure 6 Trends in Australian exports of waste and recovered materials, 2006–07 to 2022–23



Link to Data table.

Figure 7 is a diagram of flows of waste in Australia in 2022–23. The arrows are proportional to the flow size measured in tonnes. The diagram provides an overview of the major material flows including source stream, waste management and destinations of recycled product.

Figure 7 Flows of waste and recovered materials in Australia, 2022–23



1. Introduction

This report was prepared on commission to the Australian Government's Department of Climate Change, Energy, the Environment and Water (the Department). Under Target 7 of the *National Waste Policy Action Plan* the Department has committed to preparing national data for waste and resource recovery that is timely and accessible.[3]

The *National Waste and Resource Recovery Report 2024* provides a summary of waste and resource recovery in Australia for the financial year 2022–23 (1 July 2022 to 30 June 2023). It includes data on waste generation, source streams, materials and fates. Trend data is included back to 2016–17. The report is released together with:

- National Waste Reporting Tools for 2021–22 and 2022–23, containing most of the 'raw' data reported for those two years.
- The *National Waste Database 2024*, containing collated data for all available years in a format that allows users to do their own data analysis. The Department has prepared a set of visualisations so this dataset can be explored online.[4]

The report name has changed from the 'national waste report' to emphasise the importance of resource recovery. The report complements the web-based version available on the Department's website and includes interactive data viewers. The web-based version has been streamlined and organised into modular sections to ensure readability for a general audience, adhering to web readability guidelines.

Waste and resource recovery are a collective responsibility for all Australians. Governments, industries, businesses, the community and individuals each need to play a part:

- The Australian Government provides national coordination and funding support. It regulates and manages exports and imports of certain waste types and engages on waste matters internationally.
- State and territory governments have primary responsibility for managing waste.
- Local governments work within their state or territory legislative framework. They interact directly with the community and have a significant role in organising waste collection and processing.
- Industry and businesses are at the front of innovation and invest in processing waste and options to reduce waste.
- The community and individuals undertake on-the-ground actions to direct waste to the appropriate collection system.

1.1 Scope

The report covers waste generated in Australia. The scope is guided by the *Australian Standard for Waste and Resource Recovery Data and Reporting – second edition* (the Standard; DCCEEW 2024a). The Standard was developed in coordination with state and territory authorities to harmonise waste management data nationally. It establishes a common set of definitions, scope, categories and

[3] The National Waste Policy Action Plan 2019 includes targets and actions to implement the 2018 National Waste Policy. In 2022, Environment Ministers agreed to update the plan's action items. These updates are reflected in an annexure to the action plan.

[4] See National waste and resource recovery reporting hosted on the Departments website.

processes for use by governments and industry. The *Australian Hazardous Waste Data and Reporting Standard* (DCCEEW 2022a) performs a similar function for hazardous wastes.

Wastes included

The 'headline' waste data set reported in Chapters 2, 3 and 5 to 9 comprises:

- 'Core waste', which is material generally managed by the waste and resource recovery sector. Core waste is made up of solid non-hazardous waste materials, biosolids from wastewater treatment and hazardous wastes[5] as listed in Table 1.
- 'Ash', which is mainly the residues of coal-fired power generation. Ash is included in the headline data because it is produced in large quantities and opportunities exist to improve its recovery.

Table 1 Categories and types in the headline data set

Waste categories		Waste types included in this category
Core wastes	Building and demolition materials	Asphalt; bricks, concrete and pavers; ceramics, tiles and pottery; plasterboard and cement sheeting; uncontaminated soil, sand and rock; rubble.
	Glass	Glass from food and beverage containers; other glass.
	Hazardous[6]	Acids; alkalis; inorganic chemicals; reactive chemicals; paints, resins, inks and organic sludges; organic solvents; pesticides; oils; food-derived organic wastes (K100, K110 and K200); other putrescible or organic waste (K140 and K190); organic chemicals; contaminated soils; asbestos contaminated materials; other soil/sludges; clinical and pharmaceutical; tyres[6]; other miscellaneous; unclassified hazardous wastes.
	Metals	Ferrous; stainless steel; aluminium; other non-ferrous metals.
	Organics	Food organics; vegetation; timber; sawdust; biosolids (non-contaminated); and other organics. Excludes paper, cardboard, textiles, leather, rubber and hazardous organic wastes, which are included in separate categories.
	Paper and cardboard	Cardboard; polymer-coated paperboard; newsprint and magazines; office paper; other paper.
	Plastics[7]	PET (1); HDPE (2); PVC (3); LDPE (4); PP (5); PS (6); certified compostable plastics; other plastics (7).
	Textiles, leather and rubber (excl. tyres)	Textiles; leather and rubber (excluding tyres).
	Other materials	Hygiene and sanitary products; unclassified materials.
Ash	Ash	Ash from coal-fired power stations; bottom ash from thermal waste processing; other bottom ash.[8]

Other waste data is presented at different parts of the report, including on local government services, product stewardship and exports of recovered material. The tonnages in these parts are also in the headline data set – for example, exports of metals are also in the headline recycling data.

[5] The Australian Government's report series '*Hazardous waste in Australia*' addresses these wastes in detail.

[6] Tyres are hazardous due to fire risks. In some parts of the report, tyres are addressed separately from hazardous wastes because they are a major waste material and are subject to specific export regulations.

[7] The full chemical names of these types of plastic are provided in the glossary.

[8] Fly ash from sources other than coal-fired power stations is classified in the 'hazardous' category.

The previous *National Waste Report* 2022 (NWR 2022) covered some large non-core waste flows from mining, processing of mining products and agriculture. These are not addressed in this report.[9]

The period covered

The *National Waste and Resource Recovery Report 2024* focuses on waste generated and managed during the financial year (1 July to 30 June) 2022–23. Some more recent information is presented where available. For the headline data set, trends are presented covering the period 2016–17 to 2022–23. The report includes two years of headline data not included in previous national waste reports – that is, for 2021–22 and 2022–23.

The geographic area covered

The report covers waste generated in Australia, including exports of waste and recovered materials. Small amounts of imported waste are likely to be included. The report covers the Australian states and territories: Australian Capital Territory (ACT); New South Wales (NSW); Northern Territory (NT); Queensland (Qld); South Australia (SA); Tasmania (Tas); Victoria (Vic); and Western Australia (WA).[10]

Waste sources

Waste sources are considered within three source streams: municipal solid waste (MSW) from households and local government activities; commercial and industrial (C&I) waste; and construction and demolition (C&D) waste.

Waste management

Two types of waste management processes are considered in this report:

1. Pathways, which comprise interim steps on the way to the end destination of the material. They include short-term storage[11], stockpiling[11], treatment, sorting, processing and export
2. Waste fates or end destinations, which are categorised into waste reuse, recycling, energy recovery, long-term storage[11] and disposal.

The term 'resource recovery' is used to encompass waste reuse, recycling and energy recovery.

The term 'management type' is used to describe the infrastructure type used (landfill, materials recovery facility, etc.).

Most waste sent to a landfill is considered to have the fate 'disposal'. However, many large landfills capture methane-rich landfill gas and burn it to capture its energy value. Typically, the energy is used to generate electricity that is sold to the grid. The quantity of waste generating this energy is estimated and allocated to the fate 'energy recovery' (see Section 1.4).

Some waste is dissipated into the environment by wear and tear, littering and dumping. Litter and dumped waste that is collected by government agencies is included in the data reported here. The remainder is excluded due to lack of data.

Changes due to adoption of the revised Standard

This report was developed to be consistent with the requirements of the Standard. This involved several changes:

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[9] Except agricultural organics sent to commercial composters and landfills, which are included in core waste.

[10] May exclude data from some unincorporated areas such as Aboriginal lands.

[11] Reporting of short-term storage, stockpiling and long–term storage are limited due to data unavailability.

- expanding the scope of organic materials in the headline data to encompass all materials managed by commercial organics processors, including agricultural and forestry organics
- restricting 'waste reuse' to materials that entered a waste or resource recovery facility
- improving the estimates of the composition of municipal waste to landfill in states and territories that do not provide their own estimates, based on the proportions of the population that have an organics service
- small changes to the ways some wastes are categorised and reported.

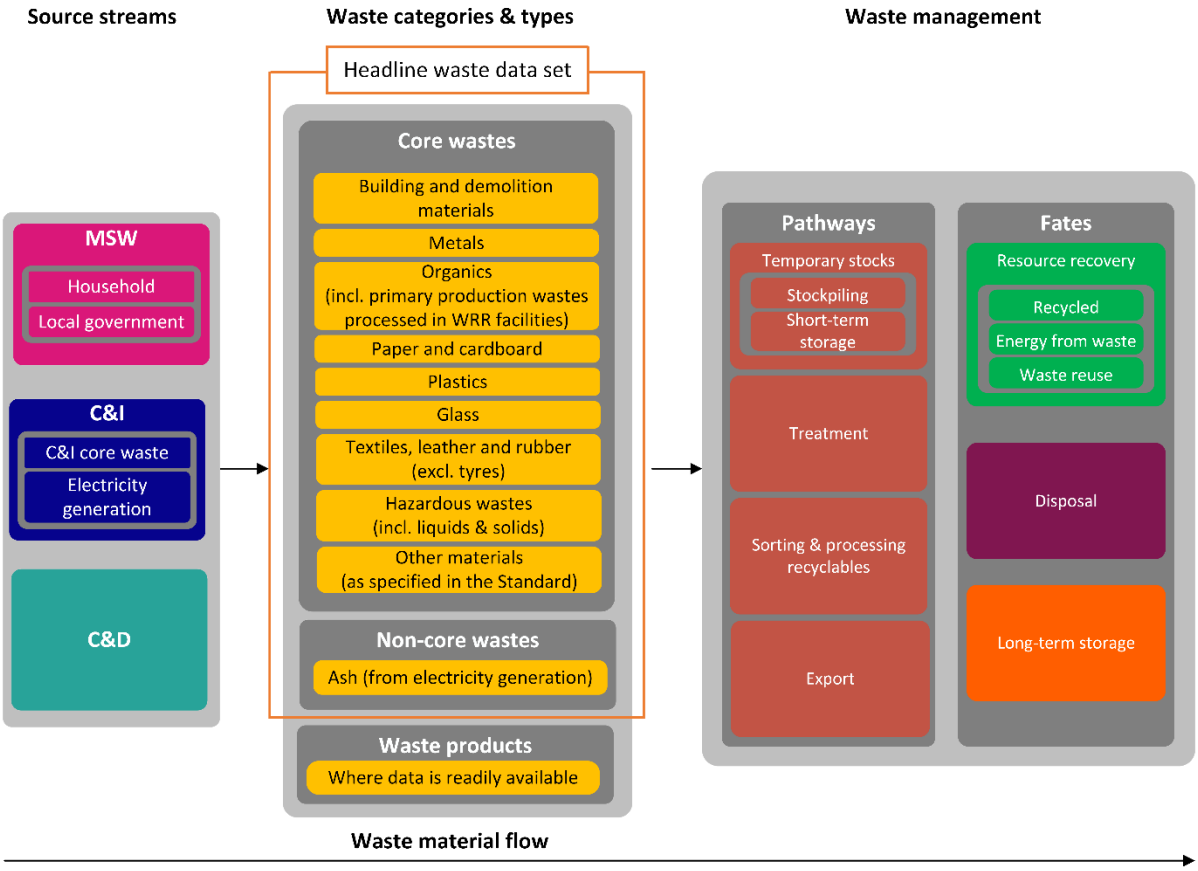
Scope difficulties

It is not straightforward to draw the boundary around the scope of wastes to be included. Sometimes it is not obvious if a material flow is actually a waste – for example, food processing residues sent for stockfeed, or Tasmanian fish processing residues applied to land. Some material flows are excluded for consistency despite having many characteristics of waste – for example, 'clean fill' used to rehabilitate quarries. The primary guide for the scope is the Standard.

Summary

Figure 8 provides a summary of the scope of reporting for this report.

Figure 8 Summary of the scope of the National Waste and Resource Recovery Report 2024



1.2 About the data

This section addresses data sources, units, historical updates and differences from state and territory data sets. Data quality is addressed separately in the following section.

Data sources

Much of the waste and resource recovery data included in this report was obtained from state and territory governments. The governments collect the data from waste operators and local governments for their own monitoring and reporting.[12] To provide that data to the Department, states and territories completed National Waste Reporting Tools for 2021–22 and 2022–23. These include, for each state and territory:

- tonnes of landfill waste, disaggregated by source stream where known
- the composition of waste to landfill in percentage terms, where local audits have been undertaken and are considered representative
- transfers of waste and recovered material across jurisdictional boundaries where known
- tonnes of recovered material, disaggregated by material type and source stream, sent for recycling, energy-from-waste or waste reuse
- additional data, to the extent available, on local government waste management, product waste, litter and dumping and other issues.

State and territory data is supplemented, and sometimes replaced, by national industry data or other national estimates. Significant sources are listed in Table 2. Data sources are listed in full in the bibliography and in the National Waste Reporting Tool 2022–23.

Table 2 Major data sources additional to the states and territories

Data	Data sources
HEADLINE DATA	
Biosolids	Australia and New Zealand Biosolids Partnership (PSD 2024)
Hazardous waste	State and territory data provided to the Australian Government for use in the annual report to the Basel Convention
Ash from coal-fired power	ADAA (2024)
Packaging and material recovery facility (MRF) data	APCO (2024)
Methane recovered from landfills for energy generation by state and territory	The Department of Climate Change, Energy, the Environment and Water

[12] The primary source for NSW data was waste contribution reports collected under the Protection of the Environment Operations (Waste) Regulation 2014 via the EPA's Waste and Resource Reporting Portal (WARRP). Other facility data was requested directly when expected to be significant, or informed estimates were made using administrative data, including from Environment Protection Licences. The NSW EPA processes WARRP data to remove double counts, estimate net recovery and disposal tonnages, and allocate to source streams (MSW, C&I and C&D) when facilities did not do so. The 2021–22 data is current as at 30 October 2023 and the 2022–23 data is current as at 7 June 2024, but reports may be amended by operators retrospectively.

WA waste and recycling data was primarily collected from annual returns prepared by 257 liable persons under Part 3A of the Waste Avoidance and Resource Recovery Regulations.

Data	Data sources
Proportions of organic waste to landfill in some states and territories	National Greenhouse and Energy (Measurement) Determination 2008 as amended
Plastics recycling	Blue Environment plastics recycling surveys
OTHER DATA	
Local government waste data	Various local government surveys and reports
Population data	ABS (2022, 2024)
Exports of waste and recovered materials	Analyses by the Department based on ABS data

Data units

Quantitative data is presented by weight, in kilograms (kg), tonnes (t), thousands of tonnes (kilotonnes or kt) or millions of tonnes (megatonnes or Mt). Financial values are in Australian dollars.

Data in this report may differ from state and territory data

The methods used by the Australian Government for categorising and analysing waste data are not always the same as those used by individual states and territories. Consequently, data presented here may differ from corresponding data presented in state and territory reports. Methodological approaches likely to cause differences include that:

- Some waste is generated in one state but transferred to another. States and territories typically report waste recovery and disposed within their boundaries. In this report, where data is available, transfers are reassigned to the jurisdiction where the waste was generated.
- This report covers waste that is sometimes excluded from state and territory reports, such as biosolids from sewage treatment plants, ash from power stations and hazardous waste.
- This report uses national instead of state and territory data for some waste and some jurisdictions, including for plastics recycling, ash and biosolids.
- In this report, some waste sent to landfill is counted in energy recovery data when methane is used for its energy value (see Section 1.4). The states and territories do not include this in their recovery data.

Historical updates

This report supersedes previously reported data. Some data presented in the NWR 2022 has been revised in this report. Key changes and the reasons for them are listed in Table 3, in order of impact on previously reported tonnages recovered. Amendments resulted in the following changes to the headline 2020–21 data reported in the NWR 2022, rounded to three significant figures:

- waste generation fell from 75.8 Mt to 75.0 Mt
- waste recycled and reused fell from 45.4 Mt to 45.1 Mt
- waste disposal reduced from 28.0 Mt to 27.6 Mt.

The revised overall resource recovery rate for 2020–21 is unchanged from the 63% value reported in the NWR 2022.

Table 3 Key revisions to historical waste and resource recovery data for this report

Data revision	Years	Rationale	Impact on recovery as reported in the NWR 2022 [13]
Organics recycling – add primary production organics processed in commercial compost operations (previously excluded).	2016–17 to 2020–21	Consistency with the Standard, item 5.	Adds **933 kt** (1.2%) to the 2020–21 data.
Recycling of core waste in Victoria – data revisions.	2020–21	Requested by Victoria as updated data is available.	Subtracts **902 kt** (-1.2%) from the 2020–21 data.
Waste reuse – remove contaminated soil that did not enter a waste facility; shift waste reuse of ash to recycling.	2017–18 to 2020–21	Consistency with the Standard, item 1.	Subtracts **283 kt** (-0.4%) from the 2020–21 data.
Biosolids – apply the moisture proportions reported by the ANZBP for each year (previously a fixed fraction).	All years	ANZBP assurances of accuracy of its varied proportions by year.	Subtracts **221 kt** (-0.3%) from the 2020–21 data.
Textiles in landfill – reduce the recovery allocation from methane used for its energy value to exclude plastics that do not degrade.	All years	Consistency with the Standard, item 23.	Subtracts **214 kt** (-0.3%) from the 2020–21 data.
Paper recycling in Victoria – data revisions.	2017–18 to 2019–20	Requested by Victoria as updated data is available.	Subtracts **83 kt** (-0.1%) to the 2019–20 data.
Methane from landfills used for its energy value – data revisions.	All years	Revised data from the Department.	Subtracts **80 kt** (-0.1%) from the 2020–21 data.
Plastics recycling – remove tonnages in exported used clothing.	2017–18 to 2020–21	Identified as double count / not in scope.	Subtracts **15 kt** (-0.02%) from the 2020–21 data.
ACT biosolids – allocate incineration ash to recycling as it is used as a soil conditioner.	2016–17 to 2020–21	New information and data available.	Adds **4 kt** (0.01%) to the 2020–21 data.

1.3 Data quality

Significant effort has been made to ensure that the data presented in this report is reliable. In general, the quality and quantity of Australian data on waste tonnages, source streams and materials are improving. Historical data has been adjusted where possible to maintain methodological consistency over time, but some discrepancies remain. Margins of error have not been calculated. Overall, the authors believe the data reliably supports the key messages presented in this report.

There have been several improvements to the data for this cycle, including:

- greater clarity of data needs and processes and more harmonised reporting due to guidance from the revised Standard
- transparent insertion and transformation of NSW data in the national waste reporting tool

[13] The reported impacts of some revisions may partly include the impacts of some other revisions.

- more accurate hazardous waste data from Qld as it clears a backlog of paper tracking certificates
- historical data revisions as listed in Table 3.

Specific data quality problems and their management

Data quality problems can arise due to difficulties and costs in collecting the data and the fact that state and territory data systems have evolved largely independently. Issues include the following:

- Data is not always available to encompass the full scope of geography, waste categories, source streams and management types needed. In these cases, a best estimate is made, sometimes using data from other states and territories (see the national waste reporting tools published with this report).
- State and territory data systems focus on material managed in their jurisdiction and may not separately identify material imported from or exported to other jurisdictions. This creates risks of double-counting and incorrect estimates of recovery rates.
- Data is sometimes categorised in different ways by states and territories, requiring assumptions for conversion to a common measure. Calculations performed to establish a common dataset are included in the national waste reporting tools.
- The composition of waste to landfill is estimated from periodic audits at a few landfills. These snapshots are not perfectly representative and may miss waste types deposited infrequently or seasonally.
- In some jurisdictions, data on recovered wastes is based on voluntary surveys (see Table 5 on page 11). Some facilities may be overlooked, or decline to respond or submit incomplete data.
- A small proportion of the tonnage data is derived from volumetric measures or truck counts combined with density factors that may not always be reliable.
- Reporting or calculation errors can occur.

Table 4 describes the main weaknesses in the headline data set, and how they were dealt with for this report. Gaps are filled with best estimates as described so the national data set is comprehensive. The Standard should help reduce data quality problems over time.

Table 4 Data difficulties and how they were dealt with

Issue	Known cases in the raw data provided	Adjustments and rationale
Misallocated jurisdiction	Interstate transfers known to occur including • landfill waste from northern NSW to cheaper Qld landfills and the ACT and Vic to levy-free landfills in rural NSW • recovered materials that are traded widely across borders • hazardous wastes for which national treatment markets exist.	This is a declining problem as jurisdictional reports are increasingly capturing and reporting this data. These are used to reallocate materials as shown in the National Waste Reporting Tool 2022–23 and the Hazardous Waste Data Collation (not published at the time of writing). Uncertainty remains in relation to some recovered materials, particularly where reporting is voluntary.
Data gaps	Some jurisdictional data does not cover all material flows or areas, e.g. NT area, NT recycling, non-metro WA, NSW hazardous organics.	Extrapolation by the jurisdiction (e.g. non-metro WA) or the authors (NT, NSW hazardous organics).

Issue	Known cases in the raw data provided	Adjustments and rationale
	Disaster waste may not always be perfectly accounted. There may be some data gaps and some double-counts.	Requested separately from jurisdictions and added to the totals or not based on their advice.
Double-counting	Interstate transfers are at risk of being included in data from both generating and receiving jurisdiction.	This is a declining problem as jurisdictional reports are increasingly capturing and reporting this data.
	Organic hazardous waste may be included in both hazardous waste data from tracking systems and non-hazardous organics recycling data from the compost industry data.	Careful statement of scope to the states and territories, with confirmations as needed.
	Material delivered to a reprocessing facility is generally counted as recycled, but a portion may be subsequently sent to landfill and counted again.	None. Likely to be small and restricted to a few wastes in a few jurisdictions.
	Organics recycling data – NSW experience suggests there may be significant movement of material between facilities. Double-count risk is highest where voluntary data is relied upon.	None.
	WA and SA asbestos and contaminated soil data is likely to be included in both hazardous waste and landfill data.	Totals in hazardous waste data were deducted from SA and WA landfill data (all years).
Misallocated stream	Some MSW may be included in C&I or vice-versa, e.g. transfer station waste all counted as MSW, or MSW from high-rise buildings collected by commercial operators. The allocation of recovered materials to source streams is particularly problematic because facilities may receive aggregated material from third parties.	None.
	Jurisdictional regulators in SA and Vic do not comprehensively record the source stream of waste to landfill. The 'split' of waste across these source streams is based on audits and estimates carried out by other government agencies.	None.
Historical errors and method changes	Various methodological changes.	Historical data was reviewed and updated based on new information and revised methods as described in Table 3 on page 7.
	Shift from voluntary to mandatory reporting in various states highlighted weaknesses in the preceding data. These include: • NSW (from 2016–17) – likely previous overestimate of organics • WA (from 2019–20) – likely previous underestimate of C&D recovery • Tas (from 2022–23) – previous underestimate of recycling generally.	No change. No data to provide a basis for this change.

Issue	Known cases in the raw data provided	Adjustments and rationale
Misallocated fate	Some tonnes allocated to recycling may in fact have gone to energy recovery, as not all states and territories distinguish well between these fates.	Careful checking undertaken and corrections made.
	Hazardous waste fates are partly based on assumptions because data in some states does not readily map to national management types and fates. There is particular uncertainty about the fate of waste to 'treatment', 'storage and transfer' and 'other'.	None directly. The *Australian Hazardous Waste Data and Reporting Standard* provides a suggested long-term framework for categorising fates in state tracking systems.
Over-reporting of recycling	Material is counted as recycled if recorded in state and territory data. However, some of this material may have been delivered but not processed, or processed but then stockpiled on- or off-site.	None. Data on these quantities is not available. Some states regulate and restrict stockpile sizes.
	Material is counted as recovered if it was exported for recovery. However, some of this material may have contaminants that required disposal overseas. Recent regulation on exports of glass, tyres and plastics (and paper from mid-2024) has greatly reduced the significance of this issue.	None. Data on these quantities was unavailable.
Stockpiles inadequately reported	The reporting approach sums waste generation by year based on materials counted at waste facilities. However, some waste is produced in one year but processed in another, e.g. unprocessed materials at recycling facilities or bankrupt operators.	Piecemeal response. The Standard documents an accounting method for stockpiles but it is not well-implemented.
Data is too aggregated	Ash data is received on a national basis but needs to be allocated to states and territories.	Estimates made as shown in the National Waste Reporting Tool 2022–23.

Data quality indicators

A number of other characteristics of state and territory data systems can be seen as indicators of higher underlying quality:

- reporting via compulsory, rather than voluntary, programs
- measurement via a weighbridge, rather than via volumetric measures or truck counts
- recycling collected via a comprehensive industry survey rather than partial or ad-hoc surveys
- for hazardous waste, tracking of truck movements.

Table 5 shows the characteristics of the data from each state and territory against these indicators.

Table 5 Indicators of quality in the 2022–23 state and territory waste data

	Recycling			Landfill			Hazardous
	% tonnes from compulsory facility reporting?	% tonnes measured via weighbridge	Comprehensive recycling survey?	% tonnes from compulsory facility reporting?	% tonnes measured via weighbridge	Source stream split direct from landfill reporting?	Waste tracking system?
ACT	100%	42%	Yes	100%	100%	Yes	No
NSW	88%	98% [1]	Yes	100%	100%[1]	Yes	Yes
NT	69% [2]	100%	No	69%	80%	Yes	No
Qld	100%	Unknown	Yes	100%	95%	Yes	Yes [3]
SA	100% [4]	77%	Yes	100%	99%	No	Yes
Tas	100%	100%	No [5]	100%	85%	Yes	No
Vic	0%	56%	Yes	100%	97%	Partial	Yes
WA	100%	27%	Yes	84%	81%	Partial	Yes

Notes 1 Exemptions apply in some circumstances.
2 This proportion covers only the collected data. NT recycling data is not comprehensively reported.
3 Qld has a multi-year backlog of non-transcribed paper-based hazardous waste transport records.
4 SA compulsory reporting complements a voluntary annual survey of the recycling industry.
5 Only facilities processing more than 10 kt/yr. Changed to comprehensive survey from 2024–25.

1.4 Data collation methods

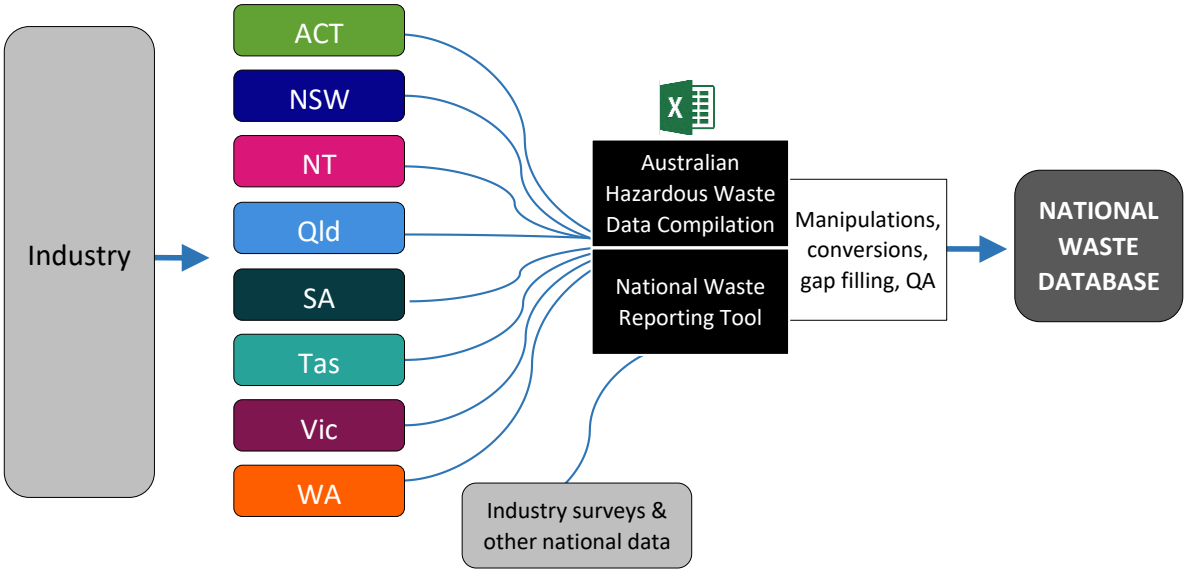
To derive a national picture on waste, a common set of assumptions and categories are applied to the collected data. These are based on the Standard. Some manipulation of state and territory data is required. This includes re-categorisations, applying assumed compositional splits, and adjusting for cross-border transport.

The manipulations are mostly undertaken in the national waste reporting tools discussed in Section 1.2 and published together with this report. Hazardous waste is compiled in a separate workbook titled the National Hazwaste Data Collation, which is published separately.

The outputs of these tools and previous versions of them are combined into a National Waste Database 2024. This contains a record of the headline data set back to 2006–07[14] and limited data on mining and agricultural wastes for 2018–19 and 2020–21. The database is presented in 'flat' format so that users can easily do their own analysis. Waste data flows in preparing this report are illustrated in Figure 9.

[14] Except for 2007–08, 2011–12 and 2012–13, when national data was not collected.

Figure 9 Waste data flows and the National Waste Database



The assumed composition of waste to landfill

A key area of uncertainty is the composition of waste to landfill. The assumptions applied are shown in Table 6. References are given in the National Waste Reporting Tool 2022–23, which is published with this report.

Table 6 Assumptions about the composition of waste to landfill by state and territory

	MSW	C&I	C&D
ACT	ACT bin audit (2022)	ACT landfill audit (2022)	ACT audit (2022)
NSW	NSW bin audit (2023)	NSW landfill audit (unpublished)	*NGER Determination method*
NT	*NGER Determination method*	*NGER Determination method*	*NGER Determination method*
Qld	*NGER Determination method*	*NGER Determination method*	*NGER Determination method*
SA	SA bin audit (2019)	SA landfill audit (2022)	*NGER Determination method*
Tas	*NGER Determination method*	*NGER Determination method*	*NGER Determination method*
Vic	Vic bin audit (2018)	Vic landfill audit (2018)	Vic landfill audit (2018)
WA	WA bin audits	*NGER Determination method*	*NGER Determination method*

The 'NGER Determination method' refers to the National Greenhouse and Energy Report (Measurement) Determination. This document provides a set of default composition values for each source stream that larger landfills apply when reporting their greenhouse gas emissions (see Feature 2). The NGER Determination method is used when states and territories do not have a good understanding of the composition of a source stream to landfill. It estimates the proportional composition of landfill waste as follows:

1. For food organics, vegetation, timber, other organics, paper and cardboard, and textiles and leather and rubber (excluding tyres) in MSW –
   a) calculate the proportion of the population that has an organics bin
   b) multiply this proportion by the 'Class 2' MSW composition in the NGER Determination
   c) calculate the proportion of the population that does not have an organics bin

   d) multiply this proportion by the 'Class 1' MSW composition in the NGER Determination
   e) sum these two sets of values.
2. For these same materials in C&I and C&D waste to landfill, directly use the default values from the NGER Determination.
3. For other materials, assume the breakdown of the residual proportion is equal to the population-weighted average breakdown in the reporting states and territories.

