

Report prepared by



## 2018–19 Australian Plastics Recycling Survey

### National report

Final report

12 March 2020



Report prepared for



**Australian Government**

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**Department of Agriculture, Water and the Environment**



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## Contents

Glossary / Abbreviations .....	iv
Executive summary .....	1
1 Introduction .....	8
1.1 Definition of ‘plastic’ .....	9
1.2 Definitions of ‘recycling’, ‘reprocessing’ and ‘recovery’ .....	10
1.3 Changes in scope inclusions and exclusions in 2018–19 .....	11
1.4 Data limitations and assumptions .....	11
2 Survey method .....	12
2.1 Data sources .....	12
2.2 Determination of plastics consumption .....	13
2.3 Determination of plastics recycling .....	14
2.4 Reporting categories.....	14
2.5 Plastic retail carry bag consumption.....	16
3 Australian consumption and recovery of plastics.....	17
3.1 Annual consumption and recovery of plastics.....	17
3.2 Plastics consumption in 2018–19 .....	20
3.3 Plastics recovery in 2018–19 .....	25
3.4 Impact of using consumption as a proxy for end-of-life arisings.....	35
3.5 Plastic retail carry bag consumption.....	37
4 Consumption and recycling by state/territory.....	40
4.1 Plastics consumption by state/territory .....	40
4.2 Plastics recovery by source state/territory.....	42
4.3 Cross border recycle flows .....	46
4.4 Reprocessor numbers by state/territory .....	48
5 Market commentary .....	50
5.1 Business operations.....	50
5.2 Product and packaging design .....	50
5.3 Increasing virgin resin competition .....	50
5.4 Export market competition.....	51
5.5 End market uses.....	52
6 References.....	53



## GLOSSARY / ABBREVIATIONS

ABS/SAN/ASA	Acrylonitrile butadiene styrene (ABS), styrene acrylonitrile (SAN), and /or acrylonitrile styrene acrylate (ASA) (PIC 7).
Bioplastics	Plastics that are biobased, biodegradable or both. Bioplastics fall into three broad groupings, which are: biobased (but not biodegradable); biodegradable (but not biobased); or biobased and biodegradable. Conventional polymers (e.g. PET and HDPE) can also be fully or partially 'biobased'.
Commercial and Industrial (C&I)	Material from all commercial and industry sources other than construction and demolition (C&D) related sources.
Construction and Demolition (C&D)	Material from the construction, refurbishment and building demolition industries.
Consumption	Total use of product by Australian industry and consumers. Includes locally made and used product, imported product and locally utilised recyclate. Does not include locally made product that is exported for sale.
Converter	Company which converts resin, either virgin resin or recycled content resin, into plastic products.
Diversion rate	Recovery (at a defined point) as a percentage of end-of-life disposal. Also see 'Recovery rate' and 'Recycling rate'.
Domestic	Material from domestic (household) sources.
Energy recovery	Combustion of waste plastics as either a fuel substitute (e.g. in cement kilns), or in specialised waste combustion facilities to create heat, which is then generally used for steam production. The steam is then used directly in industrial processes and/or used to generate electricity. Excludes incineration where a substantial portion of energy value in the waste plastic is not recovered.
Export for reprocessing	Material sent for reprocessing overseas.
Feedstock (chemical) recycling	The use of chemical processes such as pyrolysis to convert scrap plastics into a hydrocarbon gas or liquid (often a polymer to monomer conversion) that is usable as a fuel or as an input for manufacturing plastics resins.
Flexible plastics	Soft (flexible) plastics are generally defined as plastics that can be scrunched into a ball, unlike 'rigid' plastics such as bottles and tubs, which are moulded and hold their shape. Also refer to the 'Rigid packaging' entry.
Household	Material from domestic (household) sources.
In the gate	Material entering a facility for reprocessing. This may include material that is unusable due to contamination. In the gate material that is subsequently sent to landfill is generally either a combination of gross contamination (i.e. materials that should not have been presented and are not recyclable at the receiving facility) and/or designated scrap plastics that were not recovered into product due to cross contamination with unrecyclable materials or losses due to other types of production inefficiencies (e.g. losses to trade waste). Also see 'Out the gate'.
Internal use	Recyclate processed and used within the one company.
Local use	Recyclate used within Australia by an Australian company in the manufacture of a new product.
Local/Locally	In Australia.
Material flow analysis (MFA)	Material flow analysis (MFA) is a mass balanced based analytical method to quantify flows and stocks of materials or substances for a well-defined system and time period. MFA is also referred to as substance flow analysis (SFA).
Mechanical recycling	The use of physical processes such as sorting, chipping, grinding, washing and extruding to convert scrap plastics to a usable input for the manufacture of new products.
MRF	Material Recovery Facility – a facility for the sorting of recyclables (typically packaging) into various product streams.
Municipal	Household material plus material from public place recycling and other council services.
Non-packaging / durable	Long-term use item; not designed to be single use or disposable within a 12-month period.
Out the gate	Material leaving a facility following reprocessing, and excludes most contamination. Also see 'In the gate'.
Packaging	Material used for the containment, protection, marketing or handling of product. Includes primary, secondary and tertiary/freight packaging in both consumer and industrial packaging applications.
PE-HD or HDPE	High density polyethylene (PIC 2). Typically referred to as HDPE.
PE-LD/LLD or LDPE/LLDPE	Both low density polyethylene and linear low density polyethylene (PIC 4). Typically referred to as LDPE/LLDPE.
PE-LD or LDPE	Low density polyethylene (PIC 4). Typically referred to as LDPE.