Waste in landfill assumed to be recovered for energy

When organic waste decays in the anaerobic environment of a landfill, the greenhouse gas methane is formed. Many large landfills capture methane-rich landfill gas and use its energy value, commonly through combustion to generate electricity that is sold to the grid. In this report, this process is classified as a form of energy recovery. The national waste reporting tools apply formulas from the NGER Determination to back-calculate the quantity of waste associated with captured landfill gas. These quantities are attributed to the fate 'energy recovery'. For convenience, the method assumes instantaneous decay of waste in the landfill. The methodological steps are set out in item 23 of the Standard and are given in full in the national waste reporting tools.

Other assumptions

A range of other assumptions are needed to build a comprehensive headline data set. These are described at relevant calculation or data entry points in the national waste reporting tools released with this report. The methods for gap-filling often assume that proportions or rates in a jurisdiction, time period, area or source stream were similar to those in another. Table 4 describes some of these assumptions.

1.5 Layout of the data and report

The headline data is presented in Chapters 2 and 4 to 8. These chapters focus on the 2022–23 financial year, showing static bar charts with tonnages split by material type, source stream and/or jurisdiction.

Trend data is presented for the period 2016–17 to 2022–23. This is a change from previous reports in this series, which presented trend data from 2006–07. The main reason for this change is that financial year 2016–17 is the baseline year of the *National Waste Policy Action Plan*, against which progress is measured. The older data is also likely to be of lower quality, and there is no data for 2007–08, 2011–12 and 2012–13. This older data is nevertheless available for analysis in the *National Waste Database 2024*.

Trend data is presented mainly in area charts, showing tonnages and, where applicable, tonnes per capita. Most of these charts show the full headline data set but some show trends only for core waste, which comprises the waste categories of primary interest to the waste and resource recovery industry and the states and territories.

Technical terms and abbreviations are explained in the glossary below the tables of contents.

A data appendix (Appendix B) is presented containing data corresponding to the charts.

Data is rounded to different levels of significance for the benefit of different users, as shown in Table 7. Blue Environment recommends that users of the data reported in this document:

- express data to two significant figures only – this is to appropriately reflect the uncertainty in the values

- undertake calculations using data in the National Waste Database 2024 (which expresses the data to the nearest tonne) or, alternatively, use the data in the appendices.

The National Waste Database on the Department's website enables users to do their own analyses.

Due to rounding, some data may not appear to add up perfectly and percentages may sum to more or less than 100%.

Table 7 Levels of significance of the data presentations in this report

Report elements	Level of significance
• Headline numbers box on first page of 'At a glance' • Charts • Percentage values • Values in 'At a glance' and Chapters 2 and 5 to 9 that are <10 and part of a group in which most values are >10.	Two significant figures.
• Most other text in 'At a glance' and Chapters 2 and 5 to 9.	Three significant figures.
• Appendix B.	Largest value in any table with a particular unit given to four significant figures. Other data rounded to same number of decimal places as that value. Percentages to one decimal place.
• Other chapters.	Ad hoc, based on source data.

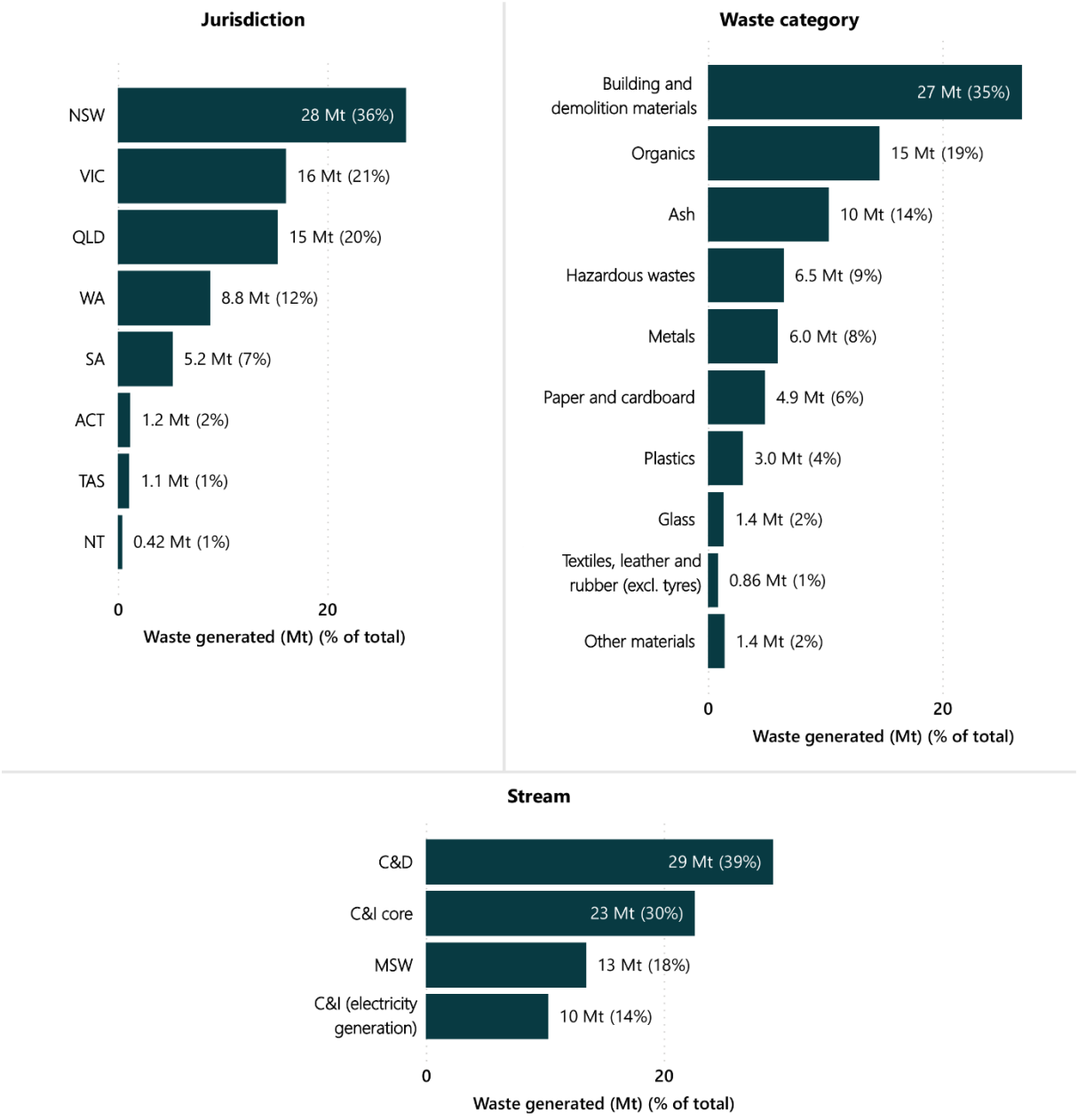
2. Waste generation

This chapter reports on waste generated in Australia in 2022–23 and the trends since 2016–17. Full data for all charts is given in Appendix B.

2.1 Waste generation 2022–23

Waste generation in Australia in 2022–23 is illustrated in Figure 10, broken down by source stream, waste category and jurisdiction. In total, about 75.6 Mt of headline waste was generated, or about 2.88 t per capita. This included 13.5 Mt of MSW (512 kg per capita and 18% of the total), 32.9 Mt of headline C&I waste (44% of the total) and 29.2 Mt of C&D waste (39% of the total).

Figure 10 Waste generation by jurisdiction, waste category and source stream, Australia 2022–23



Link to Data table.

For comparison, in 2016–17 (the baseline year of the National Waste Policy Action Plan), there were 12.9 Mt of MSW, 33.6 Mt of headline C&I waste and 23.6 Mt of C&D waste. These sum to overall headline waste generation of 70.0 Mt.

By waste category, in 2022–23 there were 26.8 Mt of building and demolition materials, 14.6 Mt of organics, 10.3 Mt of ash, 6.5 Mt of hazardous wastes, 6.0 Mt of metals, 4.9 Mt of paper and cardboard, and 3.0 Mt of plastics.

NSW generated the most waste at 27.5 Mt, with high levels of ash, building and demolition wastes, metals, paper and cardboard, and hazardous wastes (mainly contaminated soils).

Australia generated about 65.4 Mt of core waste, or 2.49 t per capita. This is up from 57.8 Mt in 2016–17.

2.2 Trends in waste generation

Figure 11 on page 17 shows the trend in the generation of headline waste between 2016–17 and 2022–23 by source stream. The charts on the left are total tonnes and those on the right are tonnes per capita.

Over the 6-year data period, headline waste generation increased by 5.6 Mt (8.0%) or by 7.6 Mt (13%) when ash is excluded. During the same period, Australia's population grew by about 8% and its gross domestic product by 15%.

By stream, MSW grew by 0.6 Mt (4.9%), C&I headline waste shrank by 0.7 Mt (-2.0%), C&I core waste grew by 1.3 Mt (6.0%) and C&D waste grew by 5.7 Mt (24%). Some displacement of C&I waste to MSW is apparent during the COVID-19 lockdown years of 2019–20 to 2021–22. Quantities of C&D wastes are strongly affected by major projects, particularly related to transport infrastructure. Consequently, the data for C&D is less even than the other streams.

Table 8 summarises the 6-year changes on a per capita basis by source stream. Headline waste quantities increased by 0.1% per capita between 2016–17 and 2022–23, or 4.8% per capita when ash is excluded. Ash quantities are declining as coal-fired power stations close. The main increase per capita is in C&D waste quantities. MSW tonnages per capita fell by 2.8% per capita over this period.

The phenomenon of declining MSW per capita has been observed in other developed nations, including Belgium (StatBel 5 January 2024), Japan (MoE 2024), Singapore (NEA 2024) and the USA (US EPA 2023). Probable causes include:

- reduced printed material due to digitisation
- substitution of plastic packaging in place of glass
- advances in material science and technology making products smaller, lighter and more resource efficient (Hoornweg et al. 2013).

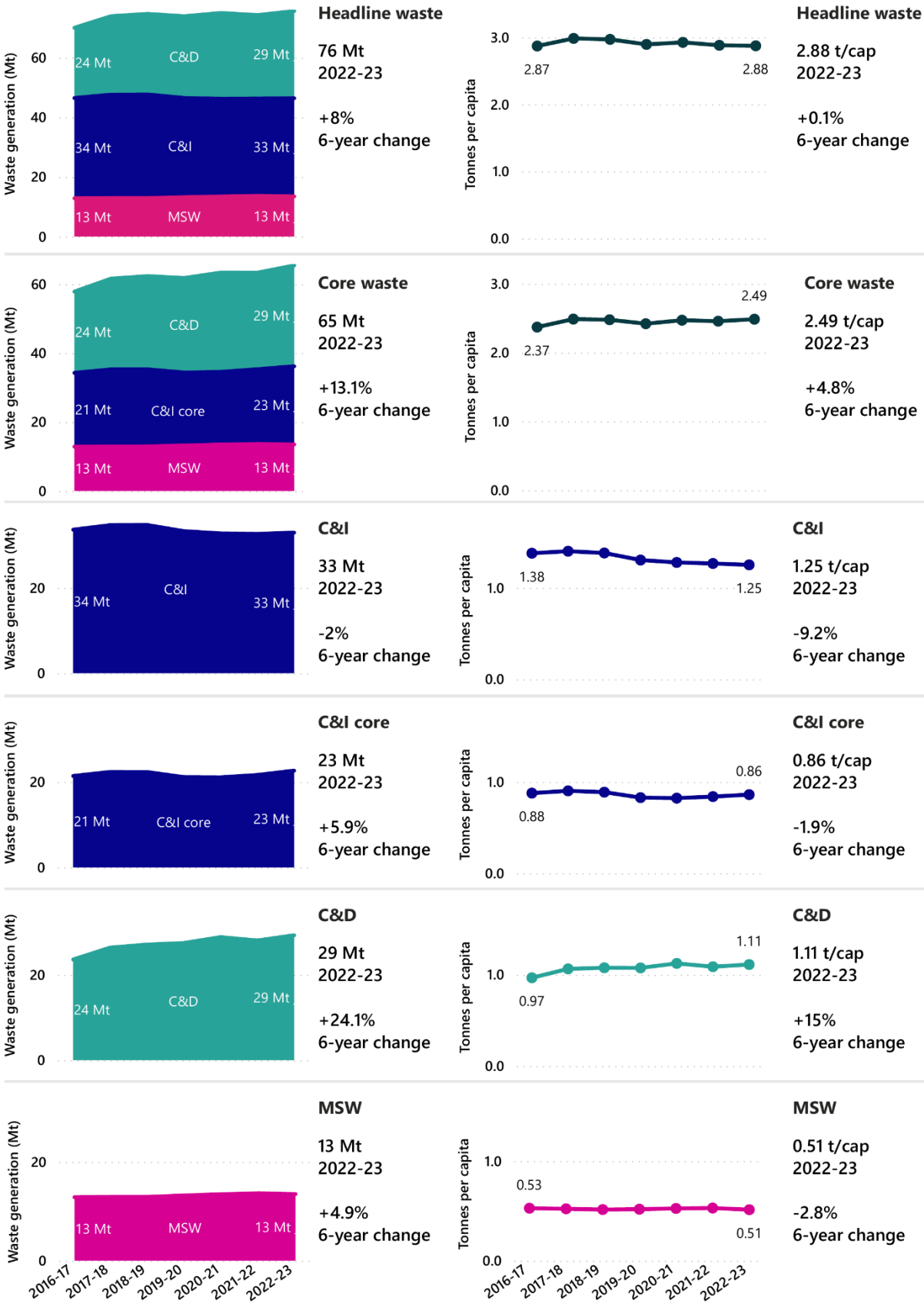
Declining weights do not necessarily correspond to declining volumes.

Table 8 Changes in waste generation per capita, Australia 2016–17 to 2022–23

Headline waste	Core waste	MSW	Headline C&I waste	Core C&I waste	C&D waste
+ 0.1%	+ 4.8%	- 2.8%	- 9.2%	- 1.8%	+ 15%

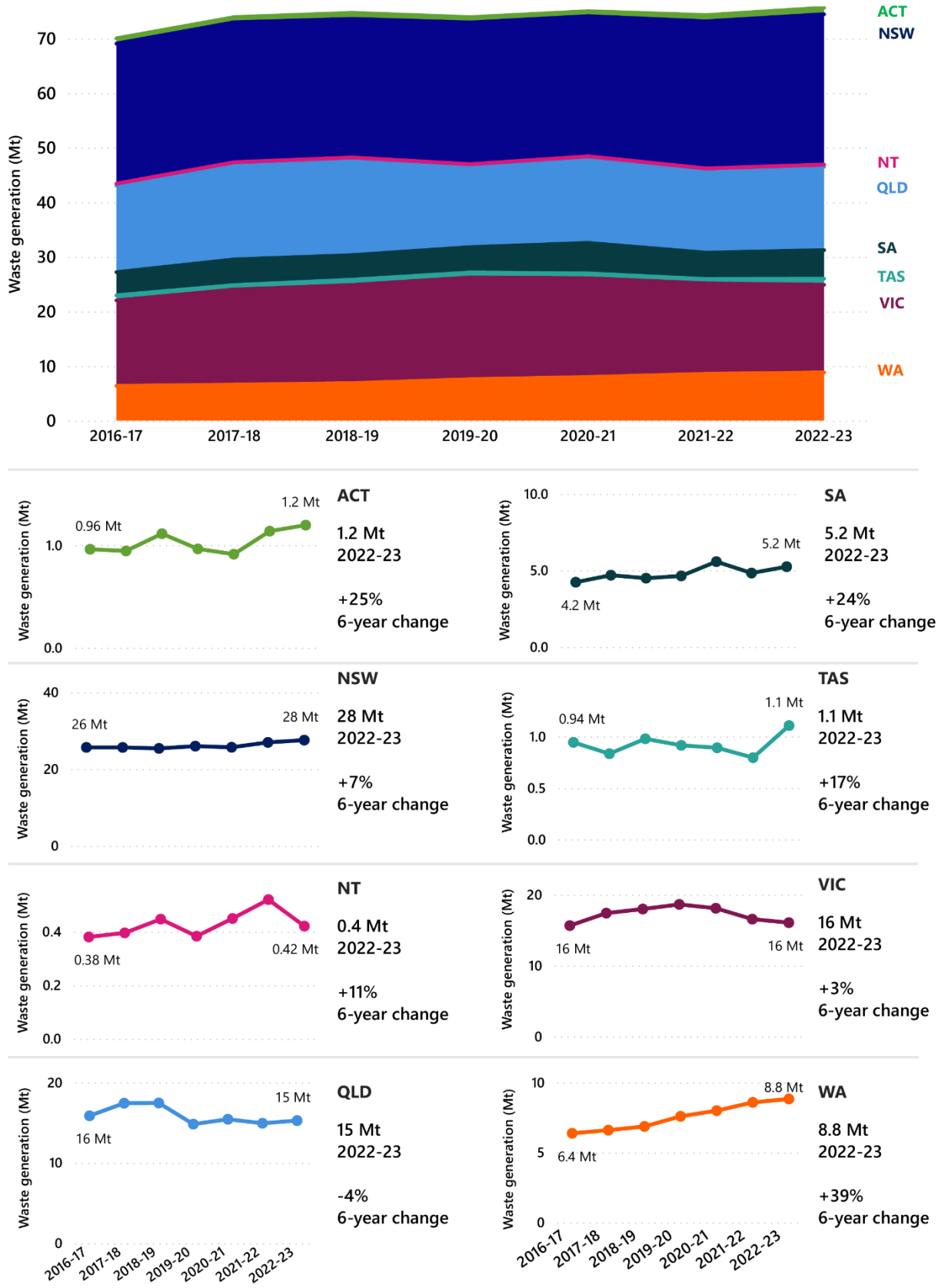
Figure 12 (page 18) shows waste generation trends by jurisdiction between 2016–17 and 2022–23. The largest recorded increases were in WA (39%), the ACT (25%) and SA (24%). In each case, the biggest rise was in the C&D stream. The only recorded fall was in Qld (-4%).

Figure 11 Trends in waste generation by source stream in total (left) and per capita (right), Australia 2016–17 to 2022–23



Link to Data table.

Figure 12 Trends in the generation of waste by jurisdiction, Australia 2016–17 to 2022–23



Link to Data table.

3. Waste prevention

3.1 What is waste prevention?

Waste prevention is any deliberate action that stops an item, component or material from entering a formal or informal waste management facility or system.

Waste prevention actions focus on reducing waste at its origin and are of central importance in driving change as Australia moves towards a circular economy.

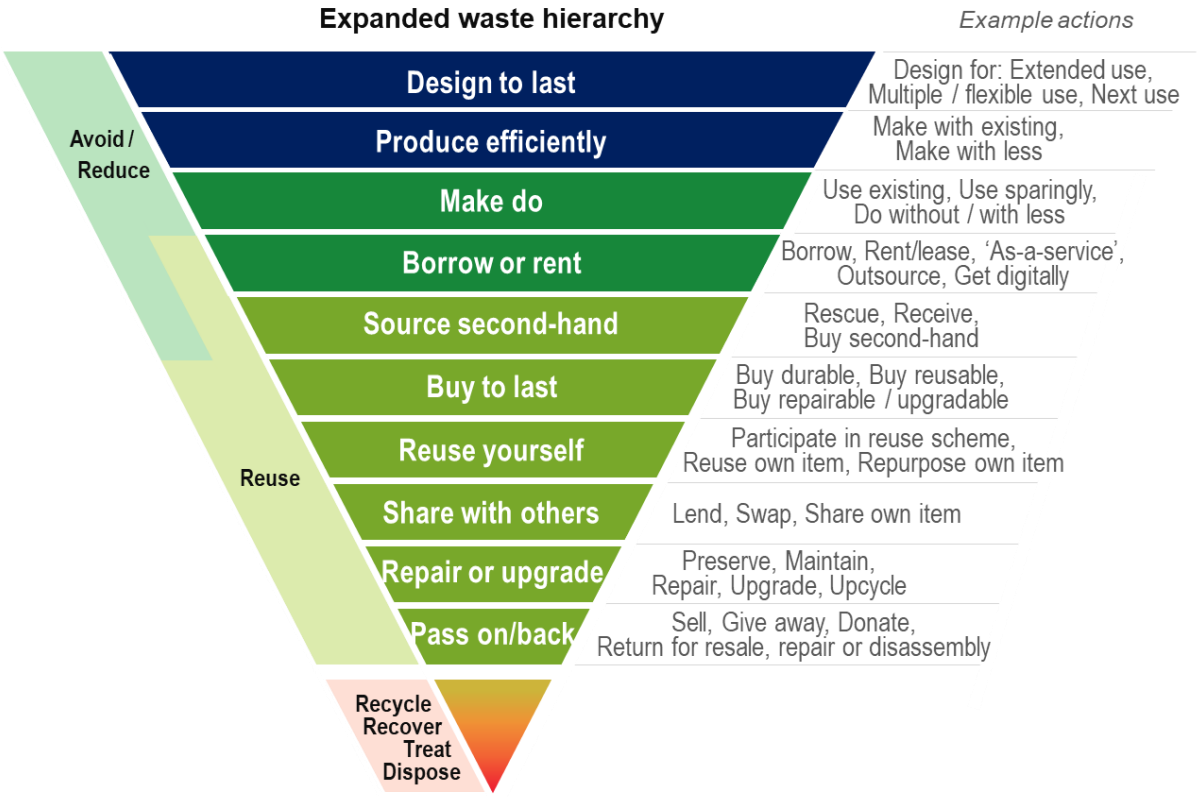
The waste hierarchy framework

The 'waste hierarchy' framework (Figure 13) helps prioritise waste management actions based on their environmental impact, shaping policies and decisions for better waste and resource management. The revision below places additional focus on waste prevention efforts (based on DCCEEW 2022b). The hierarchy is structured in generally descending order of preference, emphasising the most favourable options.

The adoption of the revised framework by government, industry, and the community aims to:

- improve the quality of data collected
- assist stakeholders in understanding, measuring, and promoting waste prevention efforts in Australia.

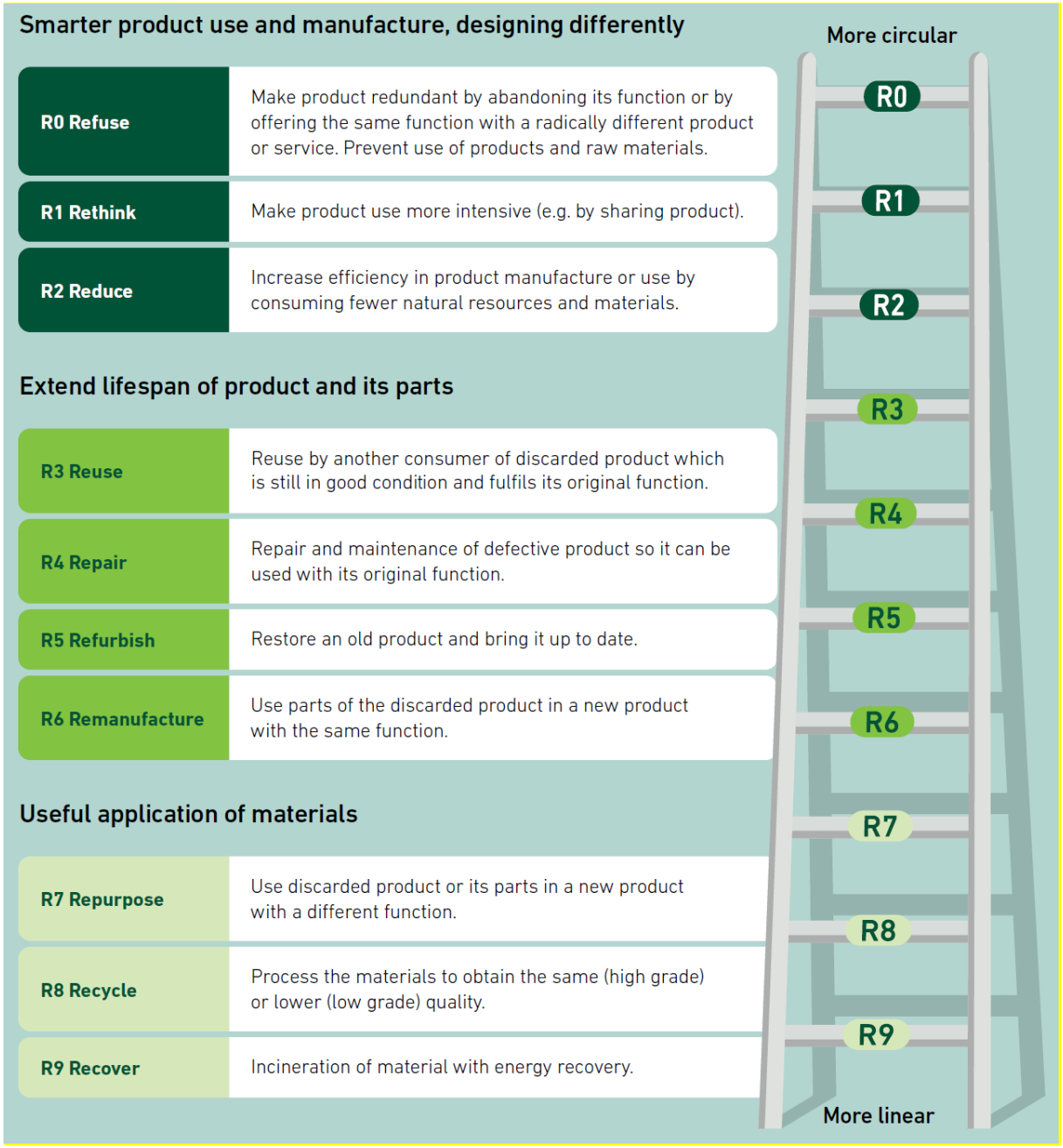
Figure 13 The waste hierarchy framework, showing example waste prevention actions



Alignment with Circular Economy

Waste prevention aligns with the circular economy principles of minimising resource inputs and keeping products and components in use at their highest value for as long as possible. Particularly, it aligned with strategies R0–R7 of the '10Rs' framework (see Figure 14).

Figure 14 '10Rs' of circular economy, in an 'R ladder'



Source: Sustainability Victoria (2024)

Measuring Waste Prevention

For data collection purposes, waste prevention outcomes are defined as the weight of products, components or materials that would have entered a waste management facility but were prevented by deliberate action.

3.2 Waste prevention actions

Government action

All levels of government in Australia are beginning to focus on waste prevention in public policy and programs. Most initiatives encourage household and business action through campaigns, innovation funding and resources.

At the national level, recent developments include:

- The Circular Economy Ministerial Advisory Group has proposed upstream indicators of circularity for The Treasury's *Measuring What Matters* framework. These include material footprint, domestic material consumption and resource productivity (DCCEEW 2024b).
- The recent *Environmentally Sustainable Procurement Policy and Reporting Framework* contains 'innovation metrics'. These include innovative design that ensure products last longer (DCCEEW 2024c).
- Measurement guidelines for second-hand reuse were funded through the Australian Research Council (Allen et al 2022).
- Research and action on reducing plastic waste funded through the cooperative research centre Solving Plastic Waste (2023).
- The Australian Government funded not-for-profit End Food Waste Australia to develop and deliver a nationwide behaviour change campaign to help Australian households reduce food waste. The Great Unwaste campaign was launched on 29 September 2024.

Some active state and territory initiatives to encourage and facilitate waste prevention are listed in Chapter 9.

Product stewardship and industry action

Under product stewardship schemes, organisations that place products on the market play a proactive role in eliminating and/or reducing the negative impacts associated with those products. Explicitly prioritising waste prevention in product stewardship – for example through good design and provision of repair options – is critical to achieving a circular economy (Macklin et al 2024). Some individual businesses initiatives include waste prevention activities (Florin et al 2023). Currently, few collective product stewardship schemes incorporate waste prevention. Table 9 showcases some that do.

Table 9 Waste prevention activity by sector or material type

Sector	Summary of activity
Clothing	Australia's first clothing stewardship scheme, Seamless, has been announced. Its strategic priorities consider the whole of a garments' life, covering design for durability, circular business models (rental, reuse and resale) and citizen behaviour change for reuse, donation, buying better and caring for clothes. Its planned focus on collection and sorting redirects wearable clothing back into use (Seamless 2024). Clothing chain Kathmandu has established Kathman-redu, a clothing take-back, repair and resell pilot, with support from Sustainability Victoria (2023).
Packaging	The National Packaging Targets recognise the potential for reusable packaging. The *Sustainable Packaging Guidelines* include principles that support reuse and waste reduction (APCO 2020). For data on packaging waste, see Feature 3 on page 68.
Electronics	Design and repair options are being considered for the proposed regulatory product stewardship scheme for small electrical and electronic equipment and solar PV systems.

Sector	Summary of activity
Food	The voluntary Australian Food Pact has been signed by a number of major food manufacturers, retailers, non-government organisations and others. More broadly, effort is being spearheaded by End Food Waste Australia, in partnership with the Australian and state and territory governments, a number of local councils and many industry bodies (End Food Waste 2023, 2024). In addition, the work of food rescue charities continues, with OzHarvest (2022) moving beyond rescue to consumer food waste avoidance campaigns.
Consumer goods sector	Charitable and social enterprise retailers and online trading platforms continue to facilitate the donation and purchase of second-hand goods (CRA 2024).
Built environment	Guidelines and resources are emerging for preventing waste in the design, operation and deconstruction of buildings and infrastructure. Individual projects exhibit waste prevention and circular design principles, such as design for longevity, adaptability and disassembly, modular construction and reuse of existing assets (NSW Treasury 2023).

Action by waste prevention strategy

Table 10 sets out the main waste prevention activity by each of the major strategies from the expanded waste hierarchy in Figure 13 above.

Table 10 Waste prevention activity by strategy

Strategy	Summary of activity
Avoid / reduce	Strategies are centred around 'lean manufacturing' and material efficiency in production, and consumer avoidance campaigns around single-use plastics and food waste. There is some focus on durability in product design and the built environment.
Borrowing (incl. hiring, leasing)	Mainstream channels for vehicles, information and communication technology equipment, and power tools continue. Micro/membership rental models continue to expand beyond short-term car hire, to bicycles and fashion. Pilots for returnable reusable products/packaging, such as in food courts and commercial offices, are beginning to emerge. The number of rental and hiring business has remained stable at approximately 1% of all businesses in Australia between 2017–2023.
Reuse (incl second-hand, reusables, repurposing and sharing)	Most reuse is centred around second-hand consumer goods via charitable and social enterprise retailers, commercial online trading platforms and electronics brands selling refurbished options. Packaging reuse is also a focus, with some established services for business-to-business secondary and tertiary packaging. Enterprises are also emerging that offer reusable alternatives to single-use items, and refillable/returnable packaging. Corporate donation of unsold goods to charities, and food rescue operations continue. Some individual experimentation is also occurring in building component reuse. Repurposing activity is predominantly focused on manufacturing processes, particularly agricultural and aqua-cultural food by-products, as well as aesthetically 'imperfect' produce.
Repair and upgrade	Commercial and industrial repair and refurbishment continues, as does a local government focus on community repair. Coordinated research and advocacy is stronger, with annual conferences bringing together repairers across industries and product streams. The number of repair and maintenance business has remained stable at approximately 2.5% of all businesses in Australia between 2017–2023.
Passing on or back	Activity is predominantly centred in donation via charitable and social enterprises. This includes unwanted business equipment, surplus pre-consumer stock and food, and unwanted post-consumer items. Retailers and major brands identified 'buy–back' and 'take-back' as having high potential (Macklin et al 2023). But beyond vehicle and electronics trade–in schemes, only a few pilot schemes operate.

3.3 Waste prevented

The measurement and reporting of waste prevention is still in its infancy in Australia. The following table provides a snapshot of a limited number of initiatives for which measurement and/or public reporting were identified. Few additional data sources have been identified since the *National Waste Report 2022*. The following figures are estimates of the weight of actual waste generation prevented nationally. In some cases, this is smaller than the weight of items/material subject to the waste prevention activity / initiative due to the application of a waste generation displacement rate.[15]

Table 11 Identifiable amounts of waste prevented, Australia 2022–23

Strategy	Initiatives	Prevented (kt)
Make do without / with less	Consumer waste avoidance campaigns, e.g. Plastic Free July (Plastic Free Foundation: Ashton-Graham 2023).	47.8
Source second-hand	Purchase of second-hand consumer goods, e.g. charity reuse and second-hand stores (Charitable Reuse Australia: Heinrich et al 2024).	50.8
	Consumer second-hand campaigns, e.g. Garage Sale Trail (Garage Sale Trail 2024).	1.8
Reuse, repair and repurpose	Reusable business-to-business packaging, e.g. pallets, crates, drums, etc (APCO 2024).	2,700
	Reused and retreaded tyres (Tyre Stewardship Australia 2024).	63.5
	Reusable consumer packaging, e.g. reusable shopping bags, coffee cups (APCO 2024).	114
	Returnable/refillable packaging services, e.g. coffee cups, laundry products (Cercle 2024, Dirt Company 2024, Responsible Cafes 2024).	0.7
Pass on or back	Household donation of unwanted consumer goods, e.g. to charity reuse & second-hand stores (Charitable Reuse Australia: Heinrich et al 2024).	114
	Business donation of consumer goods, e.g. unsold/surplus retail product, etc (GIVIT 2023, Good360 2023).	2.3
	Business donation of unsold food, e.g. supermarkets and food services (FareShare 2024, Foodbank Victoria 2023, SecondBite 2023, OzHarvest 2023, Uniting WA 2024).	81.9

The total of 3.18 Mt presented in the table is only a fraction of all waste prevented, as a much larger range of activities and organisations preventing waste in Australia exists than captured here (BehaviourWorks Australia 2022).

[15] Waste is prevented only if a waste prevention activity 'displaces' a waste generating activity. For example, buying an item second-hand only prevents waste if the second-hand item was purchased *instead of* a new item. Data on tonnage subject to an activity may overstate the net waste prevention if the 'displacement rate' is less than 100%. Displacements rates are drawn from the National Waste Prevention framework (DCCEEW 2022b), which sets out displacement rates for household waste prevention activities such as borrowing, buying second-hand, repairing and passing on.

4. Recycling and waste reuse

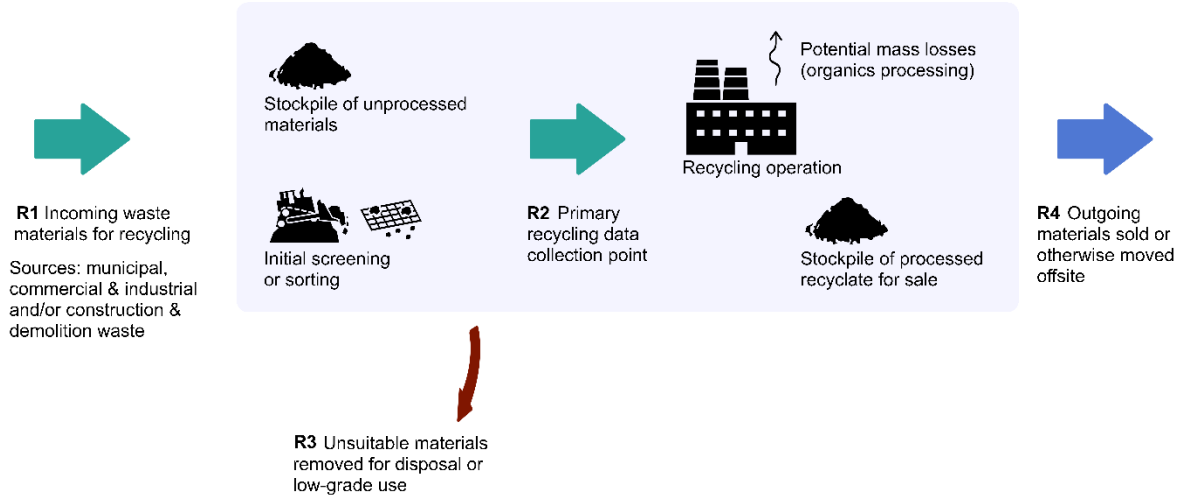
This chapter reports on the quantities of waste materials reused and processed for recycling in Australia in 2022–23 and the trends since 2016–17. Information on the recycling of particular waste materials is given in Chapter 8. Full data for all charts is given in Appendix B.

4.1 What the recycling data covers

Figure 15 illustrates material flows at a generic recycling facility. Material flows to recycling can be measured at different points, illustrated as R1 to R4. The measurement points used vary by waste type and jurisdiction. If materials are measured at point R1, quantities could be exaggerating because stockpiles of processed or unprocessed material could be included or rejected materials (R3) could be counted twice (at the recycling depot and landfill). Some jurisdictions report at point R4, on the grounds that this is the true measure of actual recycling. However, this is not currently achievable by all, and it makes tracking of waste generation more difficult.

The national approach is to measure recycling at point R2. However, some is recorded at point R1, including some material exported for use overseas.[16] Although recycling is not fully undertaken until the processed material is used in new products, buildings or infrastructure (that is, after R4), the vast bulk of material reaching R2 is so used.

Figure 15 A generic recycling process, illustrating what is included in the data presented in this section

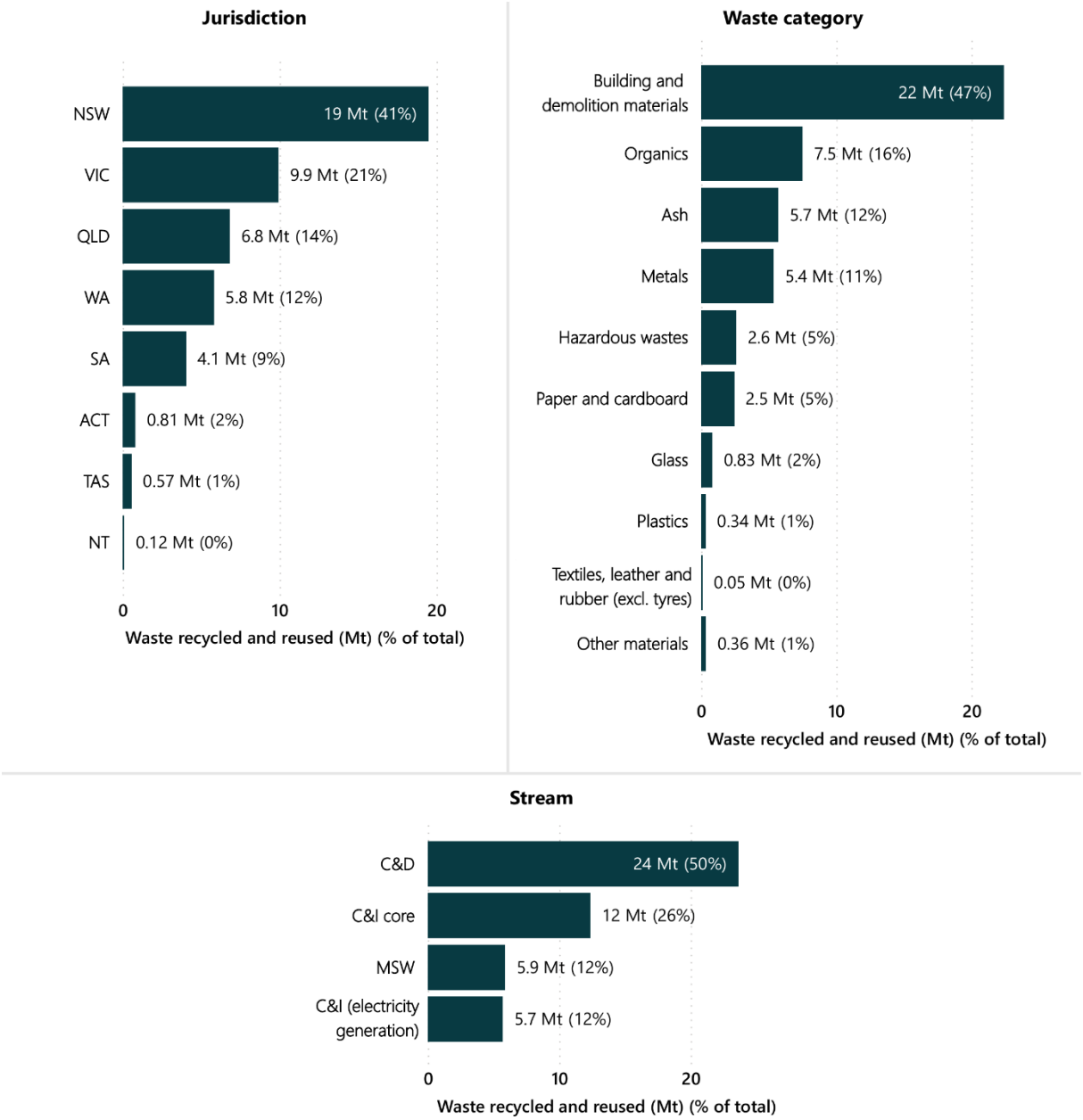


4.2 Recycling and waste reuse in 2022–23

Recycling and waste reuse of core wastes and ash in Australia in 2022–23 are illustrated in Figure 16. About 47.6 Mt of waste materials were recycled or reused, up from 40.5 Mt in 2016–17. More than 90% of the tonnage increase was from the construction and demolition sector. The four largest fractions of recycling, making up 86% of the total, were building and demolition materials (22.4 Mt), organics (7.5 Mt), ash (5.7 Mt), and metals (5.4 Mt). C&D represented the largest source stream (50%) followed by headline C&I waste (38%) and MSW (12%). The equivalent values in 2016–17 (the baseline year of the National Waste Policy Action Plan) were 42%, 45% and 13% respectively.

[16] The quantity of contamination (or 'off–spec' material) in Australia's exports of recovered materials is now reduced due to its regulation of exports of glass, plastics, tyres and paper and cardboard.

Figure 16 Recycling and waste reuse by jurisdiction, waste category and source stream, Australia 2022–23



Link to Data table.

4.3 Sorting

The data presented in Figure 16 covers materials processed by or delivered to recycling operations. Depending on the source and material, materials often need to be sorted before delivery to these facilities. Sorting of homogenous, commercially-sourced material streams such as cardboard or glass can be a simple manual process, but mixed material streams need sophisticated sorting.

The most complex sorting processes are at material recovery facilities (MRFs), which receive mixed domestic 'dry recycling'. In 2022–23, MRFs received about 2.00 Mt of materials, comprising about 1.80 Mt from households and 0.20 Mt from commercial sources. About 21% of receipts were sent to landfill. Typically, MRFs send waste to landfill when materials are:

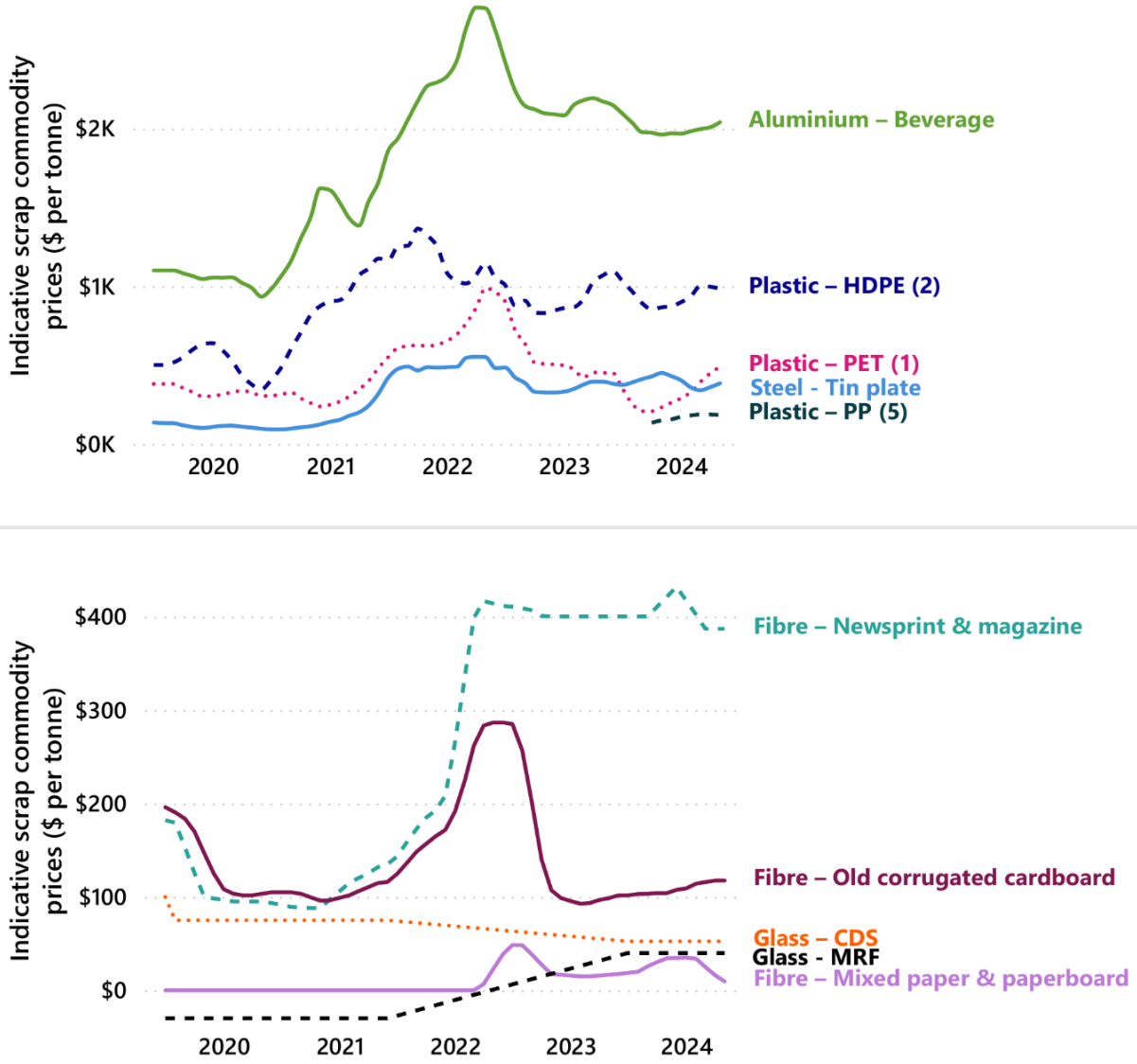
- not recyclable and should not have been put in the recycling bin

- improperly presented, for example inside a plastic bag
- too small, for example container caps
- damaged by the recycling process, for example small pieces of broken glass.

MRFs separate materials using a mix of manual and automated sorting methods. Machinery may include trommels, air separators, magnets, eddy currents, optical sorting devices and, increasingly, units controlled through artificial intelligence. MRF outputs include high value products such as baled aluminium cans and low value materials such as mixed paper.

Figure 17 shows time series data on indicative commodity prices of MRF outputs since July 2019. Unlike much of the data in this report, values are extended through to 2024. Prices for these commodities are reasonably strong. Quantities and prices of low value mixed materials have declined strongly since the China's 'National Sword' policy and Australia's subsequent regulation of exports of waste (see Section 11.2).

Figure 17 Indicative scrap commodity prices, July 2019 to May 2024 ($ per tonne, product leaving a materials recovery facility)



Sources: Blue Environment and Envisage Works research and consultation

Link to Data table.

4.4 Waste reuse

Waste reuse encompasses materials that have entered a waste or resource recovery facility and are recovered without any reprocessing (but potentially with some repair). It covers goods and products 'rescued' from waste in reuse shops (sometimes called 'tip shops') and contaminated soils that are recovered from 'soil banks' without processing.

Australia's estimated 130 reuse shops play an important role. They contribute to a reduction in waste to landfill, produce low-cost goods, and often provide employment for disadvantaged people. In 2022–23, reuse shops in the ACT, NT, Qld and WA reported sales of about 41.1 kt of goods (the other jurisdictions were unable to provide data).

Feature 1 Mechanical biological treatment

Mechanical biological treatment (MBT) involves processing mixed residual waste (garbage), primarily from households. Recyclables are mechanically extracted and the organic-rich residual material is processed by composting or anaerobic digestion. The promise of MBT was to avoid the need and cost of separate collections for MSW. There was great optimism about this technology in the 2000s and significant investments in NSW, Qld and WA.

Unfortunately most of these facilities were unable to deliver high quality recovered product at a reasonable cost. In 2018 NSW banned the deposit of the processed organic material on land, and most is now used to cover landfilled waste. Neither of the WA facilities are still operating as an MBT.

Source separation of MSW organics for processing is now considered best practice nationally.

4.5 Trends in recycling and waste reuse

Figure 18 shows the trends in recycling and waste reuse by source stream, in tonnes on the left and per capita on the right. Recycling is the dominant component. Overall recycling and waste reuse increased strongly during the 6-year timeframe, rising by 17% on a tonnage basis and 8.9% on a per capita basis. Considering core waste only (i.e. excluding ash), the increase was 22% on a tonnage basis and 13% on a per capita basis.

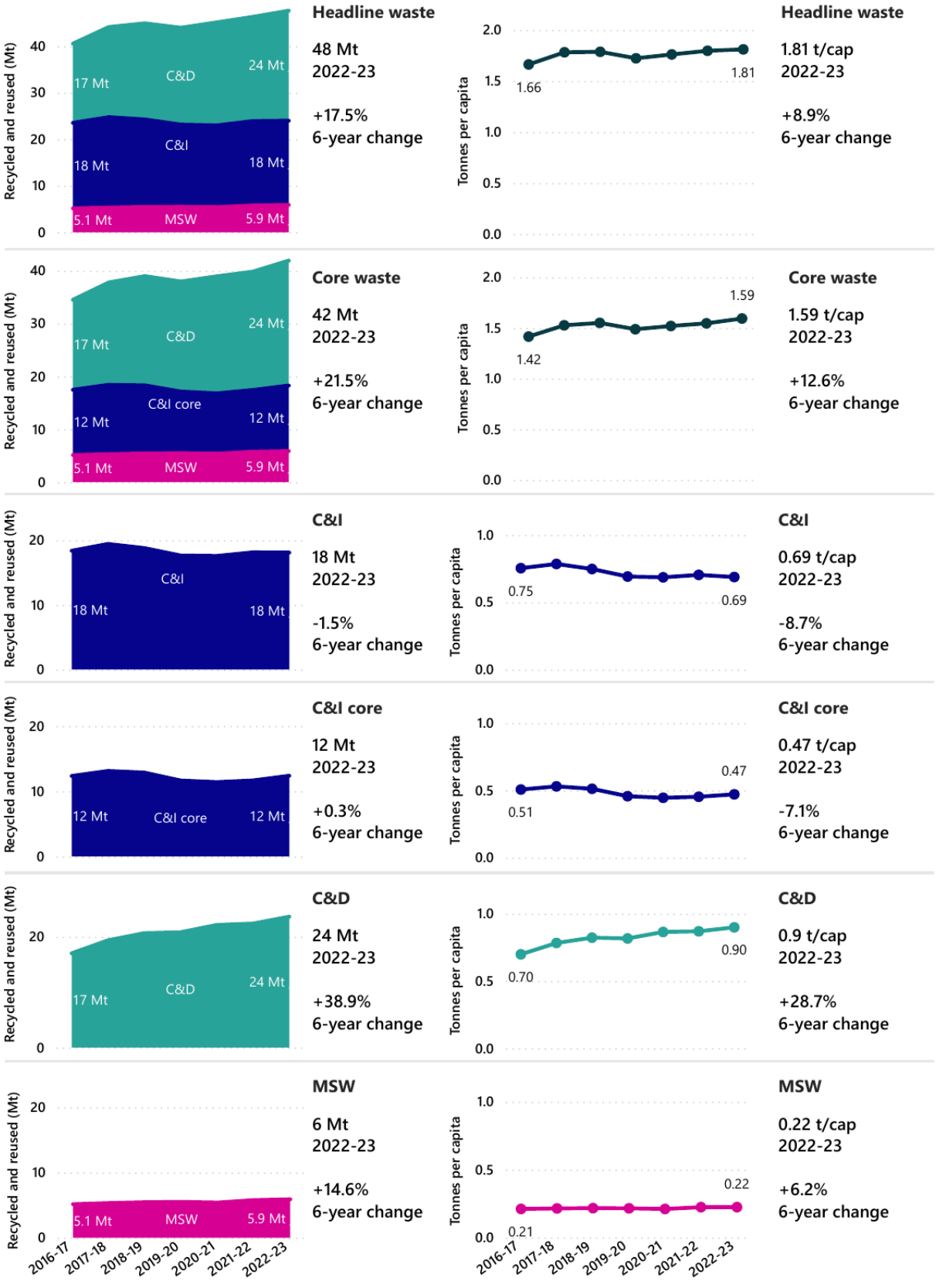
Most of the increase was C&D waste recycling, which rose by 39% or 6.6 Mt between 2016–17 and 2022–23. More C&D waste was generated (see Section 2.2) and the rate at which it was recovered grew sharply from 72% to 81%. Demolition waste recycling is a success story in most jurisdictions, providing an alternative source of materials for road base and construction aggregates (see Section 8.3).

C&I waste recycling declined by 1.5% or 280 kt over the 6-year timeframe. No waste reuse was recorded in the C&I source stream. When only core C&I waste is included, there was an increase of 0.4% (or 52 kt). On a per capita basis, both values represent a decline. However, recycling of C&I core waste picked up markedly in the last two years of the data set, coinciding with the end of the COVID-19 lockdowns.

MSW recycling and waste reuse rose by 15% or 750 kt over the six-year timeframe, and by 6.2% on a per capita basis. This can mostly be attributed to increased organics recycling, which grew by 42% or 1.0 Mt. Other MSW recycling declined by 11% or 290 kt. The trend to lower quantities of non-organics recycling may seem counter-intuitive. It appears to be caused by lower sales of newsprint, declining quantities of glass and generally lighter packaging.

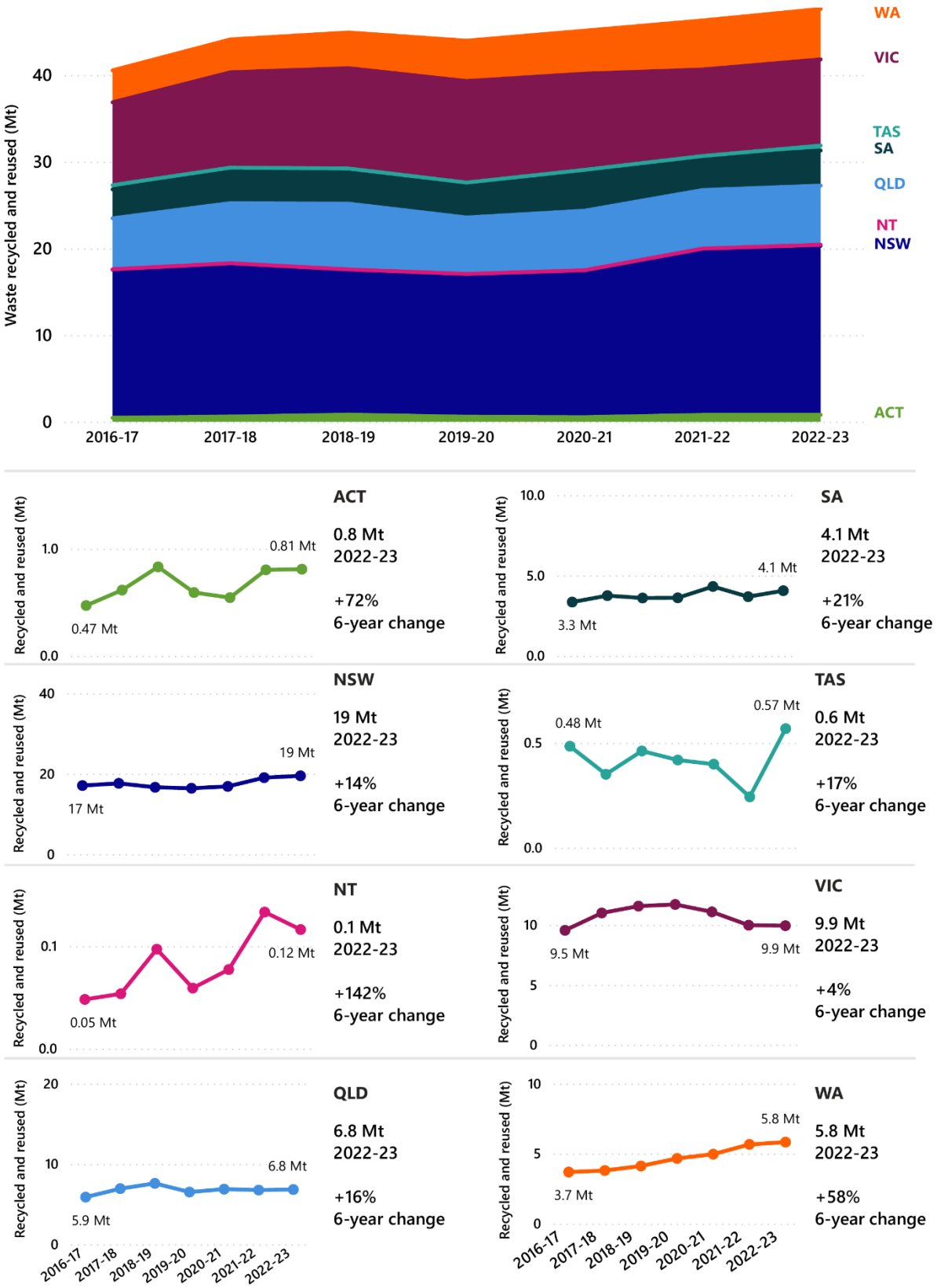
Figure 19 (on 29) shows trends in the quantities of headline waste to recycling and waste reuse by jurisdiction between 2016–17 and 2022–23. Rates increased in all jurisdictions. The high rates of variability in the smaller jurisdictions are associated with large-scale projects and some data measurement issues.

Figure 18 Trends in recycling and waste reuse by source stream in total (left) and per capita (right), Australia 2016–17 to 2022–23



Link to Data table.

Figure 19 Trends in recycling and waste reuse by jurisdiction, Australia 2016–17 to 2022–23



Link to Data table.

5. Energy recovery

This chapter reports on wastes used for their energy value in Australia in 2022–23 and the trends since 2016–17. Chart data is presented in Appendix B.

5.1 Types of energy recovery

The main ways waste was or could be used for energy are described below, in order of quantity of energy recovered in 2022–23.

Table 12 Types of energy recovery from Australian solid waste

Method	Description
Landfill gas	Methane-rich gas is generated from anaerobic decay of organic wastes in landfills. At larger sites, including those accepting about 75% of MSW, this is collected and combusted for its energy value, usually by generating electricity for sale to the grid.
Waste-derived fuels	Waste-derived fuels are of different types: • 'solid recovered fuels' (sometimes called 'processed engineered fuels') are made to a specification, including a calorific value, mainly from C&D and C&I waste timber, plastics, paper, cardboard and/or textiles • 'tyre-derived fuels' are solid recovered fuels made from shredded waste tyres • 'refuse-derived fuels' are not processed to a specification, and are generally residual timber or garden organics • high calorific value liquid hazardous wastes (solvents and paints).
Anaerobic digestion	Anaerobic digestion is like composting in large, oxygen-deprived tanks. This produces methane that can be used for generating electricity. Anaerobic digestion is not yet widely used at scale for solid waste, primarily due to cost.
Thermal energy from waste facilities	No large-scale energy from waste facilities yet operate in Australia. Two are under construction to service Perth. Several others are planned in other states. Several incinerators process mainly medical waste but do not recover energy.

5.2 Energy recovery in 2022–23

Figure 20 shows recorded energy recovery from waste by source stream, waste category, jurisdiction and management type. About 2.3 Mt of waste is recorded as used for energy recovery, an increase of 5.7% since 2016–17.

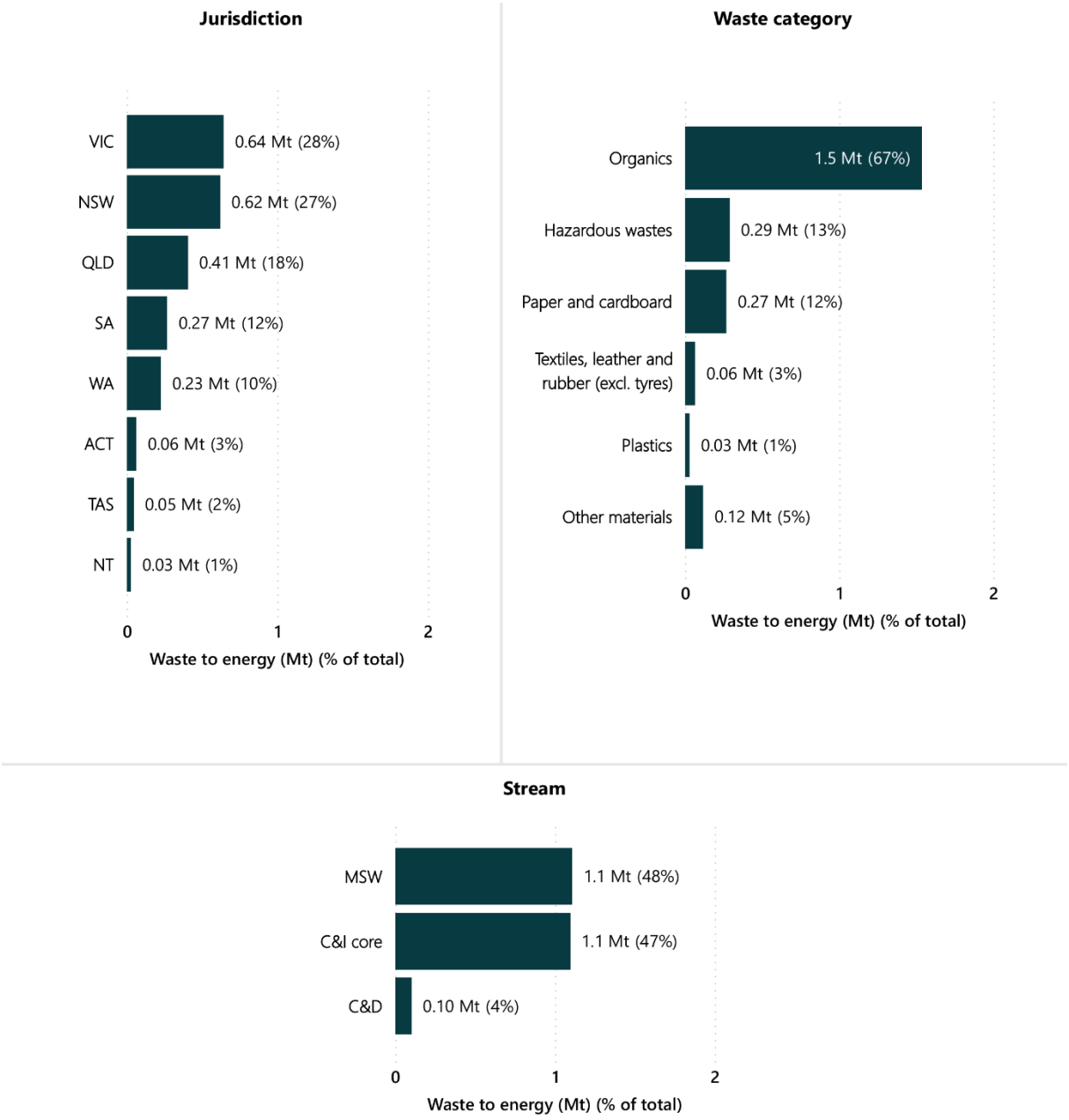
Landfill gas collection accounts for 76% of the energy recovery, or 1,760 kt of waste.[17] About 42% of landfill gas generated in Australia was captured. About three-quarters of this was used for its energy value (UNFCCC 2024). The National Greenhouse Accounts can be used to estimate the proportion of landfill methane used for energy recovery by state and territory. The latest inventory reports on financial year 2021–22. Those proportions were ranked as follows: Vic (47%), Tas (36%), NSW (32%), Qld and SA (both 31%) and WA (27%). The energy derived from landfill gas in 2022–23 was about 9% of the reported energy derived from solar photovoltaic systems (DCCEEW 2024d).

[17] The calculation method is set out in Section 1.4.

Nearly all the remaining energy recovery (526 kt) was waste-derived fuels.[18] This included about 197 kt of tyre-derived fuel for export and the remainder going mainly to cement kilns in Qld, SA and Tas.

Smaller quantities went to industrial boilers and 18 kt is allocated to anaerobic digestion. Most of the tonnage to anaerobic digestion is recorded against the fate 'recycling' as the process generates large amounts of digestate that is assumed to be recycled. This material has characteristics similar to compost.

Figure 20 Energy recovery by jurisdiction, waste category and source stream, Australia 2022–23



Link to Data table.

[18] This covers only material redirected from waste. Many industrial facilities use processing residues as a power source (e.g. saw mills, sugar cane processors) but these are not in the scope of this report.

5.3 Trends in energy recovery

Trends in energy recovery by state and territory are shown in Figure 22. The figure suggests that energy recovery from waste nationally increased by about 6% between 2016–17 and 2022–23. A decline of 17% in NSW was offset by increases in all other jurisdictions.

This small increase masks an apparent fall of 6% in landfill gas energy recovery, due to one or more of the following factors:

- landfill gas companies redirecting effort from energy generation to flaring
- reduced quantities of organics sent to landfill, resulting in less gas generation
- data problems.

Feature 2 Solid waste management and climate change

The carbon footprint of waste management is multi-faceted.

There were direct emissions of 10.5 Mt of carbon dioxide equivalent (CO_2-e) from solid waste management (landfill, biological treatment and incineration) in 2021–22, equivalent to 2.5% of Australia's total. Methane from landfills represented 97% of these emissions. Landfill emissions have declined substantially over 25 years (see Figure 21), primarily due to increasing methane capture and combustion. However, the data suggests that in recent years emission rates have flattened and may have started to rise.[19]

Emissions from on-site fossil fuels or electricity can be high in some processes, especially scrap metal processing, paper recycling and MRF operation.

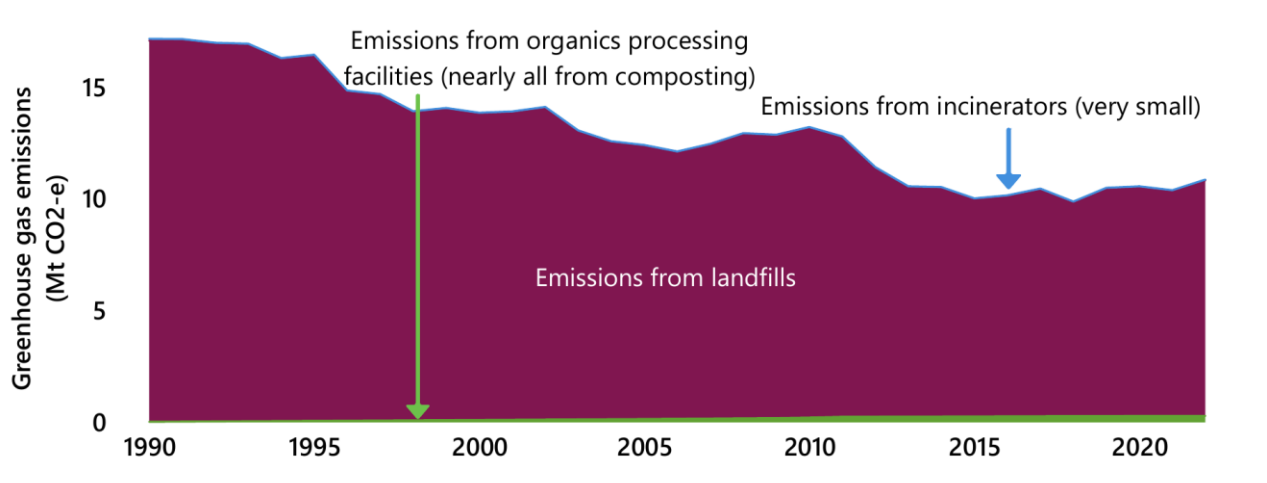
Emissions from collecting and transporting waste, on the other hand, are generally low. National accounting methods suggest that depositing a 20-tonne load of municipal waste in a landfill with no gas capture would produce more emissions than driving that same load on a 14,000 km lap of the continent.

Recycling produces significant carbon benefits by substituting for emissions-intensive primary production. This effect is particularly pronounced for metals (Carre et al. 2015).

There are also significant benefits in generating low emission energy from waste, including from landfills, noting that this will often substitute for fossil fuel energy.

Organic carbon stored in soils and landfills represents a greenhouse benefit by delaying emissions, potentially for long periods.

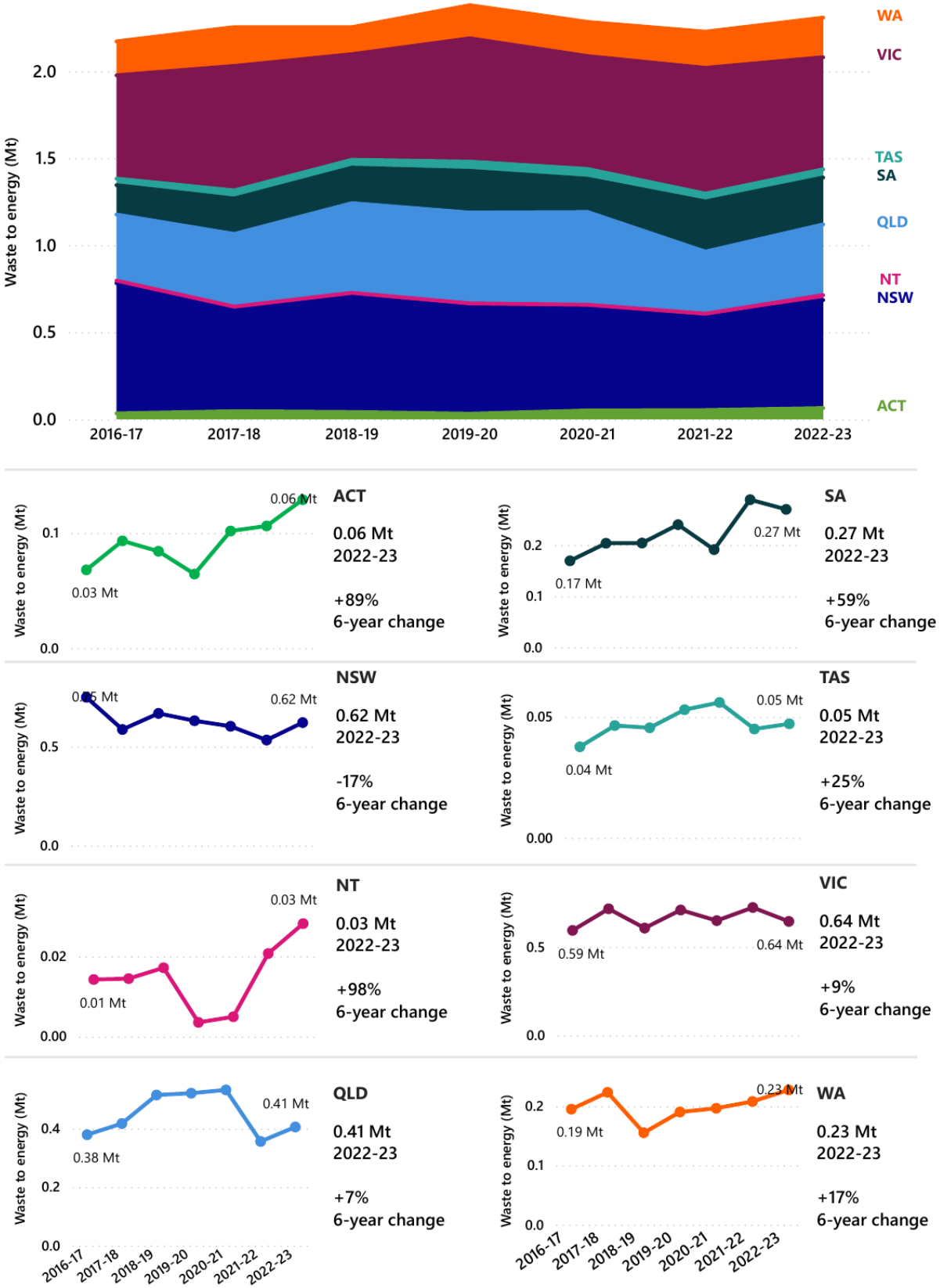
Figure 21 Greenhouse gas emissions from solid waste management, 1989–90 to 2021–22



Link to Data table.

[19] There are some uncertainties in this data, including the estimated composition of waste to landfill.

Figure 22 Trends in energy recovery by jurisdiction, Australia 2016–17 to 2022–23



Link to Data table.

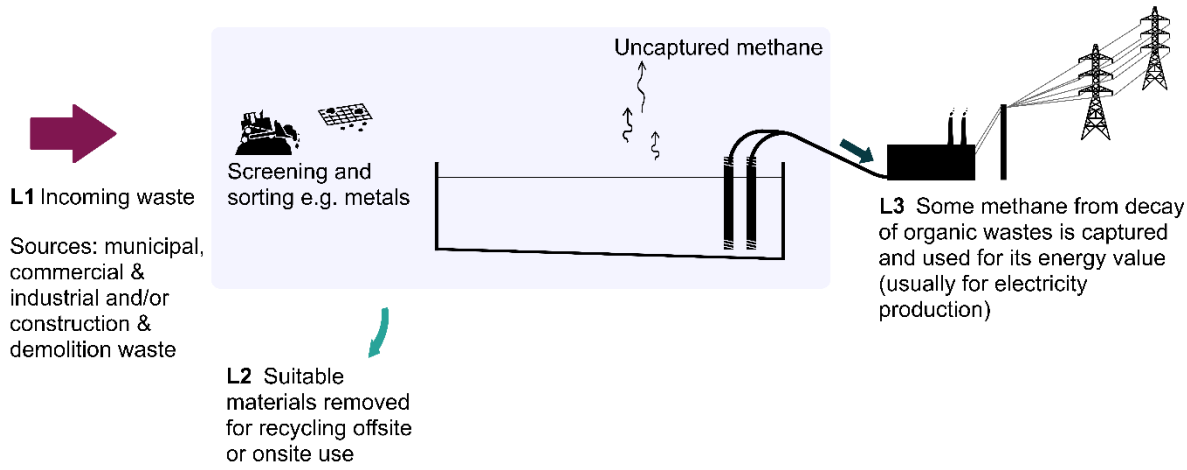
6. Disposal

This chapter reports on the quantities of core waste plus ash materials disposed of in Australia in 2022–23. Disposal means allocation to a fate in which no use is made of the waste. About 82% of disposed headline waste was sent to landfill. The remainder was ash sent to long term storage (18%) and other disposal of hazardous waste (1%).

6.1 What the data covers

In this report, not all waste taken to landfill is 'disposal'. Waste to landfill that generates methane used for generating electricity is counted under 'energy recovery'. Material that is subsequently sold (e.g. metals) or used on-site (e.g. crushed concrete) is counted under 'recycling'. This is illustrated in Figure 23, which shows material flows at a generic landfill facility. Waste disposal is equal to L1 minus L2 minus L3.

Figure 23 A generic landfill process, illustrating the data presented in this section



6.2 Waste disposal in 2022–23

Figure 24 shows disposal of headline waste by jurisdiction, waste category and source stream. About 25.7 Mt of waste were disposed of, some 34% of the 76.1 Mt generated. Disposal tonnages were 27.3 Mt in 2016–17. The biggest material fractions disposed of were organics (22%), ash (18%), building and demolition waste (17%), hazardous waste (mainly soils contaminated with hydrocarbons, heavy metals or asbestos, 14%), and plastics (10%).

The proportions of the disposal stream were MSW 25%, C&I waste 53% and C&D waste 21%. In 2016–17 (the baseline year of the National Waste Policy Action Plan), these values were 24%, 53% and 24% respectively.

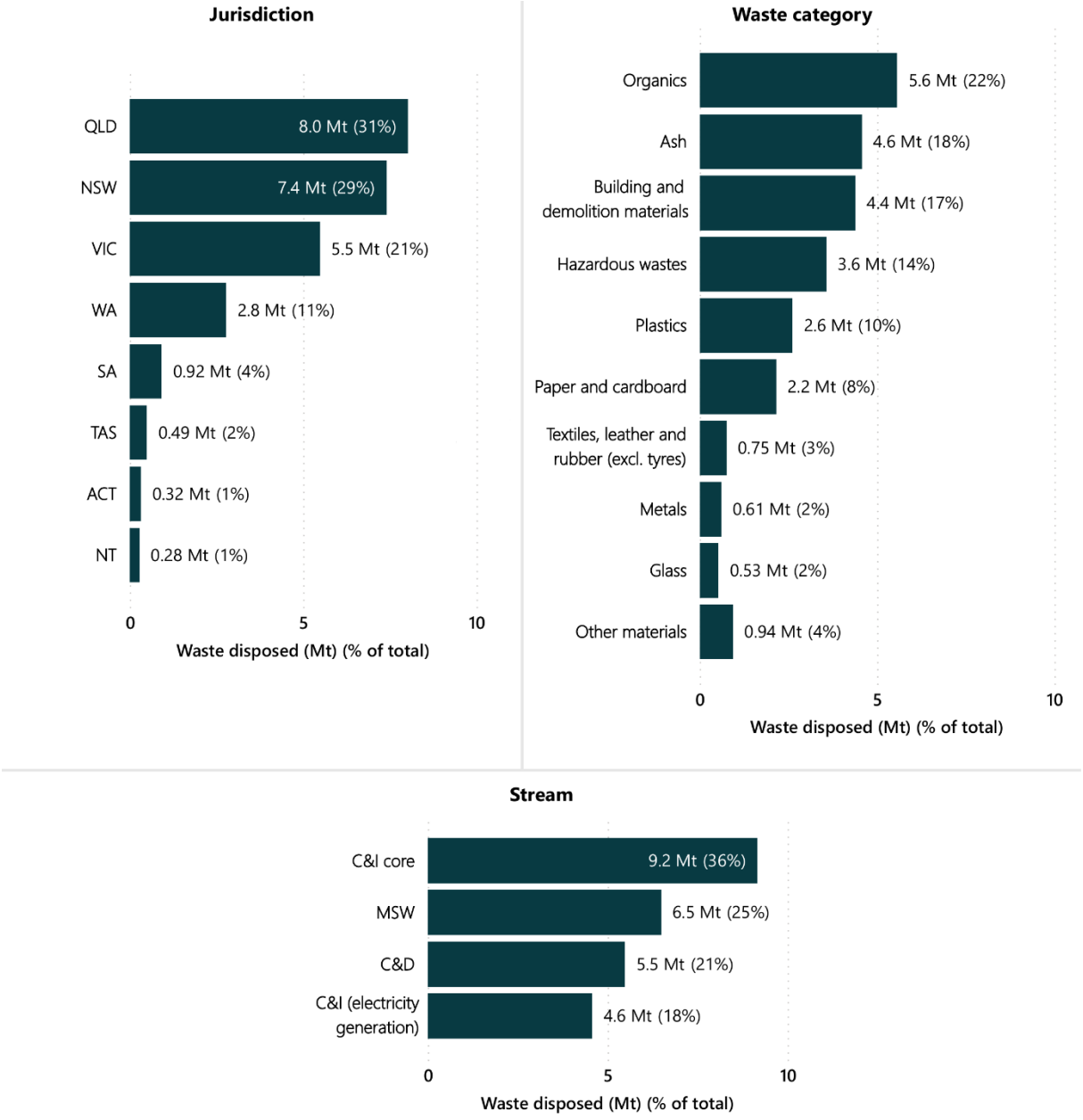
Supplementing the disposal data, Table 13 shows the quantity of waste sent to landfill (L1 minus L2 in Figure 23) for each state and territory. About 22 Mt of waste was deposited in landfill in Australia in 2022–23, comprising 34% of the 66 Mt of core waste generated. The changes in quantity since 2016–17 vary widely by jurisdiction. These are mostly linked to waste from major transport infrastructure projects. The large fall in ACT waste is due to disposal of many asbestos-contaminated houses in 2016–17.

Table 13 Waste to landfill by jurisdiction and source stream (kt), Australia 2022–23, and changes since 2016–17

	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust.
MSW	92	2,420	69	1,880	382	147	1,580	973	7,530
C&I waste	124	2,840	144	2,010	494	292	2,080	1,260	9,230
C&D waste	153	2,450	75	843	73	78	1,270	519	5,460
Total	**369**	**7,710**	**288**	**4,733**	**949**	**516**	**4,930**	**2,753**	**22,200**
Change since 2016–17	–22%	8%	–11%	–23%	28%	14%	–1%	16%	–1%

Apart from landfill, in 2022–23 about 4.6 Mt of ash was deposited in ash dams. About 30 kt of clinical and pharmaceutical wastes were sent for incineration, and a further 3.8 kt of hazardous waste were sent for other types of disposal.

Figure 24 Waste disposal by jurisdiction, waste category and source stream, Australia 2022–23

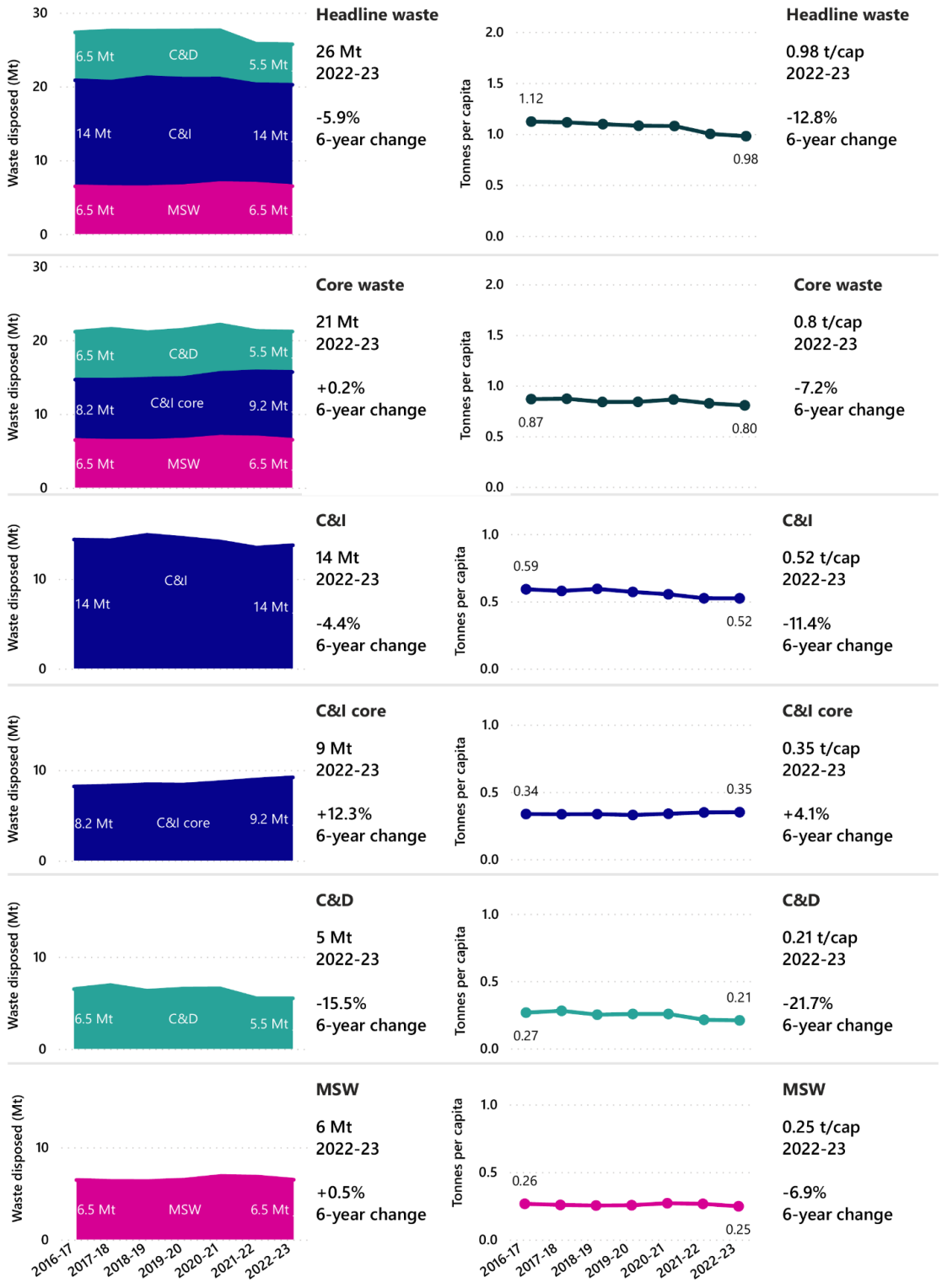


Link to Data table.

6.3 Trends in waste disposal

Figure 25 shows trends in waste disposal by source stream. Over the 6-year reporting period waste to disposal fell by 5.9%. Core waste to disposal was almost unchanged. Quantities of MSW to disposal rose by 0.5%, core C&I waste rose by 12% and C&D waste fell by 15%. On a per capita basis, disposal declined by 13% and fell in all streams except core C&I waste, which rose by 4.1%.

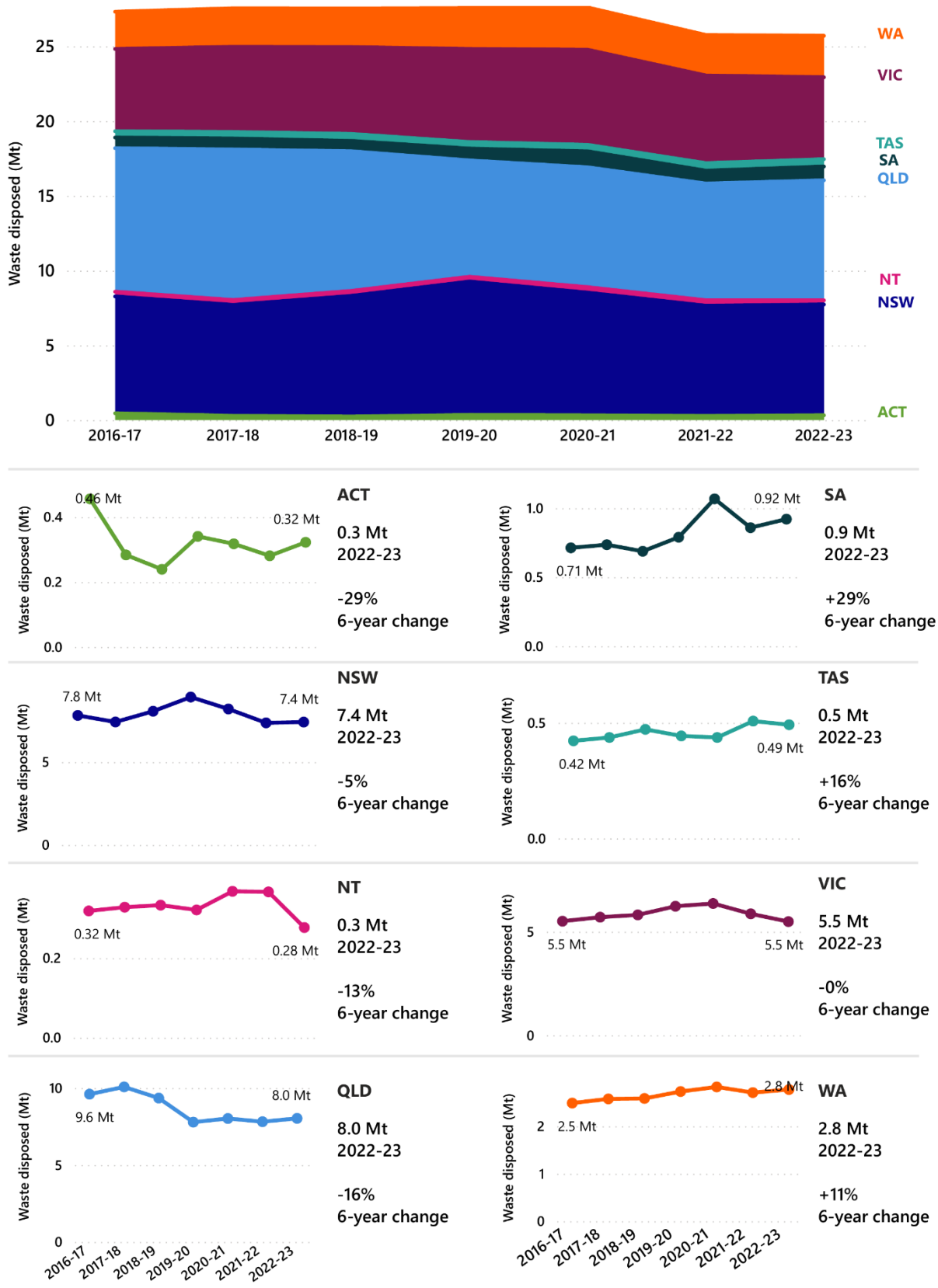
Figure 25 Trends in waste disposal by source stream in total (left) and per capita (right), Australia 2016–17 to 2022–23



Link to Data table .

Figure 26 shows that disposal trends by state and territory varied. Quantities declined in most cases.

Figure 26 Trends in waste disposal by jurisdiction, Australia 2016–17 to 2022–23



Link to Data table .

7. Resource recovery rates

This chapter assesses and compares resource recovery rates for the states and territories[20] and the three main source streams. For clarity, the resource recovery rate is the proportion of generated waste that is allocated to waste reuse, recycling or energy recovery.

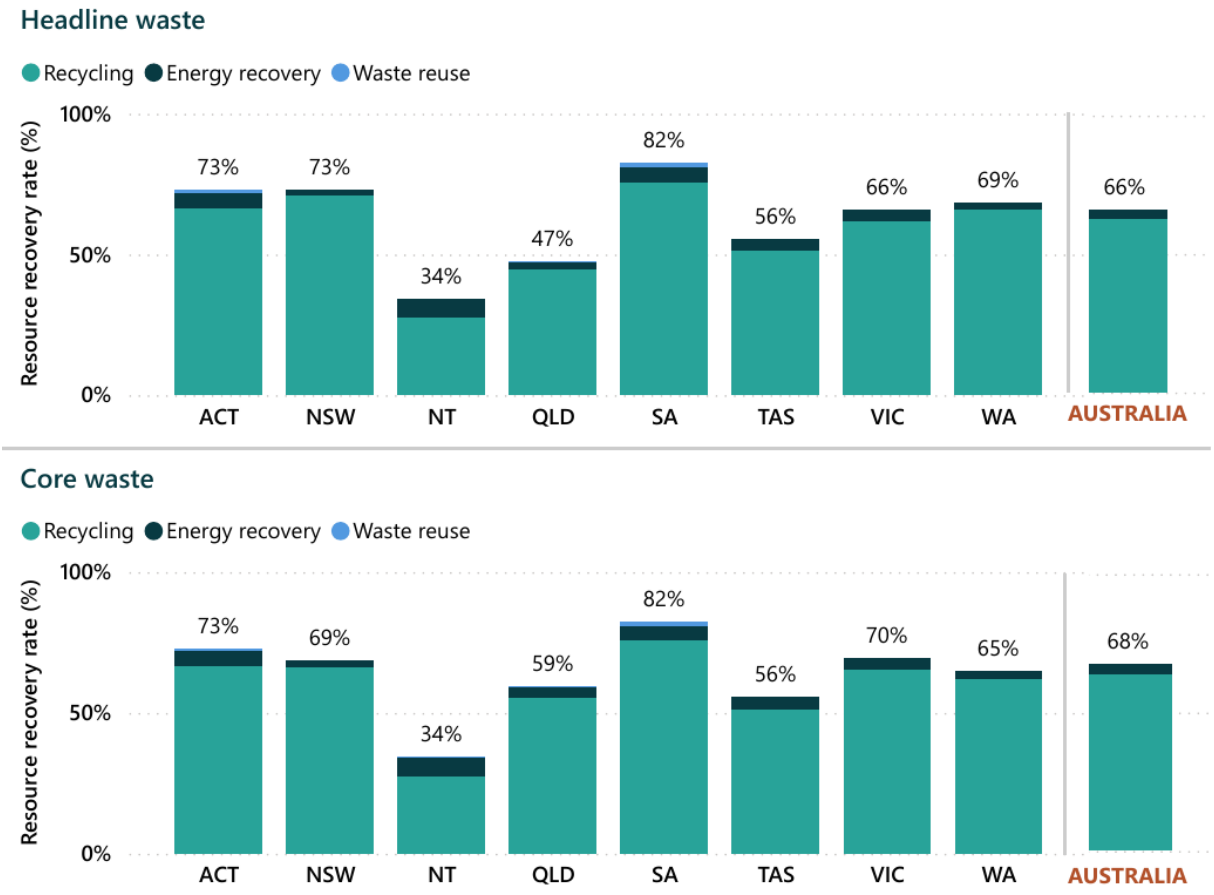
7.1 Resource recovery rates, 2022–23

The national resource recovery rate in 2022–23 was 66%. This comprised 63% recycling, 0.2% waste reuse and 3% energy recovery, mostly associated with the use of landfill gas for generating electricity. In 2016–17, the resource recovery rate was 61%.[21]

Figure 27 shows the estimated resource recovery and recycling rates for each state and territory. The upper chart shows headline waste; the lower shows core waste (i.e. excluding ash). In both charts, SA had the highest recovery rate at 82%. In the headline data set, the subsequent ranking is NSW and the ACT (73%), WA (69%), Vic (66%), Tas (56%), Qld (47%) and NT (34%).

Ranked under the core waste data, Vic is third, NSW fourth, WA fifth and Qld sixth.

Figure 27 Resource recovery rates by jurisdiction, 2022–23



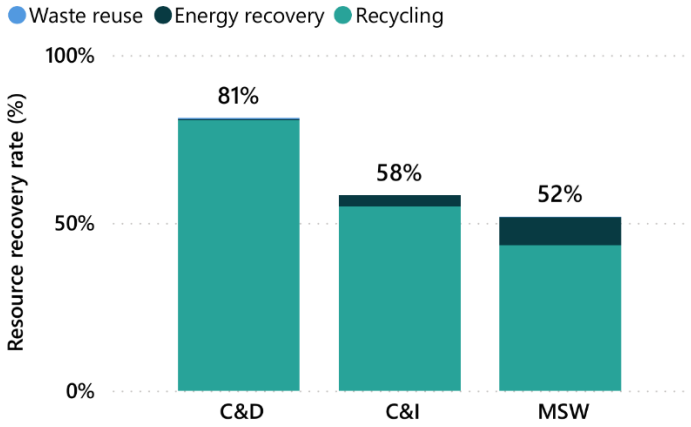
Link to Data table.

[20] The Standard is helping to standardise national waste reporting but there may still be differences in the scope of state and territory data. Caution should be exercised in comparing between jurisdictions.

[21] This differs from the value given in the NWR 2022 due to revisions to the Standard and the data since then.

Figure 28 shows resource recovery rates by source stream in 2022–23. Recovery from the C&D source stream was highest (81%), followed by C&I waste (58%) and lastly MSW (52%).

Figure 28 Resource recovery rates by source stream, 2022–23



Link to Data table.

7.2 Trends in resource recovery rates

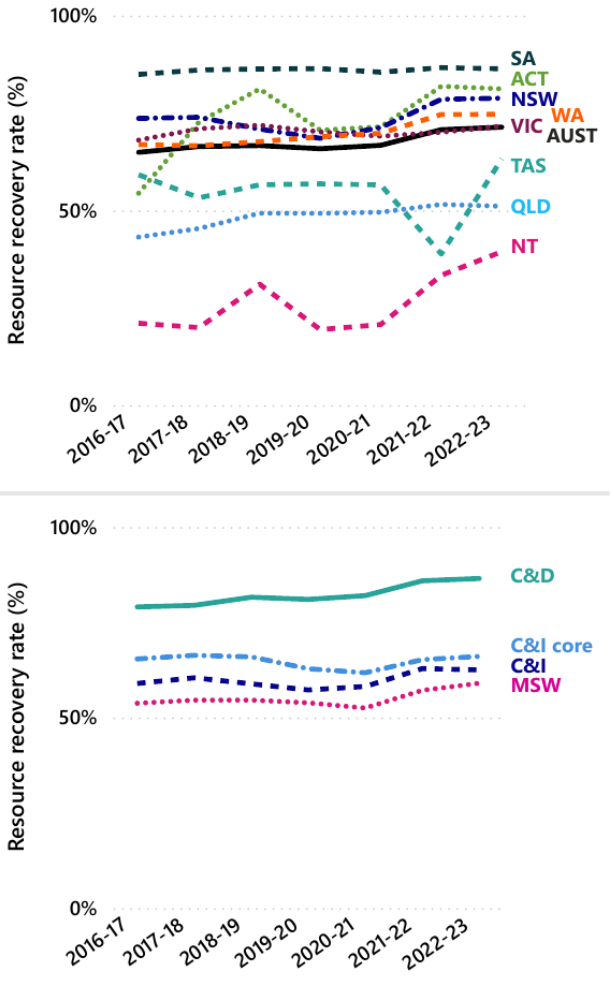
Figure 29 shows the trends in resource recovery rates by jurisdiction and by source stream over the 6 years from 2016–17 to 2022–23. In general, and across Australia in aggregate, recovery rates are trending upwards. Australia's resource recovery rate rose from about 61% in 2016–17 to 66% in 2022–23. In 2006–07, Australia's recovery rate was about 49%.

Tas completed a major upgrade of its waste data collection and reporting systems, starting in 2022–23. This explains the high rate in that year and the lower rate in 2021–22, when data collection systems were disrupted by the changes. The low ACT recovery rate in 2016–17 was due to the demolitions of asbestos-contaminated houses in that year.

Examined by source (the lower part of Figure 29):

- C&D recovery rates remain the strongest and continue to climb.
- MSW recovery rates have climbed strongly in the last two years of the data trend. During this period many households received an organics service bin for the first time, and many others have been asked to put food waste into their organics bin (see Section 10.3).
- C&I recovery rates also climbed following two or three years of decline.

Figure 29 Resource recovery rate trends by jurisdiction (top) and source stream (bottom), Australia 2016–17 to 2022–23



Link to Data table.

8. Waste materials analysis

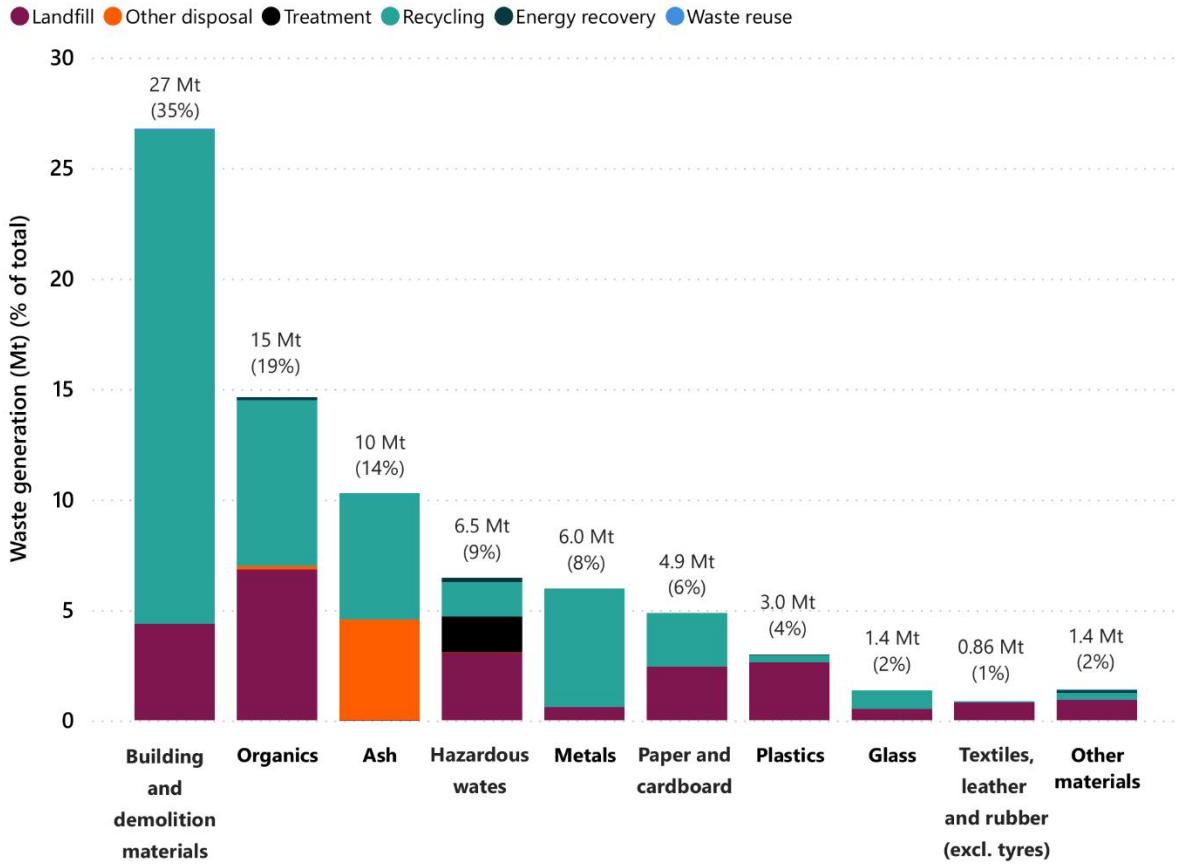
This chapter reports on the status and trends of particular waste materials. It opens with an overview comparing waste generation, management type, recovery rate and trends by material category. It then addresses the status and trends in generation and management of key waste categories in turn.

8.1 Waste materials analysis overview

Figure 30 shows the generation and management types for each waste category in 2022–23. The categories arising in the largest tonnages were:

- building and demolition materials (35%)
- organics (20%)
- ash (14%).

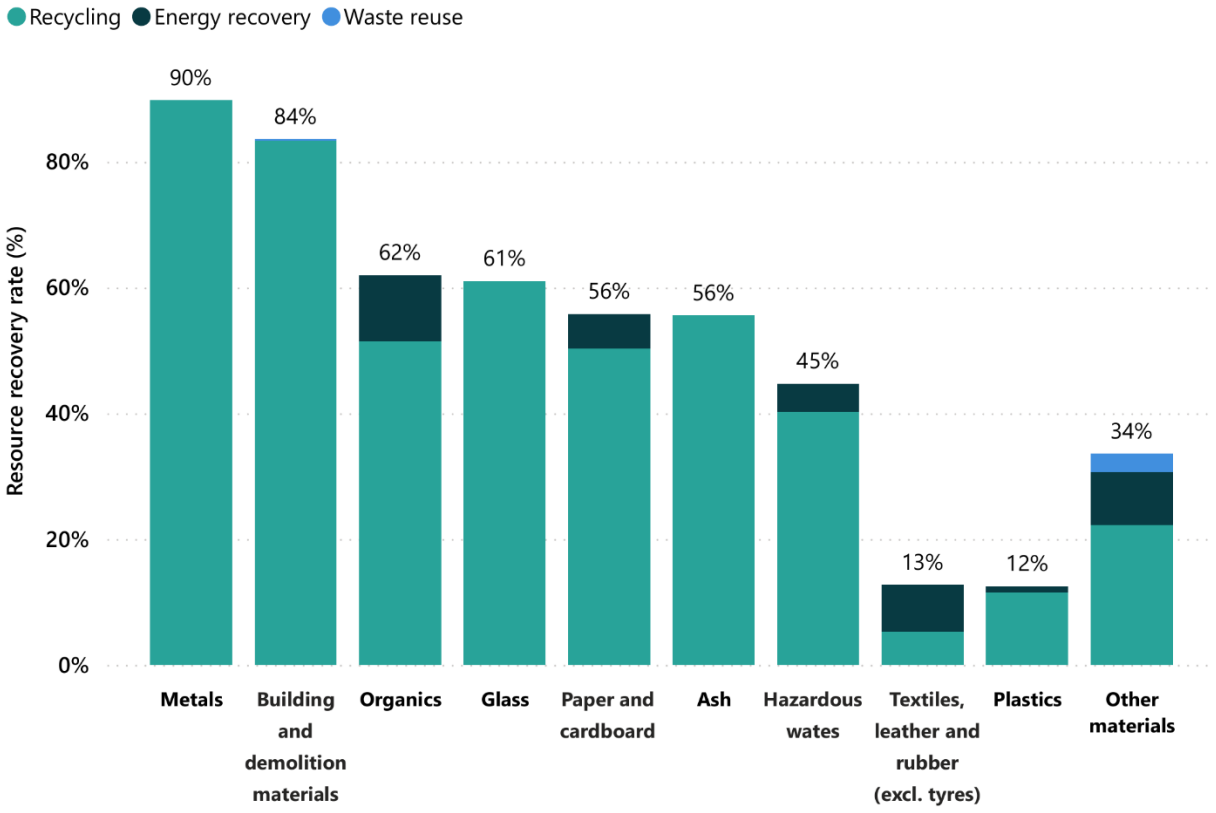
Figure 30 Waste generation and management by waste category, Australia 2022–23, showing tonnage and percentages of headline waste



Link to Data table.

Figure 31 shows estimated resource recovery rates by waste category. The highest rate was for metals (90%), followed by building and demolition materials (84%). The recovery rate for plastics was the lowest at only 12%. The recycling rate for textiles, leather and rubber (excluding tyres) was the lowest at an estimated 5% but this excludes charitable donations (see Section 8.10).

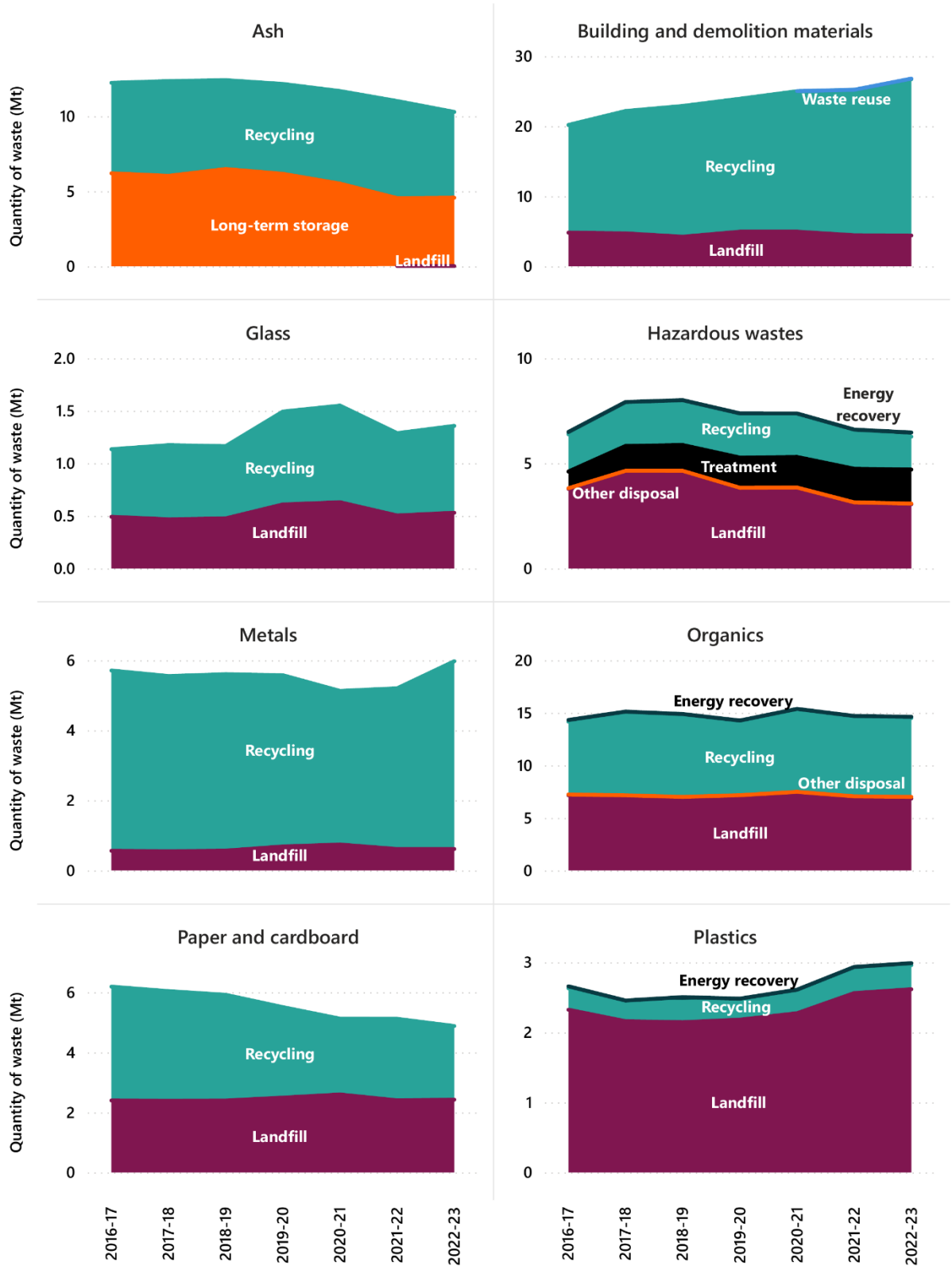
Figure 31 Resource recovery rates by waste category, Australia 2022–23



Link to Data table.

Figure 32 shows the trends in generation and management type for some important material categories. These are addressed in turn in the sections following. End-of-life tyres generally form part of the 'hazardous waste' category because of fire risk, but in this chapter they are addressed separately (Section 8.11).

Figure 32 Trends in the generation and management of key waste categories, Australia 2016–17 to 2022–23



Notes: The y-axis scales differ by waste category. 'Other disposal' of hazardous wastes is mostly incineration.

Link to Data table.

8.2 Ash

Coal-fired power accounted for 47% of Australia's electricity in 2022–23, down from 63% in 2016–17 (DCCEEW 2024d). This produced about 10.3 Mt of ash, or 391 kg per capita, compared with 12.2 Mt in 2016–17 (ADAA 2024).[22] The quantity of ash produced exceeds the quantity of all MSW kerbside bin collections from households. About 89% is 'fly ash' – the lightweight particles that rise with flue gases before being captured. The remainder is coarser 'bottom ash' that settles to the combustion chamber floor.

Figure 32 (p.42) shows the trend in ash waste generation and management type from 2016–17 to 2022–23. Waste generation fell 16% over the period reflecting the decline in coal-fired power in Australia. Ash is produced by a host of other industrial operations but on a smaller scale. As energy-from-waste facilities become operational, there will be a need to recycle or dispose of their ash waste.

About 56% of this ash (5.7 Mt) was recycled in 2022–23, up from 49% in 2016–17. Its primary uses are site rehabilitation and material substitutes in the mining and construction industries. Surplus material is typically placed in on-site 'ash dams' within the footprint of the coal fired power station. Australia's rate of utilisation of coal ash is lower than the global average, and much lower than Japan (97%), China (70%) or Great Britain (70%) (REC 2020). Internationally, ash repositories are sometimes harvested to supplement increased resource demand.

8.3 Building and demolition materials

In 2022–23 about 26.8 Mt, or 1,020 kg per capita, of building and demolition wastes were generated. This material category includes heavy waste types such as concrete, bricks and rubble and is mostly recorded in the C&D stream. Building and demolition wastes are recovered from most large development projects but less so from smaller projects, from which mixed material loads may be sent directly to landfill. Development projects also often generate contaminated soils, which are dealt with under 'Hazardous wastes' (Section 8.50).

Figure 32 (p.42) shows the trend in building and demolition waste generation and management types from 2016–17 to 2022–22. Waste generation grew by 33% from the 20.2 Mt generated in 2016–17. The high growth rate is associated with high rates of urban development, especially in NSW, Vic, WA and SA.

The 2022–23 resource recovery rate for building and demolition materials was 84% (22.4 Mt), rising from 76% in 2016–17. There are good markets for recycled concrete aggregate for use as road base, aggregates and hardstand areas. Recycled concrete aggregate consolidates well and forms a harder and more stable hardstand than pure virgin aggregate. There are also good options for recycling bricks and asphalt. Asbestos contamination risks are generally well-recognised and managed.

8.4 Glass

In 2022–23 about 1.36 Mt or 52 kg per capita of glass waste was generated. About two-thirds of this material was MSW.

Figure 32 (p.42) shows the trend in generation and management type of glass from 2016–17 to 2022–23. Glass waste generation increased by an estimated 20% over this period. The proportion recycled has stayed fairly consistent over this period, rising slightly from about 57% to 61%. The

[22] Data estimated from calendar year reports.

steep increase in 2019–20 was mostly reported by Victoria and was apparently due to processing of accumulated stockpiles. While this material is attributed to 2019–20, it was generated over previous years.

Glass recycling has always suffered from breakage in collection trucks and MRFs. This leads to high wastage of small fragments to landfill and contamination of paper and cardboard with embedded glass pieces. The establishment of container deposit schemes across the country is helping to alleviate these problems (see Section 11.3). Victoria is also establishing separate household glass collections to deal with this problem.

Scrap glass can be colour separated, cleaned and used for making new glass packaging. Australia's major glass manufacturers Visy and Orora are both working to increase the recycled content of their product. Clean and well-separated glass cullet requires less processing and energy than virgin sand. Another growing market for crushed glass is in civil construction projects.

Export of mixed glass has been regulated since January 2021 (see Section 11.2), requiring additional processing and licencing prior to export. Exports subsequently fell from 3% of recovered glass to 0.1% (see Figure 39).

8.5 Hazardous waste (excluding tyres)

In 2022–23 Australia generated 5.97 Mt of hazardous wastes excluding tyres, or 227 kg per capita.[23] This is slightly down from the 6.08 Mt generated in 2016–17. About half of this category comprised contaminated soils and asbestos (which was mostly soil contaminated with asbestos).

About 27% was sent for treatment processes that reduce or remove the hazard, facilitating recovery or disposal. When the outputs of treatment are added, about 42% of hazardous waste was recycled, 1.6% was used for its energy value, and 56% was disposed of. Disposal was nearly all to landfill but about 30 kt of medical wastes were incinerated.

Figure 32 (p.42) shows the trend in the generation and management type[24] of hazardous waste excluding tyres from 2016–17 to 2022–23. Quantities fell by 2% over this period, with a larger decline of 21% from the peak of 2018–19. Most of the change is associated with changing rates of urban development resulting in lower quantities of contaminated soils and asbestos waste.

Hazardous waste generation and management are examined in more detail in the Department's Hazardous Waste in Australia report series. A new version of this report is expected in 2025.

8.6 Metals

In 2022–23 about 5.97 Mt, or 227 kg per capita, of metals waste was generated, up 5% from the tonnage in 2016–17. An estimated 65% was C&I waste, 19% C&D waste and 16% MSW.

Figure 32 (p.42) shows the trend in metals waste generation and management type from 2016–17 to 2022–23. Waste generation fell for most of this period then jumped to a peak in 2022–23. Quantities tend to increase with prices as stocks of stored material are retrieved from scrap yards, industrial sites and farms.

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[23] Tyres are classified as hazardous wastes due largely to fire risk. They are considered separately in this report. The quantity of hazardous waste generated including tyres was 6.47 Mt or 246 kg per capita.

[24] This chart shows the primary management. Most material sent for 'treatment' is subsequently recycled or sent to landfill.

The 2022–23 resource recovery rate of 90% was higher than any other waste category and was unchanged from 2016–17. An estimated 43% of recovered metals were exported for recycling, including all aluminium and tin-plated steel cans. Some toxic metals (e.g. cadmium and cobalt) and precious metals (e.g. gold and palladium) are landfilled in composite material products such as electronic waste.

8.7 Organics

In this report, 'organics' includes waste food, vegetation, timber, sawdust, biosolids[25] and agricultural organics that are sent to waste and resource recovery facilities. It excludes paper and cardboard, textiles, rubber, leather, nappies, compostable plastics and hazardous organic wastes.

In 2022–23, about 14.6 Mt, or 556 kg per capita, of waste organics were generated. This comprised about 31% vegetation, 28% food organics, 14% timber, 11% biosolids, 1.5% sawdust and about 14% other organics. The 'other organics' fraction is mostly unidentified mixes of vegetation, food and timber, which means the true proportions of these materials are likely to be higher than those stated above.

About 49% of organics were generated as MSW, 47% was C&I waste and 4% was C&D waste.

Figure 32 (p.42) shows the trend in organic waste generation and management types from 2016–17 to 2022–23. The quantity of organics generated in 2022–23 is about 2% higher than the quantity recorded for 2016–17. The estimated recovery rate of 62% compares with 59% in 2016–17. Recovery in 2022–23 included 6.12 Mt of composting and mulching, 1.38 Mt of biosolids applied to land, 87 kt used as fuels, 36 kt processed via anerobic digestion, and 1.43 Mt recovered through use of landfill gas to produce electricity.

8.8 Paper and cardboard

About 4.88 Mt of scrap paper and cardboard was generated in 2021–22, or 185 kg per capita. This is a large drop of 21% from the 6.19 Mt recorded for 2016–17. About 61% was from the C&I stream and almost all the remainder from MSW.

Figure 32 (p.42) shows the trend in paper and cardboard waste generation and management type from 2016–17 to 2022–23. The falling quantities are linked to the digitisation of information. Annual consumption of newsprint and magazine material has fallen over the last decade by 400 to 500 kt per year and printing and writing papers by another 300 to 400 kt per year. Packaging papers, including cardboard, have grown strongly but not enough to offset these major declines.

The estimated resource recovery rate was 56%, down from 68% in 2016–17. The decline can be linked to reduced consumption of newsprint and magazines and printing and writing papers – grades with traditionally high recycling rates. Exports of scrap paper and cardboard have fallen by more than a third from their peak in 2012–13. From July 2024, Australia began regulating paper and cardboard exports through the implementation of a licensing and declaration scheme, with licensing mandatory from 1 October 2024 (see Section 11.2). This is to ensure exported materials are of a quality suited to direct recycling without removal of contamination overseas.

[25] Biosolids are stabilised organic solids produced by wastewater treatment.

8.9 Plastics

About 2.99 Mt or 114 kg per capita of plastic waste[26] was generated in 2022–23. This is up from 2.66 Mt in 2016–17.[27] An estimated 53% was from the C&I source stream and 44% was MSW.

Figure 32 (p.42) shows the trend in generation and management type of plastics from 2016–17 to 2022–23. The quantity of plastic waste generated per year increased by about 12%. Over the same period, the population grew by 8%.

The 2022–23 recovery rate for plastics was about 12.5%, almost identical to the 12.6% estimated for 2016–17. About 1% of this recovery was for its energy value. The rest was recycled. Landfills received an estimated 87.5% of plastics waste.

Exports of scrap plastics to Asia grew in the early part of this century and by 2016–17 had become the dominant market for plastic scrap. Much of this material was in poorly sorted bales that were sorted and processed at lower cost overseas. This resulted in poor environmental outcomes such as use as fuel or unmanaged release into the environment. China and other destination countries imposed import restrictions, and Australia matched these with export regulations. Exports are now much reduced (see Section 11.2) and are increasingly comprised of sorted and processed product requiring no further preparation.

Major investments in plastics sorting and processing infrastructure are underway to soak up the additional demand and meet Australia's targets for recycling of plastic packaging (see Feature 3 on page 68). To meet the targets, it will be necessary to greatly expand recovery of soft plastic packaging. Trials are in progress to collect these materials in domestic recycling bins.

There is also a need to find more onshore productive uses for recovered plastics. Opportunities include use in civil infrastructure such as roads. Recovered plastics can also potentially be processed by chemical recycling, breaking them down into their chemical building blocks from which fuels or new plastics can be created.

8.10 Textiles leather and rubber (excluding tyres)

Textiles, leather and rubber is a single category with types comprising (1) textiles and (2) rubber and leather. Textiles are the largest portion of this category, and include a broad range of products including clothing, carpets, manchester and others.

In 2022–23, an estimated 860 kt, or 33 kg per capita, of textiles, leather and rubber waste were generated. This is up from about 780 kt in 2016–17. About 70% was from the C&I source stream and most of the rest from MSW. The recycling rate for products in this category is estimated at only 5%, most of which is carpet recycling. The recovery rate is a much higher 13% because of collection and use of landfill gas generated from decaying textile wastes.[28]

Import records show clothing is the largest component of this waste category at more than a third.

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[26] In this report, 'plastics' excludes plastic material in textiles and tyres.

[27] The Australian Plastics Flows and Fates Study (DCCEEW 2024e) estimates this value at about 25% lower. That estimate is based on reported materials placed on the market and their typical lifespan. The difference highlights the uncertainties in both approaches to data collection and modelling. The 2022–23 values are similar using both methods.

[28] A revised method for calculating this fraction has resulted in a lower value than reported in the NWR 2022.

8.11 Tyres

In 2022–23 about 495 kt, or 19 kg per capita, of end-of-life tyres were generated, up from 412 kt in 2016–17. The resource recovery rate is estimated to have been 56%, comprising 40% energy recovery and 16% recycling.[29] About 38% of the tonnes of end-of-life tyres are from passenger vehicles, 32% from trucks and 30% from off-road applications, especially mining.

Nearly all of the energy recovery was in export markets. The Australian Government regulated the export of end-of-life whole tyres in December 2021 to improve environmental and human health outcomes. Exports now comprise shredded tyre-derived fuels that meet a specification, whole tyres for reuse, large tyres for retreading or processed tyre material for recycling. Some illegal export of whole tyres persists and prosecutions have occurred.[30] Onshore processing of tyres is mostly for recycling. Markets include road construction additives, playground flooring, sports surfaces and retaining walls.

[29] These values differ from those reported in the NWR 2022 due to updated and improved data from Tyre Stewardship Australia.

[30] See Strong action on illegal waste tyre exports.

9. The role of the states and territories

State and territory governments are responsible for managing waste through:

- legislation, policy and regulation
- strategy and planning
- permitting waste transport, storage, treatment and disposal operations.

The policy frameworks in each state and territory differ but there are common themes and directions, including:

- commitments to safe management of waste
- implementing the waste hierarchy (see Table 14 on p. 49)
- implementing the national waste policy action plan, including achieving its targets
- transitioning to a more circular economy.

Table 14 to Table 21 summarise selected elements of jurisdictional policy frameworks, considering:

- Waste levies – most states and territories require landfill operators to pay some amount to their government for each tonne of waste deposited in landfill. The additional fee pushes up the cost of landfill, increasing the attractiveness of recycling. Often some of the collected funds are used to support recycling infrastructure, programs or governance organisations. The table specifies levy rates operational in 2023–24.
- Strategies – most states and territories have a strategy to guide government organisations and industries in improving waste management. Strategies often set targets for resource recovery or other performance indicators. Table 14 specifies the strategy document and any targets within it.
- The status in each state and territory of various important or topical waste-related programs:
  - Does the jurisdiction require a deposit to be paid on drink containers to discourage littering?
  - Has the jurisdiction implemented bans on disposal of any wastes in landfill (other than liquids)?
  - Has the jurisdiction implemented bans on any single-use plastics?
  - Does the jurisdiction operate an internal tracking system requiring producers, transporters and receivers of hazardous waste to inform the environmental regulator of each movement of hazardous waste?
  - Does the jurisdiction provide a system for householders to dispose of waste chemicals locally?
  - Does the jurisdiction collect resource recovery data through a reporting program that is mandatory, rather than voluntary?
  - Is the jurisdiction working on initiatives to prevent waste, and if so, what are some of the main activities or programs?

Table 14 Summary of the ACT Government's waste policy settings

ACT

Waste levy (2023–24)	
Prices rather than levy amounts, as ACT owns the landfill and sets fees:	
MSW	$109.20/tonne
C&I	$189.20/tonne
Mixed C&I with >50% recyclable material	$358/tonne

Strategy document (including key targets)

ACT Circular Economy Strategy and Action Plan 2023–2030

This strategy is underpinned by three strategic objectives:

- grow extended producer responsibility
- grow markets for recovered materials and goods, and circular business models
- create high-value jobs and attract innovative new enterprises.

ACT Waste Management Strategy: Towards a sustainable Canberra 2011–2025

Waste generation grows less than population. Expand reuse of goods. Waste sector is carbon neutral by 2020. Double energy generated from waste and recover waste resources for carbon sequestration

Recovery rate increases to over 90% by 2025.

Other policy settings		
Container deposit scheme	**Yes**	Introduced June 2018
Landfill bans	**Yes**	Ban on computers from 2005 and televisions from 2010.
Single-use plastics bans	**Yes**	Single-use plastic plates and bowls, expanded polystyrene loose fill packaging and expanded polystyrene trays, plastic microbeads in rinse-off personal care and cleaning products, single-use plastic straws, cotton buds with plastic sticks, oxo-degradable plastics, single-use plastic cutlery, single-use plastic stirrers, expanded polystyrene takeaway food and beverage containers, single-use plastic shopping bags at or below 35 micrometres in thickness, and heavyweight and boutique plastic bags
Internal hazwaste tracking	**No**	
Household chemical collections	**Yes**	Free drop-off at two facilities
Mandatory data collection program for recycling	**Yes**	
Waste prevention	**Yes**	Various initiatives under the circular economy strategy.

Table 15 Summary of the NSW Government's waste policy settings

NSW

Waste levy (2023–24)	
Metro levy area:	
Waste	$163.20/tonne
Virgin excavated natural material	$146.90/tonne
Prescribed shredder floc	$122.40/tonne
Regional levy area:	
Waste	$94.00/tonne
Virgin excavated natural material	$86.40/tonne
Prescribed shredder floc	$70.50/tonne
Coal washery rejects	$16.90/tonne

Strategy document (including key targets)

NSW Waste and Sustainable Materials Strategy 2041

By 2025:

- phase out problematic and unnecessary plastics
- reduce litter by 30%.

By 2030:

- reduce per capita waste generation by 10%
- average recovery rate of 80%
- introduce litter reduction target of 60%
- triple plastics recycling rate
- halve organic waste to landfill
- net zero emissions from organics to landfill.

NSW Plastics Action Plan

NSW Waste and Sustainable Materials Strategy: A guide to future infrastructure needs

NSW Circular Economy Policy Statement: Too Good To Waste outlines steps to incorporate circular economy principles into its 20-year waste strategy.

Other policy settings		
Container deposit scheme	**Yes**	Introduced December 2017
Landfill bans	**No**	
Single-use plastics bans	**Yes**	Lightweight plastic bags from June 2022, single-use plastic straws, stirrers, cutlery, bowls, plates, cotton buds, and expanded polystyrene food service items and microbeads from November 2022, integrated packaging of banned items will be banned in January 2025
Internal hazwaste tracking	**Yes**	
Household chemical collections	**Yes**	CleanOut events and Community Recycling Centres
Mandatory data collection program for recycling	**Yes**	EPA online Waste and Resource Reporting Portal to facilitate Waste Contribution Monthly Reports
Waste prevention	**Yes**	Various initiatives including the Circular Economy Accelerator training and Waste Solutions Fund to local governments, Bin Trim and Food Waste business grants and delivery of the Love Food Hate Waste consumer campaign.

Table 16 Summary of the NT Government's waste policy settings

NT		
Waste levy (2023–24)		
No waste levy.		
Strategy document (including key targets)		
Northern Territory Circular Economy Strategy 2022–2027 Strengthen regulatory waste framework, including for hazardous waste. Phase out and ban certain problematic single use plastic products by 2025.		
Other policy settings		
Container deposit scheme	**Yes**	Introduced January 2012
Landfill bans	**No**	
Single-use plastics bans	**Yes**	Bags ban since 2011, single-use plastic straws, stirrers, cutlery, bowls, plates, and expanded polystyrene consumer food containers and goods packaging, microbeads in health products and helium balloons by 2025
Internal hazwaste tracking	**No**	
Household chemical collections	**Yes**	Drop-off at Shoal Bay Transfer Station and Alice Springs Regional Waste Management Facility
Mandatory data collection program for recycling	**No**	
Waste prevention	**Yes**	Recognised in the circular economy strategy.

Table 17 Summary of the Qld Government's waste policy settings

Qld

Waste levy (2023–24)	
General waste:	
MSW, C&I, C&D	
Metro	$105/tonne
Regional	$91/tonne
Regulated waste:	
Category 1	
Metro	$185/tonne
Regional	$179/tonne
Category 2	
Metro	$135/tonne
Regional	$124/tonne

Strategy document (including key targets)

Qld *Waste Management and Resource Recovery Strategy 2018–2050*

By 2025:

- reduce MSW per capita by 10%
- increase state average MSW recycling rate to 55% (from 32% in 2018)
- increase C&I recycling rate to 65% (from 47%)
- increase C&D recycling rate to 75% (from 51%)
- reduce waste to landfill by 10%.

Targets are also set for 2030, 2040 & 2050.

Other policy settings		
Container refund scheme	**Yes**	Introduced 1 November 2018
Landfill bans	**No**	Proposed landfill ban on organic (compostable material) by 2030
Single-use plastics bans	**Yes**	Single-use lightweight bags ban since 2018; straws, stirrers, plates and cutlery, unenclosed bowls, EPS food and drink containers from September 2021, cotton buds with plastic stems, EPS loose (peanut) packaging and plastic microbeads in rinseable personal care and cleaning products from September 2023.
Internal hazwaste tracking	**Yes**	
Household chemical collections	**Yes**	Drop-off availability subject to arrangements by individual councils
Mandatory data collection program for recycling	**Yes**	Annual reporting requirements as per *Waste Reduction and Recycling Act 2011*
Waste prevention	**Yes**	Various initiatives under the *Organics Action Plan* and associated with single-use plastics ban, as well as Circular Economy Labs and Circular Economy Investment Program.

Table 18 Summary of the SA Government's waste policy settings

SA

Waste levy (2023–24)	
Metro Adelaide:	
Solid waste	$156/tonne
Shredder floc	$117/tonne
Non-metro Adelaide:	
Solid waste	$78/tonne
Shredder floc	$58.50/tonne

Strategy document (including key targets)

South Australia's Waste Strategy 2020–25

- zero avoidable waste to landfill by 2030
- 5% reduction in waste generation per capita (from 2020 baseline)
- 2025 landfill diversion targets for metro areas:
  - 75% for MSW
  - 90% for C&I
  - 95% for C&D.

Regional Waste Management Plans in place for non-metro areas by 2023 with progressive landfill diversion targets.

Other policy settings		
Container deposit scheme	**Yes**	Introduced 1977
Landfill bans	**Yes**	Ban on some hazardous, problematic and recyclable materials, including most e-waste and vegetative matter when aggregated for resource recovery and collected by a council kerbside service
Single-use plastics bans	**Yes**	Bags ban since 2009; straws, cutlery and stirrers from March 2021; EPS food and beverage containers, oxo-degradable plastics from March 2022, plastic-stemmed cotton buds, single-use plastic bowls and plates, plastic pizza savers from September 2023, plastic barrier bags, heavyweight supermarket bags, other consumer EPS food and beverage containers (such as gelato tubs, cake boxes and meat and fruit trays), plastic confetti and plastic balloon sticks and ties, plastic food bag tags, single-use plastic beverage containers, single-use plastic food containers from September 2024
Internal hazwaste tracking	**Yes**	
Household chemical collections	**Yes**	Statewide household chemical drop-off
Mandatory data collection program for recycling	**Yes**	
Waste prevention	**Yes**	Various initiatives under the waste strategy and food waste strategy, as well as Circular Economy Market Development Grants and the Circular Impact Accelerator.

Table 19 Summary of the Tas Government's waste policy settings

Tas

Waste levy (2023–24)	
State-wide	
General waste:	
C&D, C&I and MSW	$21.36/tonne

Strategy document (including key targets)
Tasmanian Waste and Resource Recovery Strategy 2023–2026 • Support strong circular economy to reduce waste and greenhouse gas emissions and improve the amenity, liveability, and sustainability of Tasmania. • Divert products and materials from landfill and recognise the inherent value of products and materials. • To invest in circular economy programs to increase the recovery and reuse of products and materials and respond to emerging issues. Targets to be developed during the first strategy period.

Other policy settings		
Container deposit scheme	**No**	Commencement date yet to be announced
Landfill bans	**No**	
Single-use plastics bans	**Yes**	Bags ban since 2013 By-law implemented in the City of Hobart from July 2021 for certain single-use plastic food packaging
Internal hazwaste tracking	**No**	Framework in place but not operational
Household chemical collections	**Yes**	Selected regional programs
Mandatory data collection program for recycling	**Yes**	Began in July 2022
Waste prevention	**Yes**	Various initiatives under the waste strategy, as well as delivering the *Reth!nkWaste* consumer waste education program

Table 20 Summary of the Vic Government's waste policy settings

Vic

Waste levy (2023–24)	
Metro and provincial:	
MSW	$129.27/tonne
C&I and C&D	$129.27/tonne
Rural:	
MSW	$64.55/tonne
C&I and C&D	$113.69/tonne
Priority waste:	
Category B – includes wastes from manufacturing industries and contaminated soils	$272.69/tonne
Category C – wastes that pose a low hazard from manufacturing industries and contaminated soils	$129.27/tonne
Category D – industrial waste that is soil	$129.27/tonne
Soil containing asbestos and packaged waste asbestos	$32.75/tonne

Strategy document (including key targets)

Recycling Victoria: A new economy (2020)

- households serviced by local governments to have a four-bin system comprising glass, organics (including food), mixed recycling and general garbage, expected by 2027
- introduce CDS by 2023 (implemented).

By 2025:

- 72% waste diversion from landfill
- 20% reduction in volume of organics waste sent to landfill.

By 2030:

- 15% reduction in waste generation per capita
- 80% waste diversion from landfill
- 50% reduction in volume of organics waste sent to landfill
- 100% of households have access to food and garden organics services or local composting.

Other policy settings		
Container deposit scheme	**Yes**	Introduced 2023
Landfill bans	**Yes**	'Category A' hazardous waste, paint, industrial transformers, grease trap waste, oil filters, whole tyres, large containers, e-waste ban
Single-use plastics bans	**Yes**	Bags ban since 2019; straws, cutlery, plates, drink-stirrers, EPS food and drink containers, and cotton bud sticks from February 2023
Internal hazwaste tracking	**Yes**	
Household chemical collections	**Yes**	Statewide program
Mandatory data collection program for recycling	**No**	
Waste prevention	**Yes**	Various initiatives under Regional Circular Economy Plans, as well as initiatives associated with single-use plastics ban, Circular Economy Business Innovation Centre grants and delivery of the Small Acts, Big Impacts campaign.

Table 21 Summary of the WA Government's waste policy settings

WA

Waste levy (2023–24)	
Generated in or disposed in metro Perth:	
Putrescible	$70/tonne $105/m3

Strategy document (including key targets)

Waste Avoidance and Resource Recovery Strategy 2030
From 2020, recover energy only from residual waste.

By 2025:

- 10% reduction in waste generation per capita
- increase material recovery to 70%
- rollout of three-bin kerbside collection system in the Perth and Peel regions, comprising organics (including food), mixed recycling and general garbage.

By 2030:

- less than 15% of waste generated in metro regions is landfilled
- all waste is managed and/or disposed to better practice facilities
- 20% reduction in waste generation per capita
- increase material recovery to 75%.

The strategy is under review. A draft was issued in May 2024. New targets are likely proposed.

Other policy settings		
Container deposit scheme	**Yes**	Introduced October 2020
Landfill bans	**Yes**	Ban on e-waste introduced July 2024
Single-use plastics bans	**Yes**	Bags ban since 2018; straws, stirrers, cutlery, plates, unlidded bowls and containers, shopping bags, cold beverage cups, EPS containers and helium balloon releases from January 2022; enforced July 2022 and cups on 1 October 2022. Stage 2 bans from March 2023 for EPS packaging, cups and trays for meat and seafood, degradable plastics, disposable cotton buds with plastic stems and microbeads in personal care, cosmetic and cleaning products. From March 2024, bans on disposable coffee cups and all plastic cup lids and disposable plastic trays for takeaway or eat-in food. From September 2024, disposable plastic produce bags and disposable plastic lids for bowls, trays and containers. From July 2025 expanded plastic packaging (moulded or cut) will be banned
Internal hazwaste tracking	**Yes**	
Household chemical collections	**Yes**	Eight metropolitan and five regional, permanent household chemical drop-off points
Mandatory data collection program for recycling	**Yes**	
Waste prevention	**Yes**	Delivery of the consumer Great Sorts campaign and WasteSorted community education grants.

10. Local government waste management

This chapter addresses the critical role played by local governments in providing waste services to their communities.

10.1 Local government services

Local government waste services include kerbside collections, public place waste management and provision of recycling and disposal infrastructure. In rural areas they are the primary owners and often operators of waste transfer stations, resource recovery facilities and landfills. Some regional and metropolitan local governments also manage waste and resource recovery infrastructure.

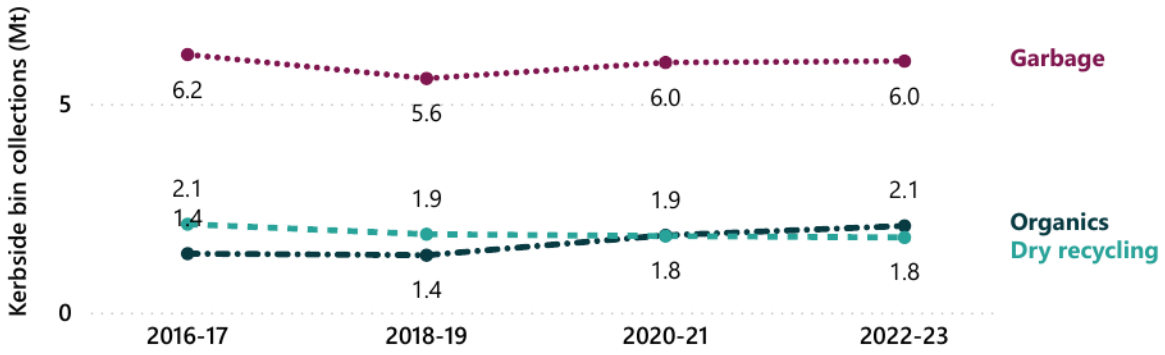
In 2022–23, Australian local governments collected about 9.9 Mt of waste via kerbside bin[31] services. These comprise 'dry' recycling[32], organics and residual waste (garbage) sent to landfill or mechanical biological treatment (MBT). Table 22 shows the quantities collected in these types of kerbside service.

Table 22 Waste collected by Australian local governments by kerbside bin service type, 2022–23

Service type	Quantity collected (Mt)
Garbage	6.02
Recycling	1.80
Organics	2.07

Figure 33 shows trends in the quantities of materials collected in each of these services, covering the data supplied for the last four national waste reports.

Figure 33 Waste collected by Australian local governments by kerbside bin service type, 2016–17 to 2022–23



Data sources: Blue Environment research and consultation as specified in the National Waste Reporting Tool 2022-23.

Link to Data table.

[31] Includes crates.

[32] 'Dry recycling' includes mixed packaging and paper typically collected from a yellow-lidded bin as well as separate collections of paper and glass that occur in some areas. It excludes collected organics, which are also recycled.

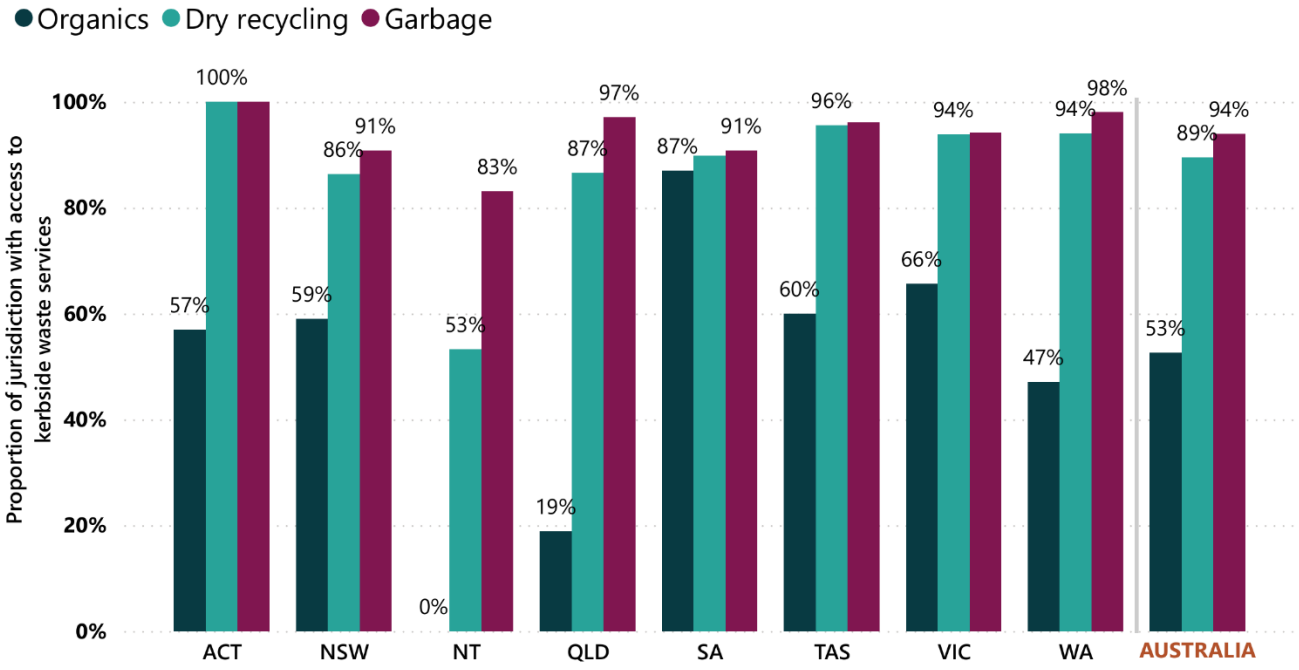
Table 22 and Figure 33 show some interesting information:

- Garbage services dominate the total, representing 61% of kerbside bin collections.
- The tonnes of organics collected has exceeded that of dry recyclables since 2020–21.
- There was a jump in the quantity of garbage in 2020–21. This is probably linked to displacement of waste from the C&I sector due to work-from-home arrangements during the COVID-19 lockdowns.
- The quantity of organics collected separately increased by almost 50% between 2016–17 and 2022–23, from about 1.4 Mt to 2.1 Mt.
- Despite the increase in organics, overall collection quantities are increasing only slowly. Garbage quantities are declining on a per capita basis, probably affected by 'lightweighting' of materials. Dry recycling quantities are falling, affected by the establishment of container deposit schemes as well as lightweighting.

In addition to these services, local governments often offer periodic or ad-hoc collection of 'hard' waste such as furniture, bikes, etc. The ACT, NSW, Qld, SA, Vic and WA reported combined collection of 510 kt of hard waste in 2022–23. A smaller number of local governments offer other collection services including bundled vegetation and e-waste.

Figure 34 shows the proportion of each jurisdiction's residential population with each type of kerbside waste service at their premises in 2022–23.[33]

Figure 34 Kerbside waste services by proportion of the jurisdictional population, 2022–23



Data sources: Blue Environment research and consultation as specified in the National Waste Reporting Tool 2022-23.

Link to Data table.

[33] The NWR 2022 reported access to kerbside services using a third-party database. That data showed the proportion of the population residing in local government areas where particular services are offered. This was incorrectly reported as the proportion of the population with actual access to each service type. The proportions shown in that report were consequently inflated and are superseded by the values shown here, which are the proportions of the population who have each type of service at their property.

About 94% of Australians had a regular local government collection service for garbage and 89% had a dry recycling service. Those without the service are mainly residents of multi-unit dwellings that are serviced by commercial operators, mainly in the capitals. A smaller proportion are in rural areas who manage their waste via drop-off services. More than half the population now have an organics bin service. The provision of these services across the population varies widely from 87% in SA to zero in the NT.

Typically, recycling and organics collections are fortnightly and garbage weekly. However, with the modern trend towards placing food organics in with the garden organics, the collection frequency is often flipped so organics are collected weekly and garbage fortnightly. This is generally considered best practice.

10.2 Kerbside dry recycling services

Kerbside dry recycling bins generally have a yellow lid, and typically collect mixed glass packaging, aluminium and steel cans, mixed paper and cardboard, and plastic containers. There is some variation in materials accepted, depending on the processing capacity at the receiving MRF. Some local governments have more than one dry recycling service type, including separate paper and cardboard bins in a few local governments in NSW and SA, and separate glass collections in some parts of Vic. Vic is moving towards separate glass only bins as part of a standard four-bin kerbside collection system (organics, glass, dry recyclables and garbage).

A few local governments nationally are trialling collection of soft plastics in a separate bag that is placed in the dry recycling bin. This is likely to become more widespread in the coming years.

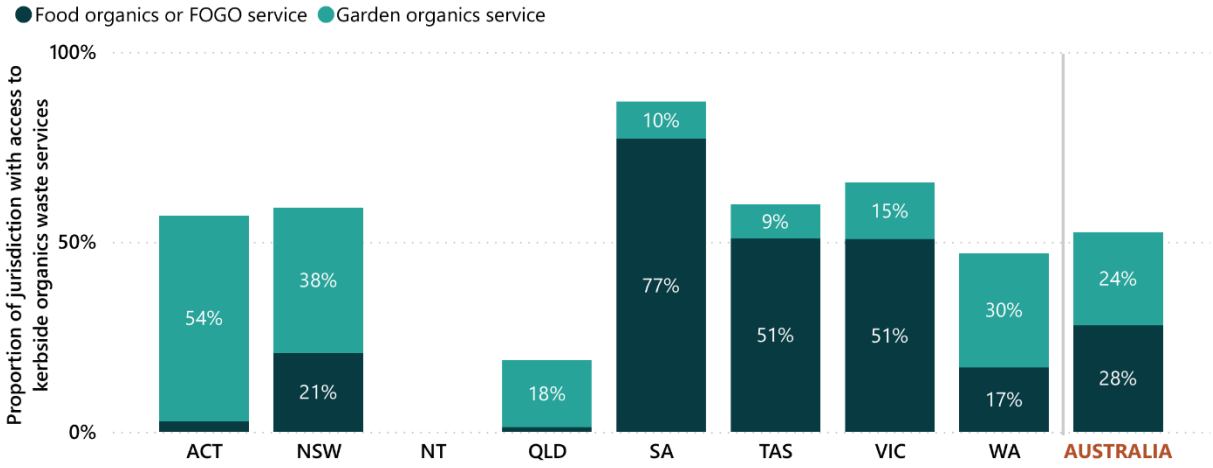
Non-recyclable material (contamination) in dry recycling bins increases the cost and difficulty in producing high-quality end-products. It may also pose safety issues for staff and may damage machinery. Common contaminants include items in bags, soft plastics generally, textiles, bottles containing liquids, organics, electrical items and nappies. In addition, product losses occur during processing due to item size, shape and firmness. Broken glass can make up a large proportion of product losses because it is difficult to sort by colour and markets for mixed colour material are poor.

10.3 Kerbside organics services

Figure 35 shows the proportion of each jurisdiction's population living in local government areas that offered a kerbside organics service in 2022–23. It is split into those with access to a service for garden organics only (GO) and those with a service for FOGO.[34] About 53% of Australians had access to a kerbside organics collection service in 2022–23. The proportion with access to FOGO, at 28%, now exceeds the proportion with GO only (24%). Organics services were pioneered in the south eastern portion of the mainland, but are now spreading across the country with high levels in Tas and WA. Collected material is generally composted, reducing waste to landfill, and enhancing soil in urban or agricultural markets.

[34] Includes a small proportion of households in NSW that have a food only organics service.

Figure 35 Access to kerbside organics services by proportion of jurisdictional population, 2022–23



Data sources: Blue Environment research and consultation (see the National Waste Reporting Tool 2022-23).

Link to Data table.

SA local governments provide the highest levels of access to kerbside organics services at 87%, and to FOGO services at 77%. The ACT and local governments in Vic, Tas and NSW each provide kerbside organics bins to between 57% and 66% of the population. In Tas and Vic, the great majority of these have FOGO services but this is less common in the ACT and NSW. Local governments in WA have established organics services to almost half the population, including FOGO to about 17%. Proportionately, organics services have grown the fastest in recent years in Tas, which recorded less than 20% of the population serviced in 2018–19.

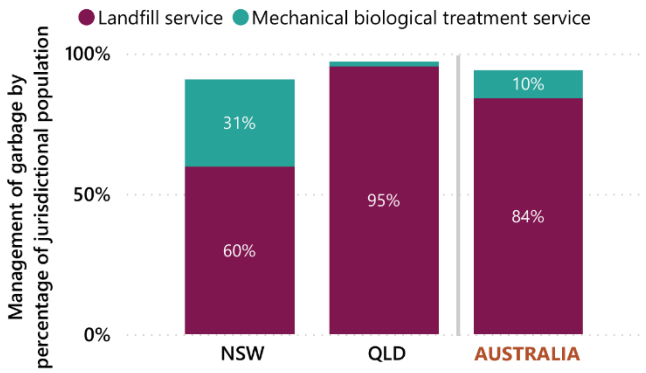
When FOGO services are strongly promoted and well designed, 70% or more of the food waste generated in the local government area can be diverted from the landfill stream (Rawtec 2018 p.12). Many jurisdictional waste strategies have committed to expand FOGO services to help achieve targets for reducing organics in landfill.

10.4 Kerbside garbage services

In 2022–23, about 94% of Australia's population had a kerbside garbage service. This material is mostly deposited directly in landfill but in parts of NSW and in Cairns (Qld) it is sent to MBT. The proportions are shown Figure 36. WA also had some MBT operations, but these have now stopped operating.

In an MBT, metals and sometimes other recyclables are extracted. The remaining organics-rich fraction is processed by composting or anaerobic digestion. In Qld the processed organics are typically used in agriculture. In NSW this is no longer allowed due to perceived contamination risks. Processed organics in that state are mostly sent to landfill for use as daily cover material.

Figure 36 Management of garbage by proportion of the jurisdictional population – landfill vs mechanical biological treatment (MBT), 2022–23



Data sources: Blue Environment research and consultation as specified in the National Waste Reporting Tool 2022-23.
Link to Data table.

10.5 Other local government services

Local governments also provide and service street litter and public place recycling bins, organise street sweeping, and collect and dispose of illegally dumped waste. National data on these is incomplete but national estimates are provided below. These are extrapolated from states and territories able to report on them. This assumes that, in aggregate and on a per capita basis, non-reporting jurisdictions produce similar quantities of each category as reporting jurisdictions.

Table 23 National estimates of the tonnages collected from other local government services, 2022–23

	Street litter bins	Public place recycling	Street sweeping	Litter and dumping
National estimate	130 kt	31 kt	340 kt	125 kt
Reporting jurisdictions	Qld, SA, Vic, WA	Qld, SA, Vic, WA	Qld, SA, Vic	NSW, Qld, Vic

11. Other waste and resource recovery data

This chapter reports on several other aspects of Australia's 2022–23 waste and resource recovery data. The first section compares Australian data with selected other countries. The next section documents waste exports from Australia. The third reports on the important issue of packaging waste, discussing the national targets for this stream and performance against them. The fourth section reports on Australia's container deposit schemes (CDS). The final section reports on collection programs for household hazardous wastes.

11.1 International comparisons

This section compares Australia's waste generation, recovery and fates and those of other countries. The first section compares overall core waste with other countries; the second section compares MSW only, since more countries report MSW data.

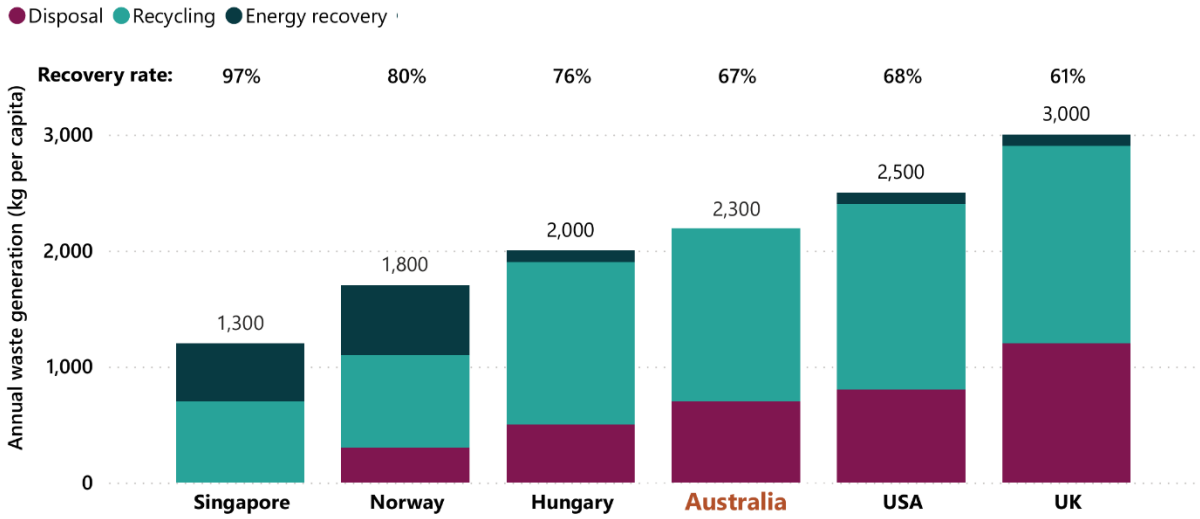
A previous assessment of Australia's national waste data found 'the approach and presentation … shows many similarities to examples from other nations … , demonstrates international best practice in discussing waste policy and related factors … and leads the field' in relation to sensitive discussion of uncertainty, transparency in data handling, reporting by sub-regions (states and territories) and comparison with other countries (Resource Futures 2018).

Waste generation and fate comparisons

There is no international standard for waste accounting. Different countries include or exclude agricultural wastes, mining wastes, hazardous wastes and industry wastes and byproducts.

Figure 37 compares Australia's waste generation, disposal, recycling and energy recovery on a per capita basis with Singapore, Norway, Hungary, the USA and the UK. These countries were chosen because their data is relatively recent and presented in enough detail to allow wastes to be included or excluded to build a common platform for comparison.[35] The Australian data shown is a modified version of core waste excluding hazardous waste, ash, and energy recovery from landfill gas.

Figure 37 Annual waste generation and fate per capita in Australia and selected countries



Link to Data table.

[35] See the 'Int. comp' worksheet in the National Waste Reporting Tool 2022–23. Despite these efforts, some wastes may not be consistently counted, e.g. the UK may include industrial wastes not in Australia's data.

The UK generated the highest amount of waste per capita at 3,050 kg, followed by the US at 2,480 kg and Australia at 2,260 kg under the adjusted scope. Singapore generated only 1,280 kg of waste per person.

Australia's adjusted recycling rate (67%) was similar to that of Hungary (71%) and the USA (63%). Singapore had the highest overall recovery rate (97%), followed by Norway (80%). These high recovery rates are both associated with high use of incineration to produce electricity, reflecting restrictions on landfill space in Singapore and European culture in Norway. Australia does very little thermal processing of waste compared to most developed countries. Some facilities are currently under development in WA and are planned in Victoria.

Table 24 lists the waste types included in the data for each analysed country. It highlights the wide variation in waste descriptions and categories between different countries.

Table 24 Producing countries' descriptions of the wastes included in Figure 37

Country	Data year	Description of wastes included
Singapore	2022	Ferrous metal, paper, cardboard, C&D, plastics, food, horticultural, wood, textiles and leather, non-ferrous metal, glass, scrap tyres, ash, sludge and other including stones and ceramics. It excludes used slag.
Norway	2022	Wet organic waste, park and garden waste, wood waste, paper and cardboard, glass, metals, e-waste, concrete and bricks, cinders, dust, bottom ash and fly ash, plastic, rubber, textiles, discarded vehicles, mixed waste, and other waste. Excludes hazardous waste, radioactive waste, sludge (which includes drilling muds), and slightly polluted soil.
Hungary	2021	MSW, C&D and industrial wastes from agricultural, food and economic waste. Excludes hazardous waste.
Australia	**2022–23**	**MSW, C&I and C&D. Excludes ash from coal fired power generation, hazardous waste, and energy recovery from landfill gas recovery.**
USA	2018	C&D waste and household, commercial, business and institutional wastes.
UK	2018	Includes glass, metals, paper & cardboard, rubber wastes, plastics, wood, textiles, discarded equipment, discarded vehicles, animal and mixed food waste, vegetal waste, household & similar wastes, mixed & undifferentiated materials, soils, sorting residues, mineral waste from C&D, other mineral wastes, combustion wastes, dredging spoils, mineral waste from waste treatment, industrial effluent sludges, sludges and liquids from waste treatment, and common sludges. Excludes most hazardous wastes and wastes from: agriculture, forestry and fishing; mining and quarrying; water collection, treatment and supply; sewerage; and remediation activities.

Municipal waste generation and fate comparisons

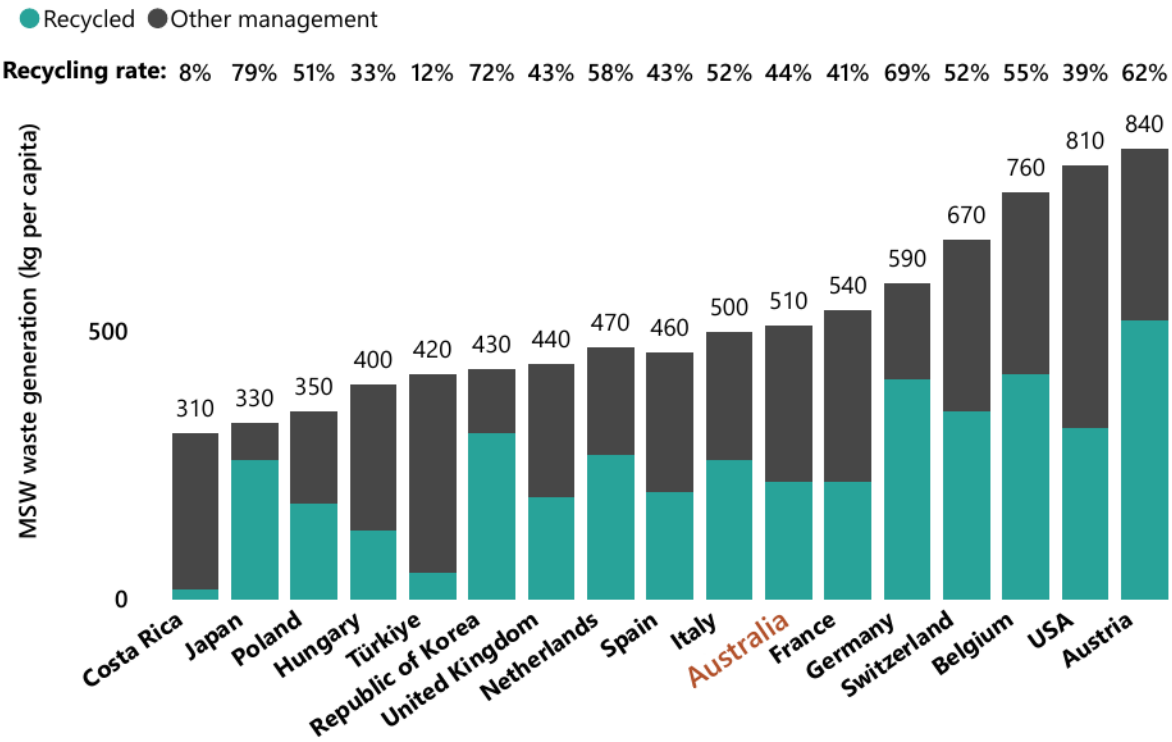
Municipal solid waste is defined similarly in most countries, covering waste from households and some businesses collected by or counted by municipal authorities. This section compares MSW generation and fate in Australia to selected countries. It is based on data sourced from the Organisation for Economic Co-operation and Development (OECD 2024) which defines the recycling rate as the quantity of material to recycling, composting and anaerobic digestion divided by the total MSW generated.[36]

[36] MSW is unavailable for two of the countries shown in Figure 37 (Singapore and Norway).

Figure 38 compares the adjusted Australian data to MSW generation in 16 selected countries. Japan had the highest reported recycling rate at 79% followed by South Korea (72%) and Germany (69%). Australia ranked 10th with an adjusted MSW recycling rate of 44%. Costa Rica had the lowest recycling rate at 8%, behind Turkey at 12%. The low recycling rates for these countries reflect infrastructure and market limitations.

Austria had the highest MSW generation per capita at 835 kg followed by the USA at 812 kg. Australia ranked 7th with adjusted generation of 512 kg per capita. Costa Rica had the lowest reported rate at 310 kg per capita.

Figure 38 Comparison of annual MSW generation and recycling rates in Australia and selected countries



Link to Data table.

11.2 Exports of waste and recovered materials

Australia exports large quantities of recovered materials. Substantial quantities went to China until 2017–18, when that country imposed its 'National Sword' import restrictions that drastically affected global recycling markets.

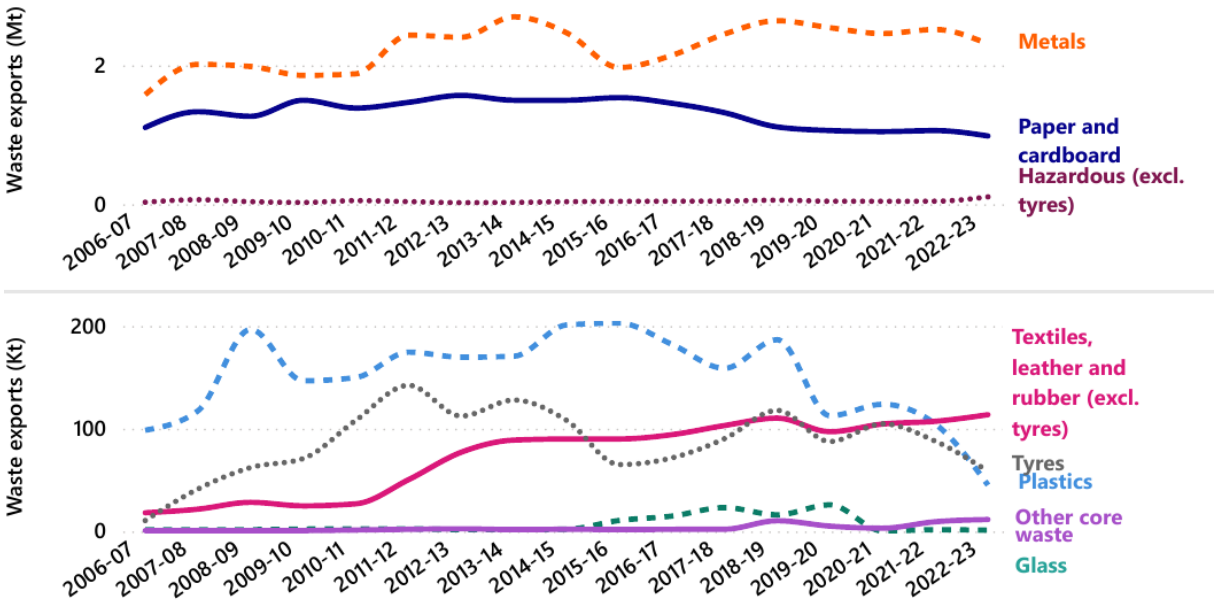
Australia subsequently regulated its exports of glass, plastics and tyres from 2021; and paper and cardboard from 2024. This involved imposing a licensing and declaration scheme. The licensing rules aim to ensure that exports are ready for use as a product and do not require further processing or cause environmental or human health problems overseas.

In 2022–23 Australia exported about 3.6 Mt of waste and recovered materials, representing about 5% of waste generated. Exports of these materials have gradually fallen from a peak of 4.6 Mt in 2013–14.

Figure 39 shows trends in exports of apparent waste and recovered materials based on Australian Bureau of Statistics (ABS) data[37], from 2006–07 to 2022–23.

- The figure shows that scrap metal exported for recycling amounted to 2.3 Mt, or 64% of Australia's total waste exports. Markets remain strong. The main destinations were Bangladesh, Indonesia, India, Vietnam, Thailand and Malaysia.
- Just under 1.0 Mt of waste paper and cardboard were exported for recycling, representing a decline of a third from the peak a decade previously. The main destinations were Indonesia and Malaysia.
- Textiles exports are mainly discarded clothing. These continued to increase, reaching 114 kt in 2022–23. They were mostly sent to sorting facilities and were mostly reused.
- Exports of hazardous wastes were mainly lead and slags bearing heavy metals. Exports grew to 105 kt in 2022–23 and went mostly to South Korea.
- Exports of tyres have fallen markedly in recent years.[38] Most tyre exports in 2022–23 were as shredded tyre-derived fuel for use in cement kilns and similar in India and Malaysia.
- Scrap plastics exports for recycling were 45 kt, mainly to Malaysia and Indonesia. This quantity is nearly 80% less than the 2016 peak, due mainly to export regulations.[39]
- Exports of waste glass were already at low quantities and fell to about 1 kt following their regulation in 2021.

Figure 39 Trends in Australian exports of waste and recovered materials, 2006–07 to 2022–23



Link to Data table.

[37] This analysis is from the Department's quarterly analyses of exports of waste and recovered materials based on the ABS data. Unlike the NWR 2022, this data covers only core waste

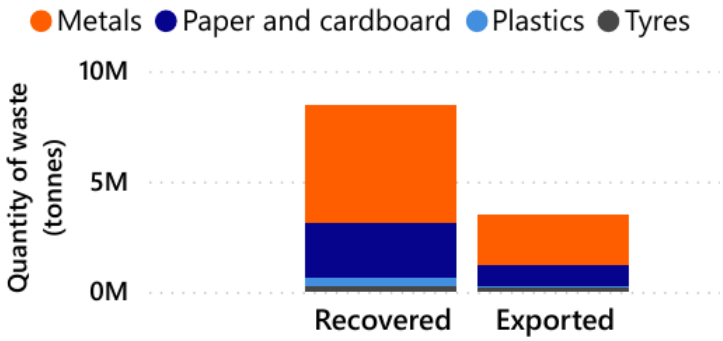
[38] Tyre export data is incomplete due to miscoding by exporters and ABS exclusion of low value exports.

[39] This data excludes exports of recovered plastics that have been processed into flakes or pellets ready for incorporation into new products.

Figure 40 compares major exports of recovered materials with the overall quantities recovered in 2022–23. It shows that exports of these material streams represent a major portion of the total recovered. The proportions exported were:

- metals – 43%
- paper and cardboard – 40%
- tyres – 71%
- plastics – 12%.

Figure 40 Major exports of recovered materials compared with overall quantities recovered, 2022–23



Data sources: Blue Environment research and consultation and DCCEEW (2024f).

Link to Data table.

11.3 Container deposit schemes

A CDS requires the collection of a monetary deposit on drink containers at the point of sale and a refund of that value when the empty bottle is returned. CDS systems now operate in all states and territories except Tasmania, which plans to introduce a system soon.

A CDS provides a financial incentive to consumers to return eligible beverage containers. This keeps litter out of the natural environment, reduces the cost of kerbside collection and sorting, and provides an ongoing source of higher value materials for reprocessing into new products. Jurisdictions establish a legislative framework that provides for the governance and operation of the scheme and requires beverage suppliers to include refund markings on eligible containers. Consumers are provided with a 10–cent refund upon the return of the empty container. Recovered product is processed similarly to kerbside recyclables. The product value is typically higher because it is better separated and cleaner.

MRF operators can also claim refunds on eligible containers recovered from recycling bins.

The NSW EPA (2022b) reported that since the introduction of its Return and Earn CDS in 2017, the volume of eligible drink containers littered fell by 52% and overall litter volumes fell by 43%. Eligible containers continued to make up 35% of the surveyed litter volume in the recent measurements.

While collection methods differ between jurisdictions, containers can typically be cashed in at:

- depots where containers are counted and refunded on the spot
- bag drops where containers are counted later
- pop-ups run by depot operators at set times and locations
- reverse vending machines where containers are counted by scanning their barcodes and users receive an immediate refund.

Table 25 presents data on CDS performance in the six jurisdictions that operated a system in 2022–23. During 2022–23, CDS systems collected about 6.2 billion containers, or 325 per capita. It shows, for each scheme, the quantity of collections, collections per capita and the overall return rate. Based on this data, the NT had the highest return rate, cashing in 78% of containers sold, followed by SA at 76%. These jurisdictions run Australia's oldest and most established CDS systems.

Table 25 Data on container deposit schemes by state and territory, 2022–23

	ACT	NSW	NT	Qld	SA	WA	Total	Average
No. of collected containers (millions)	107	2,452	100	1,938	660	927	**6,184**	n/a
Containers collected (kt)	6 [1]	169 [1]	6	173 [2]	38	61 [3]	**453**	n/a
No. of collected containers per capita	232	297	399	360	360	327	n/a	**325**
Containers collected per capita (kg)	14	20	23	32	21	18	n/a	**23**
Overall return rate	70%	66%	78%	64%	76%	63%	n/a	**66%**

Notes 1 The mass of containers collected in NSW and ACT is estimated from the average weight per container by material type reported by NSW.

2 The mass of containers collected in Qld is estimated using the average weight per container by material type reported Qld in 2021–22 (APCO 2024).

3 The mass of containers collected through MRFs in WA seemed too high, so was estimated using the average weight per container by material type reported by refund point operators (WARRRL 2024), except for the material types 'other' and 'mixed plastics', for which average container weights for the corresponding material types reported by NSW are adopted as a proxy.

Data sources: COEX (2023), EfC (2023, 2024a, 2024b), EPA SA (2024), NT EPA (2023), WARRRL (2024).

11.4 Other product stewardship

Product Stewardship in Australia[40]

Everyone who imports, designs, produces, sells, uses and disposes of products has a shared responsibility to reduce the environmental and human health and safety impacts of those products.

Product stewardship schemes support the environmentally sound management of products and materials over their life. This includes at the end of their useful life. These arrangements may be voluntary, mandatory or shared with industry.

Examples of good product stewardship are when:

- people recycle products, and their packaging
- companies design their products for easier recycling
- companies use more recycled materials and less resources to manufacture their products
- companies limit the hazardous materials their products contain.

Product Stewardship schemes and priorities

Product stewardship is an approach to managing the impacts of different products and materials on the environment and human health and safety. Product stewardship schemes help to manage these impacts over a product's life-cycle.

These schemes can be:

- industry-led voluntary schemes
- co-regulatory arrangements between industry and government
- mandatory schemes under law.

[40] For more information about product stewardship and the schemes supported, please visit Product stewardship schemes and priorities - DCCEEW.

The Government also works with industry on potential industry-led voluntary action; or where products and materials may be considered for schemes in the future.

Feature 3 Packaging waste

Packaging waste is an important component of the MSW and C&I source streams and a longstanding focus of public policy and community concern. Packaging represents about 9% of the headline data set and 15% of core MSW and C&I wastes.

Packaging is also the focus of Australia's largest product stewardship program, the Australian Packaging Covenant. The Covenant defines the shared responsibility of governments and businesses across Australia in managing the environmental impact of packaging. It is underpinned by the National Environment Protection (Used Packaging Materials) Measure 2011.

The Covenant is managed and administered by the Australian Packaging Covenant Organisation (APCO). APCO is a not-for-profit organisation with over 2200 members from across the packaging supply chain. Members include brand owners, packaging manufacturers, industry associations, government participants, community groups, and sustainability professionals, as well as waste management and recycling organisations.

APCO led the development of Australia's National Packaging Targets, which are:

- 100% reusable, recyclable or compostable packaging
- 70% of plastic packaging being recycled or composted
- 50% average recycled content included in packaging
- the phase-out of problematic and unnecessary single-use plastic packaging.

Achievement of the targets will require systemic change to the way product packaging is created, collected and recovered. They apply to all packaging made, used and sold in Australia. To achieve the targets, APCO's strategic plan highlights the use of economic incentives including an innovative membership fee model.

Data on packaging consumed and recovered in 2021–22 is shown below, sourced from APCO (2024).[41] Overall, about 56% of packaging was recovered, mostly for recycling. Recovery of paper and cardboard, and glass packaging were highest at 68% and 63% respectively. Recovery of plastic packaging remains a low 20%.

Between 2017–18 and 2021–22, packaging quantities (excluding timber) placed on the market increased by about 4% per year. This is almost three times the rate of population growth over the same period. Glass packaging declined, replaced by other materials.

Material type	Consumption (Mt)	Recovered (Mt)	Recovery rate	Increase since 2017–18 (percentage points)
Glass	1.14	0.72	63%	17%
Metals	0.30	0.15	51%	3%
Paper & cardboard	3.65	2.50	68%	6%
Plastics	1.28	0.26	20%	4%
Wood	0.61	0.28	45%	*Not known*
Total	**6.98**	**3.91**	56%	*Not known*

Progress against the National Packaging Targets is summarised below, sourced from APCO (2024).

Target	2017–18	2021–22
100% reusable, recyclable or compostable packaging	88%	84%
70% of plastic packaging being recycled or composted	16%	20%
50% average recycled content included in packaging	35%	40%
Phase out of problematic and unnecessary single use plastic packaging	Baseline	-33%

[41] Given the short lifespan of packaging, quantities placed on the market by manufacturers and importers are taken as equivalent to waste generation.

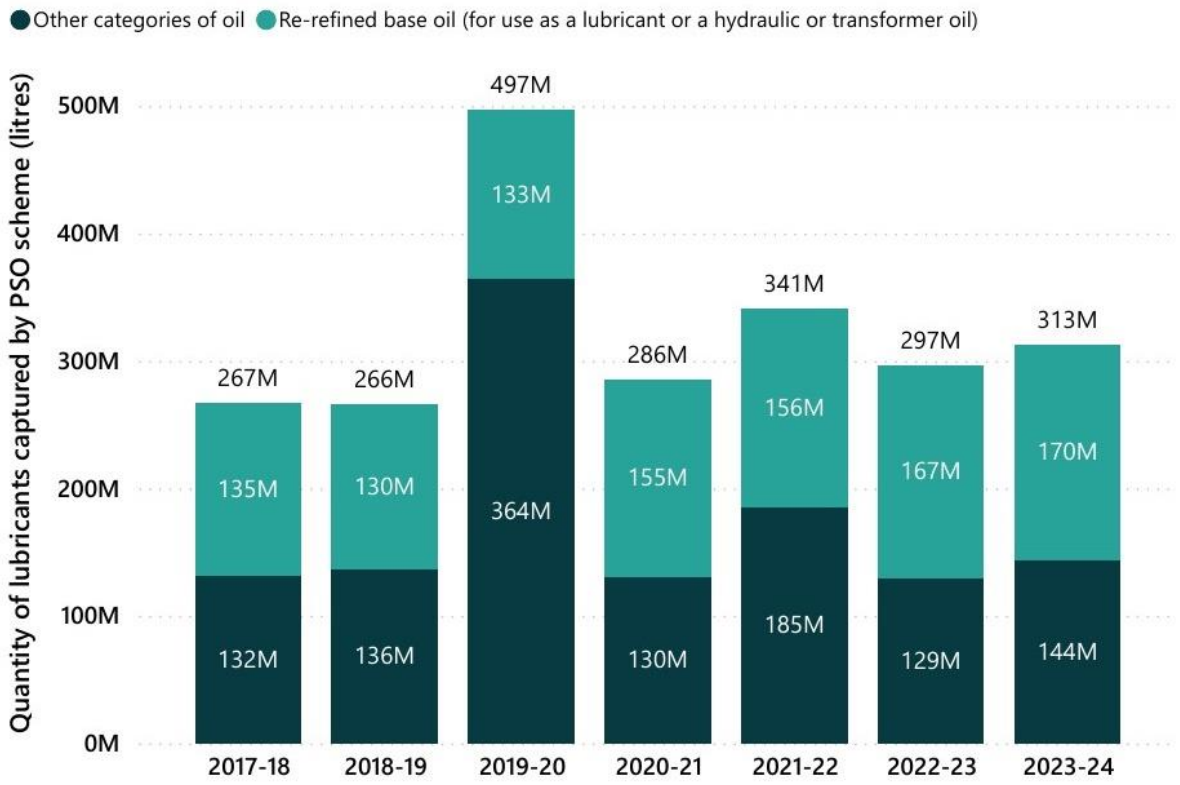
Product Stewardship for Oil Scheme

The Product Stewardship for Oil Scheme pays incentives to industry. These incentives encourage the management and re-refining of used and recycled oil. This reduces environmental and human health risks from improperly disposed oil.

The scheme was introduced in 2001 to increase the amount of used oil recycled in Australia. Since then, the amount of oil that Australia collects and recycles has risen from none to 320 megalitres of base lubricating oil every year. That is more than half the oil sold in Australia each year, or the equivalent of 160 Olympic-size swimming pools.

Figure 41 presents data on the quantity of waste oil re-refined under the scheme. For more information about this scheme, please visit Product Stewardship for Oil Scheme - DCCEEW.

Figure 41 Quantity of waste oil processed under the Product Stewardship for Oil program, 2017–18 to 2023–24



Link to Data table.

National Television and Computer Recycling Scheme

The National Television and Computer Recycling Scheme was established in 2011. It gives Australian households and small businesses free access to industry-funded collection and recycling services. These services are for televisions and computers, including printers, computer parts and peripherals.

The scheme builds on state, territory and local government e-waste management by providing other collection services. It also creates employment opportunities within the recycling sector.

For more information, please visit National Television and Computer Recycling Scheme - DCCEEW

11.5 Household hazardous waste collections

Some state and local governments run programs to collect unwanted household products that are toxic, flammable, corrosive or explosive. While often expensive to run, these household chemical collection programs are justified by the high risks to human health and the environment from improper management or indefinite storage. Collected materials are recycled or used in energy recovery where possible, and otherwise are treated and destroyed or landfilled.

Table 26 shows the tonnes of household hazardous waste collected by state, territory and major local government jurisdictions that operate a household hazardous waste collection program. The high variability in collections reported by different jurisdictions may be attributed to different scopes of materials collected by the programs. The reported materials include acids, alkalis, poisons, flammable liquids, pesticides, fumigants and various other materials where these are targeted by a collection program. Details are provided in the National Waste Reporting Tool for 2022–23.

Table 26 Household hazardous waste collected by jurisdictions with collection programs, 2022–23

	ACT	NSW	SA	Vic	WA	Brisbane	Darwin
Household hazardous waste collected (t)	85	4,075	247	268	483	20	364

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Appendix A A history of national waste reporting

Appendix A A history of national waste reporting

National waste reporting was first attempted in the 1990s to measure progress in implementing the 1992 *National Waste Minimisation and Recycling Strategy*. However, the categories and comprehensiveness of the data collected by each state and territory did not match the proposed system. During the 2000s, the Department commissioned several snapshots of national waste quantities titled *Waste and Recycling in Australia*. Data quality and comprehensiveness improved over time, but the differences meant trends could not be readily compiled. There were concerns from the states and territories about the transparency of the data transformations used to create a common national platform.

Following the release of the 2009 *National Waste Policy*, the first National Waste Report was released in 2010 using 2006–07 data. Following this release, a 'method report' was commissioned to describe what data would be collected and how it would be transformed. The method was subsequently updated in a procedural document agreed to by all states and territories (REC and BE 2015). It was accompanied by a National Waste Reporting Tool into which states and territories would enter their data. The data was transformed within the tool to a set of standardised output tables and charts. Based on the agreed method and tool, historical data was revisited and transformed for consistency with the agreed approach. This produced a historical record back to 2006–07 but missing data for 2007–08, 2011–12 and 2012–13. National waste reports in 2016, 2018, 2020 and 2022 each incorporated two more data years and used the agreed method and tool.

Changes for the *National Waste Report 2018* were driven by national consultation on improving Australia's waste data and reporting, including a review by an international consultancy (Resource Futures 2018) and consideration of the UN System for Environmental Economic Accounting (UN et al. 2014). 'Core waste' was defined and 'core waste plus ash' was set as the primary performance measure. Data access was improved through the development of a National Waste Database.

The *National Waste Policy Action Plan* (Australian Government et al. 2019) established national waste reports as the mechanism for assessing progress against targets using a 2016–17 baseline. It committed to publishing national waste reports every two years.

The *Australian Standard for Waste and Resource Recovery Data and Reporting* was established in 2021 and revised in 2024. It clarifies and revises the national framework for the scope and classification of waste data. The Standard also provides a reference to encourage convergence of state and territory data systems over time.

Detailed reporting and analysis of hazardous waste has been undertaken in separate *Hazardous Waste in Australia* reports in 2015, 2017, 2019 and 2021. The data collected for those reports is reclassified in summary form for inclusion in the National Waste Database and this report.

The Department has made Australia's waste data readily available for analysis through its national waste data viewer, which draws on the National Waste Database.

Appendix B Chart data

Appendix B Chart data

The data used in generating the charts in this report is set out below. 'CAGR' means compound annual growth rate.

The charts in the 'At a glance' section are extracts or duplicates of other charts given in the report – their data can be found in the data for the original chart as listed below:

- Figure 1 – see data table for Figure 10 (grey-highlighted data only)
- Figure 2 – see data table for Figure 11 (grey-highlighted data only)
- Figure 3 – see data table for Figure 18 and Figure 25 (grey-highlighted data only)
- Figure 4 – see data table for Figure 27.
- Figure 5 – see data table for Figure 30.
- Figure 6 – see data table for Figure 39.

Data table for Figure 10 *Waste generation by jurisdiction, waste category and source stream, Australia 2022–23*

Waste category	Generation (Mt)	Source stream	Generation (Mt)	Jurisdiction	Generation (Mt)
Ash	10	MSW	13	ACT	1
Building and demolition materials	27	C&I (core)	23	NSW	28
Glass	1	C&I (non-core)	10	NT	0
Hazardous wastes	6	C&D	29	Qld	15
Metals	6	**Total**	**76**	SA	5
Organics	15	**Total (core)**	**65**	Tas	1
Paper and cardboard	5	**Total per capita**	**2,875**	Vic	16
Plastics	3	**Total (core) per capita**	**2,485**	WA	9
Textiles, leather and rubber (excl. tyres)	1	C&I (total)	33		
Other materials	1				

Link back to Figure 1 or Figure 10.

Data table for Figure 11 *Trends in waste generation by stream in total and per capita, Australia 2016–17 to 2022–23*

Item	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	CAGR
Headline scope (Mt)								
MSW	12.85	12.90	12.92	13.20	13.45	13.63	13.48	0.4%
C&I	33.61	34.68	34.73	33.28	32.75	32.64	32.93	0.0%
C&D	23.55	26.33	27.05	27.41	28.79	28.01	29.23	3.5%
Total	**70.02**	**73.91**	**74.69**	**73.89**	**74.99**	**74.28**	**75.64**	**1.2%**
Core waste (Mt)								
MSW	12.85	12.90	12.92	13.20	13.45	13.63	13.48	0.4%
C&I	21.39	22.34	22.33	21.13	21.07	21.66	22.67	1.3%
C&D	23.55	26.33	27.05	27.41	28.79	28.01	29.23	3.5%
Total	**57.79**	**61.57**	**62.29**	**61.74**	**63.32**	**63.30**	**65.38**	**1.9%**
Waste generation per capita (t per capita)								
Headline scope	2.87	2.99	2.97	2.90	2.93	2.88	2.88	-0.3%

Item	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	CAGR
Core waste	2.37	2.49	2.48	2.42	2.47	2.46	2.49	0.4%
MSW	0.53	0.52	0.51	0.52	0.53	0.53	0.51	-1.2%
C&I (headline scope)	1.38	1.40	1.38	1.30	1.28	1.27	1.25	-1.5%
C&I (core)	0.88	0.90	0.89	0.83	0.82	0.84	0.86	-0.3%
C&D	0.97	1.06	1.08	1.07	1.12	1.09	1.11	1.9%

Link back to Figure 2 or Figure 11.

Data table for Figure 12 Trends in the generation of waste by jurisdiction, Australia 2016–17 to 2022–23

Data in Mt

Jurisdiction	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
ACT	0.96	0.94	1.11	0.96	0.91	1.14	1.20
NSW	25.64	25.63	25.38	25.96	25.67	26.94	27.53
NT	0.38	0.40	0.45	0.38	0.45	0.52	0.42
Qld	15.86	17.43	17.45	14.82	15.43	14.93	15.26
SA	4.23	4.68	4.49	4.64	5.57	4.83	5.24
Tas	0.94	0.83	0.98	0.91	0.89	0.79	1.11
Vic	15.64	17.40	17.98	18.64	18.09	16.56	16.06
WA	6.37	6.59	6.86	7.58	7.99	8.58	8.82
Total	**70.02**	**73.91**	**74.69**	**73.89**	**74.99**	**74.28**	**75.64**

Link back to Figure 12.

Data table for Figure 16 Recycling and waste reuse by jurisdiction, waste category and source stream, Australia 2022–23

Waste category	Recycling and waste reuse (Mt)	Source stream	Recycling and waste reuse (Mt)	Jurisdiction	Recycling and waste reuse (Mt)
Ash	5.71	MSW	5.89	ACT	0.81
Building and demolition materials	22.40	C&I (core)	12.40	NSW	19.50
Glass	0.83	C&I (non-core)	5.70	NT	0.12
Hazardous wastes	2.60	C&D	23.64	Qld	6.83
Metals	5.36	**Total**	**47.62**	SA	4.05
Organics	7.52			Tas	0.57
Paper and cardboard	2.45			Vic	9.93
Plastics	0.34			WA	5.82
Textiles, leather and rubber (excl. tyres)	0.05				
Other materials	0.36				

Link back to Figure 16.

Data table for Figure 17 Indicative scrap commodity prices, July 2019 to May 2024 ($ per tonne, product leaving a materials recovery facility)

Material	Jul–19	Mar–20	Jul–20	Jul–21	Jul–22	Jul–23	Mar–24
Fibre – Mixed paper & paperboard	0	0	0	0	49	19	25
Fibre – Newsprint & magazine	182	95	92	143	411	400	387
Fibre – Old corrugated cardboard	196	102	105	124	285	102	116
Glass – MRF	-30	-30	-30	0	0	40	40
Glass – CDS	100	75	75	0	0	53	53
Plastic – PET (1)	380	328	305	549	903	353	393
Plastic – HDPE (2)	500	527	404	1,164	1,006	1,034	1,002
Plastic – PP (5)	0	0	0	0	0	0	186
Steel – Tin plate	135	115	92	419	484	373	340
Aluminium – Beverage	1,100	1,056	981	1,858	2,422	2,096	1,997

Note this table only includes selected data. Further detailed data can be found in the National Waste Database 2024.

Link back to Figure 17.

Data table for Figure 18 Trends in recycling and waste reuse by stream in total and per capita, Australia 2016–17 to 2022–23

Item	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	CAGR
Headline scope (Mt)								
MSW	5.14	5.31	5.44	5.49	5.39	5.76	5.89	1.3%
C&I	18.37	19.43	18.79	17.64	17.57	18.13	18.09	1.8%
C&D	17.03	19.37	20.67	20.83	22.15	22.40	23.64	5.3%
Total	**40.53**	**44.11**	**44.91**	**43.96**	**45.11**	**46.29**	**47.62**	**3.2%**
Core waste (Mt)								
MSW	5.14	5.31	5.44	5.49	5.39	5.76	5.89	1.3%
C&I	12.34	13.11	12.87	11.65	11.40	11.67	12.40	1.5%
C&D	17.03	19.37	20.67	20.83	22.15	22.40	23.64	5.3%
Total	**34.51**	**37.80**	**38.98**	**37.97**	**38.95**	**39.84**	**41.93**	**3.4%**
Recycling and waste reuse per capita (t per capita)								
Headline scope	1.66	1.78	1.79	1.72	1.76	1.80	1.81	1.5%
Core waste	1.42	1.53	1.55	1.49	1.52	1.55	1.59	1.7%
MSW	0.21	0.21	0.22	0.22	0.21	0.22	0.22	-0.3%
C&I (headline scope)	0.75	0.78	0.75	0.69	0.69	0.70	0.69	0.1%
C&I (core)	0.51	0.53	0.51	0.46	0.44	0.45	0.47	0.0%
C&D	0.70	0.78	0.82	0.82	0.86	0.87	0.90	3.7%

Link back to Figure 3 or Figure 18.

Data table for Figure 19 Trends in recycling and waste reuse by jurisdiction, Australia 2016–17 to 2022–23

Data in Mt.

Jurisdiction	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
ACT	0.47	0.61	0.83	0.59	0.54	0.80	0.81
NSW	17.08	17.62	16.64	16.41	16.86	19.04	19.50
NT	0.05	0.05	0.10	0.06	0.08	0.13	0.12
Qld	5.88	6.94	7.59	6.51	6.87	6.76	6.83
SA	3.34	3.75	3.60	3.61	4.31	3.68	4.05
Tas	0.48	0.35	0.46	0.42	0.40	0.24	0.57
Vic	9.55	10.99	11.57	11.70	11.09	9.97	9.93
WA	3.69	3.79	4.12	4.66	4.96	5.66	5.82
Total	**40.53**	**44.11**	**44.91**	**43.96**	**45.11**	**46.29**	**47.62**

Link back to Figure 19.

Data table for Figure 20 Energy recovery by jurisdiction, waste category and source stream, Australia 2022–23

Source stream	Energy recovery (kt)	Waste category	Energy recovery (kt)	Jurisdiction	Energy recovery (kt)
MSW	1,109	Organics	1,537	ACT	64
C&I	1,096	Paper and cardboard	268	NSW	621
C&D	103	Plastics	29	NT	28
Total	**2,308**	Textiles, leather and rubber (excl. tyres)	64	Qld	406
		Tyres	197	SA	269
		Hazardous wastes	291	Tas	47
		Other materials	118	Vic	644
				WA	227

Link back to Figure 20.

Data table for Figure 21 Greenhouse gas emissions from solid waste management, 1989–90 to 2021–22

Data in kt CO_2-e.

Year	Biological treatment of solid waste	Incineration and open burning of waste	Solid waste disposal
1990	22	87	17,065
1991	30	87	17,045
1992	38	87	16,870
1993	46	87	16,821
1994	55	87	16,167
1995	63	93	16,304
1996	71	67	14,719
1997	79	29	14,589
1998	88	29	13,814
1999	96	29	13,951
2000	104	28	13,730
2001	112	28	13,779
2002	120	29	13,974
2003	129	29	12,910
2004	137	29	12,419
2005	145	29	12,242
2006	156	29	11,941

Year	Biological treatment of solid waste	Incineration and open burning of waste	Solid waste disposal
2007	165	30	12,272
2008	178	30	12,739
2009	186	31	12,662
2010	211	30	12,980
2011	245	31	12,525
2012	249	31	11,145
2013	253	31	10,283
2014	257	32	10,246
2015	261	31	9,735
2016	267	31	9,864
2017	272	32	10,162
2018	276	31	9,576
2019	278	31	10,191
2020	282	32	10,254
2021	283	32	10,079
2022	285	32	10,552

Link back to Figure 21.

Data table for Figure 22 Trends in energy recovery by jurisdiction, Australia 2016–17 to 2022–23

Data in kt.

Jurisdiction	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
ACT	34	47	42	32	51	53	64
NSW	749	586	667	630	602	533	621
NT	14	14	17	4	5	21	28
Qld	380	418	516	522	533	356	406
SA	169	203	204	240	191	288	269
Tas	38	46	46	53	56	45	47
Vic	593	715	606	709	648	723	644
WA	195	223	155	190	196	208	227
Total	**2,171**	**2,254**	**2,253**	**2,379**	**2,283**	**2,227**	**2,308**

Link back to Figure 22.

Data table for Figure 24 Waste disposal by jurisdiction, waste category and source stream, Australia 2022–23

Waste category	Disposal (Mt)	Stream	Disposal (Mt)	Jurisdiction	Disposal (Mt)
Ash	4.57	MSW	6.48	ACT	0.32
Building and demolition materials	4.39	C&I (core)	9.18	NSW	7.41
Glass	0.53	C&I (non-core)	4.56	NT	0.28
Hazardous wastes	3.57	C&D	5.48	Qld	8.03
Metals	0.61	**Total**	**25.71**	SA	0.92
Organics	5.57			Tas	0.49
Paper and cardboard	2.16			Vic	5.48
Plastics	2.62			WA	2.77
Textiles, leather and rubber (excl. tyres)	0.75				
Other materials	0.94				

Link back to Figure 24.

Data table for Figure 25 Trends in waste disposal by stream in total and per capita, Australia 2016–17 to 2022–23

Item	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	CAGR
Headline scope (Mt)								
MSW	6.45	6.35	6.34	6.49	6.89	6.81	6.48	-0.5%
C&I	14.37	14.28	14.89	14.54	14.15	13.47	13.74	-1.7%
C&D	6.49	6.91	6.30	6.53	6.56	5.48	5.48	-1.1%
Total	**27.31**	**27.55**	**27.54**	**27.56**	**27.60**	**25.76**	**25.71**	**-1.3%**
Core waste (Mt)								
MSW	6.45	6.35	6.34	6.49	6.89	6.81	6.48	-0.5%
C&I	8.18	8.26	8.41	8.38	8.64	8.94	9.18	0.8%
C&D	6.49	6.91	6.30	6.53	6.56	5.48	5.48	-1.1%
Total	**21.12**	**21.52**	**21.06**	**21.40**	**22.09**	**21.23**	**21.15**	**-0.2%**
Disposal per capita (t per capita)								
Headline scope	1.12	1.11	1.10	1.08	1.08	1.00	0.98	-2.8%
Core waste	0.87	0.87	0.84	0.84	0.86	0.82	0.80	-1.7%
MSW	0.26	0.26	0.25	0.25	0.27	0.26	0.25	-2.0%
C&I (headline scope)	0.59	0.58	0.59	0.57	0.55	0.52	0.52	-3.2%
C&I (core)	0.34	0.33	0.33	0.33	0.34	0.35	0.35	-0.8%
C&D	0.27	0.28	0.25	0.26	0.26	0.21	0.21	-2.6%

Link back to Figure 3 or Figure 25.

Data table for Figure 26 Figure 26 Trends in waste disposal by jurisdiction, Australia 2016–17 to 2022–23

Data in Mt.

Jurisdiction	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2023
ACT	0.46	0.28	0.24	0.34	0.32	0.28	0.32
NSW	7.81	7.42	8.07	8.92	8.20	7.36	7.41
NT	0.32	0.33	0.33	0.32	0.37	0.37	0.28
Qld	9.60	10.07	9.34	7.78	8.02	7.81	8.03
SA	0.71	0.74	0.69	0.79	1.07	0.86	0.92
Tas	0.42	0.44	0.47	0.44	0.44	0.51	0.49
Vic	5.50	5.70	5.81	6.22	6.36	5.86	5.48
WA	2.49	2.58	2.59	2.73	2.83	2.71	2.77
Total	**27.31**	**27.55**	**27.54**	**27.56**	**27.60**	**25.76**	**25.71**

Link back to Figure 26.

Data table for Figure 27 Resource recovery rates by jurisdiction, 2022–23

Jurisdiction	Recycling	Energy recovery	Waste reuse	Total recovery
Headline scope				
ACT	66.5%	5.4%	1.1%	73.0%
NSW	70.8%	2.3%	0.0%	73.1%
NT	27.6%	6.7%	0.0%	34.3%
Qld	44.6%	2.7%	0.1%	47.4%
SA	75.7%	5.1%	1.6%	82.4%
Tas	51.3%	4.3%	0.0%	55.6%

Jurisdiction	Recycling	Energy recovery	Waste reuse	Total recovery
Vic	61.9%	4.0%	0.0%	65.9%
WA	65.9%	2.6%	0.1%	68.6%
Australia	**62.8%**	**3.1%**	**0.2%**	66.0%
Core waste				
ACT	66.5%	5.4%	1.1%	73.0%
NSW	66.1%	2.7%	0.0%	68.7%
NT	27.6%	6.7%	0.0%	34.3%
Qld	55.5%	3.7%	0.2%	59.3%
SA	75.7%	5.1%	1.6%	82.4%
Tas	51.3%	4.3%	0.0%	55.6%
Vic	65.4%	4.2%	0.0%	69.6%
WA	62.1%	2.9%	0.1%	65.1%
Australia	**63.9%**	**3.5%**	**0.2%**	67.7%

Link back to Figure 4 or Figure 27.

Data table for Figure 28 Resource recovery rates by source stream, 2022–23

Stream	Recycling	Energy recovery	Waste reuse	Total recovery
MSW	43.4%	8.2%	0.3%	51.9%
C&I (headline scope)	54.9%	3.3%	0.0%	58.3%
C&I (core)	54.7%	4.8%	0.0%	59.5%
C&D	80.6%	0.4%	0.3%	81.2%

Link back to Figure 28.

Data table for Figure 29 Resource recovery rate trends by jurisdiction (top) and source stream (bottom), Australia 2016–17 to 2022–23

Jurisdiction	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	CAGR
ACT	52.5%	70.0%	78.5%	64.7%	65.2%	75.3%	73.0%	-0.1%
NSW	69.5%	71.1%	68.2%	65.6%	68.0%	72.7%	73.1%	1.5%
NT	16.4%	17.2%	25.6%	16.3%	18.3%	29.6%	34.3%	7.6%
Qld	39.5%	42.2%	46.4%	47.5%	48.0%	47.7%	47.4%	1.9%
SA	83.1%	84.3%	84.7%	83.0%	80.8%	82.2%	82.4%	0.5%
Tas	55.3%	47.6%	51.8%	51.5%	51.0%	36.2%	55.6%	1.8%
Vic	64.8%	67.3%	67.7%	66.6%	64.9%	64.6%	65.9%	1.7%
WA	60.9%	60.9%	62.3%	64.0%	64.6%	68.4%	68.6%	4.0%
Australia	**61.0%**	**62.7%**	**63.1%**	**62.7%**	**63.2%**	**65.3%**	**66.0%**	**1.8%**
Source stream	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**CAGR**
MSW	49.8%	50.8%	50.9%	50.8%	48.8%	50.0%	51.9%	0.6%
C&I (headline scope)	57.2%	58.8%	57.1%	56.3%	56.8%	58.7%	58.3%	1.7%
C&I (core)	61.8%	63.0%	62.3%	60.3%	59.0%	58.7%	59.5%	0.3%
C&D	72.5%	73.7%	76.7%	76.2%	77.2%	80.4%	81.2%	1.6%

Link back to Figure 29.

Data table for Figure 30 Waste generation and management by waste category, Australia 2022–23

Waste category	Anaerobic digestion (Mt)	Energy from waste facility (Mt)	Landfill (Mt)	Other disposal (Mt)	Recycling (Mt)	Treatment (Mt)	Waste reuse (Mt)	Generation (Mt)	Generation (%)	Generation (kg/cap)
Ash	0.00	0.00	0.01	4.56	5.71	0.00	0.00	10.28	13.6%	391
Building and demolition materials	0.00	0.00	4.39	0.00	22.32	0.00	0.08	26.79	35.4%	1,018
Glass	0.00	0.00	0.53	0.00	0.83	0.00	0.00	1.36	1.8%	52
Hazardous wastes	0.00	0.20	3.05	0.03	1.57	1.62	0.00	6.47	8.55%	246
Metals	0.00	0.00	0.61	0.00	5.36	0.00	0.00	5.97	7.9%	227
Organics	0.04	0.09	6.83	0.16	7.50	0.00	0.00	14.62	19.3%	556
Paper and cardboard	0.00	0.00	2.42	0.00	2.45	0.00	0.00	4.88	6.4%	185
Plastics	0.00	0.03	2.62	0.00	0.34	0.00	0.00	2.99	4.0%	114
Textiles, leather and rubber (excl. tyres)	0.00	0.00	0.82	0.00	0.05	0.00	0.00	0.86	1.1%	33
Other materials	0.00	0.12	0.94	0.00	0.31	0.00	0.04	1.41	1.9%	54
Total	**0.04**	**0.43**	**22.22**	**4.76**	**46.45**	**1.62**	**0.13**	**75.64**	**100.0%**	**2,875**

Link back to Figure 5 or Figure 30.

Data table for Figure 31 Resource recovery rates by waste category, Australia 2022–23

Waste category	Recycling	Energy recovery	Waste reuse	Total recovery
Ash	55.5%	0.0%	0.0%	55.5%
Building and demolition materials	83.3%	0.0%	0.3%	83.6%
Glass	61.0%	0.0%	0.0%	61.0%
Hazardous wastes	40.2%	4.5%	0.0%	44.7%
Metals	89.8%	0.0%	0.0%	89.8%
Organics	51.4%	10.5%	0.0%	61.9%
Paper and cardboard	50.3%	5.5%	0.0%	55.8%
Plastics	11.5%	1.0%	0.0%	12.5%
Textiles, leather and rubber (excl. tyres)	5.3%	7.5%	0.0%	12.7%
Other materials	22.3%	8.4%	2.9%	33.6%

Link back to Figure 31.

Data table for Figure 32 Trends in the generation and management of key waste categories, Australia 2016–17 to 2022–23

Data in Mt.

Management	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	CAGR
Ash								
Anaerobic digestion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Energy from waste facility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Landfill	0.00	0.00	0.00	0.00	0.00	0.02	0.01	n/a
Long term storage	6.20	6.03	6.48	6.16	5.51	4.52	4.56	-4.8%
Recycling	6.03	6.31	5.92	5.99	6.17	6.47	5.71	1.8%
Treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Waste reuse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Total	12.22	12.34	12.40	12.15	11.67	11.01	10.28	**-2.1%**
kg/capita	**501**	**498**	**493**	**476**	**456**	**427**	**391**	**-3.5%**
Building and demolition materials								
Anaerobic digestion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Energy from waste facility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Landfill	4.80	4.70	4.22	4.94	4.94	4.43	4.39	-1.4%
Other disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Recycling	15.37	17.47	18.67	18.99	20.06	20.77	22.32	5.9%
Treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Waste reuse	0.00	0.00	0.00	0.00	0.02	0.01	0.08	n/a
Total	20.18	22.17	22.89	23.92	25.01	25.20	26.79	**3.9%**
kg/capita	**828**	**896**	**911**	**938**	**976**	**978**	**1,018**	**2.4%**
Glass								
Anaerobic digestion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Energy from waste facility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Landfill	0.49	0.47	0.48	0.61	0.63	0.50	0.53	0.1%
Other disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Recycling	0.64	0.71	0.69	0.88	0.92	0.78	0.83	0.7%
Treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Waste reuse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Total	1.13	1.17	1.16	1.49	1.55	1.29	1.36	**0.5%**
kg/capita	**46**	**47**	**46**	**58**	**60**	**50**	**52**	**-1.0%**
Hazardous wastes								
Anaerobic digestion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Energy from waste facility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Landfill	3.53	4.49	4.47	3.64	3.67	2.92	2.83	1.4%
Other disposal	0.03	0.02	0.03	0.06	0.04	0.08	0.03	-1.5%
Recycling	1.73	1.78	1.81	1.78	1.74	1.53	1.49	1.3%
Treatment	0.79	1.18	1.23	1.43	1.45	1.60	1.62	3.6%
Waste reuse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Total	6.08	7.47	7.54	6.91	6.89	6.13	5.97	**1.9%**
kg/capita	**249**	**302**	**300**	**271**	**269**	**238**	**227**	**0.3%**
Metals								
Anaerobic digestion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Energy from waste facility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Landfill	0.56	0.55	0.56	0.68	0.74	0.61	0.61	0.6%
Other disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Recycling	5.15	5.00	5.04	4.89	4.39	4.59	5.36	2.8%
Treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Waste reuse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Total	5.71	5.55	5.60	5.57	5.12	5.20	5.97	**2.5%**
kg/capita	**234**	**224**	**223**	**218**	**200**	**202**	**227**	**1.0%**
Organics								
Anaerobic digestion	0.05	0.06	0.08	0.09	0.07	0.03	0.04	n/a

Management	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	CAGR
Energy from waste facility	0.11	0.15	0.24	0.17	0.13	0.05	0.09	n/a
Landfill	7.15	7.02	6.87	6.97	7.29	6.89	6.83	-1.3%
Other disposal	0.08	0.13	0.13	0.19	0.19	0.16	0.16	-4.5%
Recycling	6.93	7.76	7.57	6.85	7.69	7.56	7.50	2.5%
Treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Waste reuse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Total	14.32	15.11	14.89	14.27	15.38	14.70	14.62	**0.3%**
kg/capita	**587**	**611**	**592**	**559**	**600**	**570**	**556**	**-1.2%**
Paper and cardboard								
Anaerobic digestion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Energy from waste facility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Landfill	2.40	2.39	2.40	2.49	2.60	2.40	2.42	1.6%
Other disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Recycling	3.79	3.65	3.52	3.02	2.53	2.72	2.45	-2.5%
Treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Waste reuse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Total	6.19	6.04	5.92	5.51	5.12	5.12	4.88	**-0.8%**
kg/capita	**254**	**244**	**235**	**216**	**200**	**199**	**185**	**-2.3%**
Plastics								
Anaerobic digestion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Energy from waste facility	0.03	0.00	0.07	0.01	0.01	0.02	0.03	n/a
Landfill	2.32	2.16	2.14	2.18	2.27	2.56	2.62	0.8%
Other disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Recycling	0.31	0.29	0.29	0.29	0.32	0.36	0.34	1.9%
Treatment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Waste reuse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n/a
Total	2.66	2.46	2.50	2.48	2.61	2.93	2.99	**1.0%**
kg/capita	**109**	**99**	**100**	**97**	**102**	**114**	**114**	**-0.5%**

Link back to Figure 32.

Data table for Figure 33 Waste collected by Australian local governments by kerbside bin service type, 2016–17 to 2022–23

Data in Mt.

	2016–17	2018–19	2020–21	2022–23
Dry recycling	2.116	1.875	1.832	1.798
Organics	1.410	1.374	1.850	2.075
Garbage	6.181	5.608	5.991	6.024
Total	**9.707**	**8.857**	**9.673**	**9.897**

Link back to Figure 33.

Data table for Figure 34 Kerbside waste services by proportion of the jurisdictional population, 2022–23

Service type	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia
Dry recycling	100.0%	86.3%	53.3%	86.6%	89.8%	95.5%	93.8%	94.0%	**89.5%**
Organics	56.9%	59.0%	0.0%	18.9%	87.0%	59.9%	65.6%	47.0%	**52.6%**
Garbage	100.0%	90.8%	83.1%	97.1%	90.8%	96.1%	94.2%	98.0%	**93.9%**

Link back to Figure 34.

Data table for Figure 35 *Access to kerbside organics services by proportion of jurisdictional population, 2022–23*

Service type	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia
GO	54.1%	38.2%	–	17.6%	9.9%	9.1%	14.9%	30.0%	**24.5%**
FO or FOGO	2.8%	20.8%	–	1.2%	77.1%	50.9%	50.7%	17.0%	**28.1%**

Link back to Figure 35.

Data table for Figure 36 *Management of garbage by proportion of the jurisdictional population – landfill vs mechanical biological treatment (MBT), 2022–23*

Service type	NSW	Qld	Australia
Landfill	59.7%	95.4%	**84.1%**
MBT	31.1%	1.7%	**10.1%**

Link back to Figure 36.

Data table for Figure 37 *Annual waste generation and fate per capita in Australia and selected countries*

Country	Year	Disposal	Recycling	Energy recovery	Recovery rate
		Kg per cap.	*Kg per cap.*	*Kg per cap.*	
Singapore	2022	40	714	527	**96.9%**
Norway	2022	349	781	639	**80.3%**
Hungary	2021	491	1,446	102	**75.9%**
Australia	2022–23	735	1,512	9	**67.4%**
USA	2018	805	1,557	117	**67.5%**
UK	2018	1,182	1,749	120	**61.3%**

Link back to Figure 37.

Data table for Figure 38 *Comparison of annual MSW generation and recycling rates in Australia and selected countries*

Country	Year	MSW generated kg per capita	Reported recycling rate	Generation per capita rank	Recycling rate ranking
Costa Rica	2022	309.9	7.5%	17	17
Japan	2021	326.3	78.9%	16	8
Poland	2022	354.8	51.2%	15	14
Hungary	2022	405.6	32.8%	14	15
Türkiye	2021	416.2	12.3%	13	16
United Kingdom	2022	436.3	42.7%	12	13
Republic of Korea	2021	438.6	71.6%	11	6
Spain	2022	468.1	43.4%	10	12
Netherlands	2022	472.8	57.5%	9	7
Italy	2021	494.7	51.9%	8	9
Australia	2022–23	512.4	43.7%	7	10
France	2022	538.8	41.2%	6	11
Germany	2022	593.1	69.0%	5	3
Switzerland	2022	677.2	52.2%	4	4
Belgium	2021	757.7	55.0%	3	2
USA	2018	811.5	39.1%	2	5
Austria	2021	835.1	62.0%	1	1

Link back to Figure 38.

Data table for Figure 39 Trends in Australian exports of waste and recovered materials, 2006–07 to 2022–23

Data in kt.

Waste category	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Metals	1,578	2,014	1,983	1,854	1,877	2,435	2,404	2,698	2,469	1,968	2,144	2,451	2,642	2,541	2,457	2,516	2,307
Plastics	98	117	197	147	150	175	170	171	201	203	182	159	187	113	124	105	45
Paper and cardboard	1,105	1,332	1,265	1,497	1,384	1,466	1,567	1,497	1,497	1,535	1,453	1,317	1,112	1,060	1,045	1,060	982
Glass	2	2	2	2	2	3	2	2	2	11	15	23	16	26	0	2	1
Textiles	18	22	28	25	27	50	77	89	90	90	94	103	110	97	105	107	114
Tyres	11	41	62	71	108	142	112	128	108	65	72	90	118	88	105	88	59
Hazardous (excl. tyres)	28	64	36	25	50	36	22	25	35	41	42	45	57	42	42	42	105
Other core waste	1	1	1	1	1	2	3	2	2	2	2	2	10	5	3	9	12
Total	**2,839**	**3,592**	**3,573**	**3,622**	**3,600**	**4,309**	**4,356**	**4,611**	**4,404**	**3,914**	**4,004**	**4,190**	**4,253**	**3,972**	**3,880**	**3,929**	**3,624**

Link back to Figure 6 or Figure 39.

Data table for Figure 40 Major exports of recovered materials compared with overall quantities recovered, 2022–23

Recovered material	Exported (kt)	Recovered (kt)
Glass	1	827
Metals	2,307	5,363
Paper and cardboard	982	2,453
Plastics	45	373
Tyres	197	277
Other core waste	3,510	31,997

Link back to Figure 40.

Data table for Figure 41 *Quantity of waste oil processed under the Product Stewardship for Oil program, 2017–18 to 2023–24*

Financial year	Product	Megalitres
2017-18	Other categories of oil	131.5
	Re-refined base oil (for use as a lubricant or a hydraulic or transformer oil)	135.2
2018-19	Other categories of oil	136.2
	Re-refined base oil (for use as a lubricant or a hydraulic or transformer oil)	130.0
2019-20	Other categories of oil	364.5
	Re-refined base oil (for use as a lubricant or a hydraulic or transformer oil)	132.6
2020-21	Other categories of oil	130.5
	Re-refined base oil (for use as a lubricant or a hydraulic or transformer oil)	155.3
2021-22	Other categories of oil	185.3
	Re-refined base oil (for use as a lubricant or a hydraulic or transformer oil)	156.1
2022-23	Other categories of oil	129.4
	Re-refined base oil (for use as a lubricant or a hydraulic or transformer oil)	167.2
2023-24	Other categories of oil	143.6
	Re-refined base oil (for use as a lubricant or a hydraulic or transformer oil)	169.6

Link back to Figure 41.