PE-LLD or LLDPE	Linear low density polyethylene (PIC 4). Typically referred to as LLDPE.
PET	Polyethylene terephthalate (PIC 1).
PIC	Plastics identification code. Also known overseas as the Resin Identification Code (RIC).
PU or PUR	Polyurethane (PIC 7).
Post-consumer domestic	Used material from household sources. Mostly packaging material from kerbside recycling collections.
Post-consumer industrial	Used material from non-household sources.
PP	Polypropylene (PIC 5).
Pre-consumer industrial	Scrap off-cuts and off-specification items in the manufacturing industry which are not used by the consumer which are collected for reprocessing at a different site. Does not include material that is recycled directly back into manufacturing processes at the same site. Does not include material that has reached the end consumer, whether domestic or industrial.
PS	Polystyrene (PIC 6).
PS-E or EPS	Expanded polystyrene (PIC 6). Typically referred to as EPS.
PVC	Polyvinyl chloride (PIC 3).
Recover / recovery / resource recovery	The process of recovering resources from waste for reuse or reprocessing. This includes collection, sorting and aggregation of materials. To convert waste into a reusable material.
Recovery rate	Recovery (at a defined point) as a percentage of end-of-life disposal. Similar meaning to 'Recycling rate' but can include material into composting and energy recovery. Excludes reused products. Also see 'Diversion rate' and 'Recycling rate'.
Recyclate	Scrap material either before or after reprocessing.
Recycling	Activities in which solid wastes are collected, sorted, processed (including through composting), and converted into raw materials to be used in the production of new products (the amount of solid waste recycled is net of any residuals disposed). Excludes energy recovery and stockpiles.
Recycling rate	Recovery (at a defined point) as a percentage of end-of-life disposal. Similar meaning to 'Recovery rate' but excludes material into energy recovery and reused products. Also see 'Diversion rate' and 'Reprocessing rate'.
Reprocess / reprocessing	To put a material that has been used through an industrial process to change it so that it can be used again.
Reprocessor / reprocessing facility / reprocessing infrastructure	Facility that uses an industrial process to change the physical structure and properties of a waste material so it can be used again. This can include facilities that dismantle products, such as tyres, e-waste and mattresses, and energy from waste facilities that use materials to generate energy.
Resin	Raw polymer material.
Rigid packaging	Rigid plastic packaging such as bottles and tubs, which are (generally) moulded and hold their shape. Also refer to the 'Flexible packaging' entry.
Rubber – natural	A group of biobased polyisoprenes primarily made from latex harvested from the rubber tree. Typically made into products containing other additives, for example tyres with a partial or fully natural rubber component may also contain steel wire, plastic fibres and fabrics (typically nylon or polyester based), carbon black, silica, zinc oxide, sulfur and other additives.
Rubber – synthetic	A broad group of petrochemical based elastomers such as styrene-butadiene rubbers (SBR). Typically made into products containing other additives, for example tyres with a partial or fully synthetic rubber component may also contain steel wire, plastic fibres and fabrics (typically nylon or polyester based), carbon black, silica, zinc oxide, sulfur and other additives.
Sorting	A process typically between collection (recovery) and reprocessing in which collected end-of-life materials are sorted (or disassembled) into more usable and valuable material fractions.
Virgin material	Material that has been sourced through primary resource extraction. Virgin materials are often referred to as primary materials. Virgin materials are not sourced from recycled materials (sometimes called secondary materials).
Waste	Any discarded, rejected, unwanted, surplus or abandoned matter, including where intended for recycling, reprocessing, recovery, purification or sale. Anything that is no longer valued by its owner for use or sale and which is, or will be, discarded.
Waste plastics export	Export of (typically baled) scrap plastics material sent off-shore for reprocessing.
XPS	Extruded polystyrene (PIC 6).



## EXECUTIVE SUMMARY

In 2019, the Australian Government Department of Agriculture, Water and the Environment (formally the Australian Government Department of the Environment and Energy), and New South Wales, Queensland, Victorian and Western Australian state agencies commissioned the annual Australian Plastics Recycling Survey (APRS) to capture the consumption and recovery of plastics in Australia during the 2018–19 financial year.

This information is collected through a detailed survey of Australian reprocessors, Australian resin manufacturers and importers, and extensive interrogation of Australian Customs data, sourced from the Department of Foreign Affairs and Trade (DFAT).

The 2018–19 survey has been conducted by the partnership of Envisage Works and Sustainable Resource Use (SRU), and the survey results are aggregated and analysed within this report. This research started in 1997 and has been undertaken annually since 2000.

As an add-on task to the main time-series APRS study this year, an assessment of national consumption of plastic retail carry bags in 2018–19 has been undertaken, with a focus on single-use bags. This is an update of work last undertaken on the 2016–17 financial year.

The survey provides a comprehensive picture of the consumption, flow and recycling of plastics in Australia, the state of reprocessing markets and helps to inform product stewardship developments. The survey is a valuable tool for promotion, knowledge of the industry and forward planning. The survey informs policy development and supports the tracking of policy outcomes. It also supports programs to further improve plastics resource efficiency over product life cycles.

### Key survey findings

The key findings of the Australian Plastics Recycling Survey assessing the 2018–19 financial year are:

- A total of 3.5 million tonnes of plastics were consumed in Australia.
- A total of 393 800 tonnes of plastics were recovered, including 72 000 tonnes sent to energy recovery.
- The national plastics recovery rate was 11.5%.
- Of the 393 800 tonnes of plastics collected for reprocessing, 203 100 tonnes (52%) was reprocessed in Australia and 190 700 tonnes (48%) was exported for reprocessing.



## Annual consumption and recovery of plastics

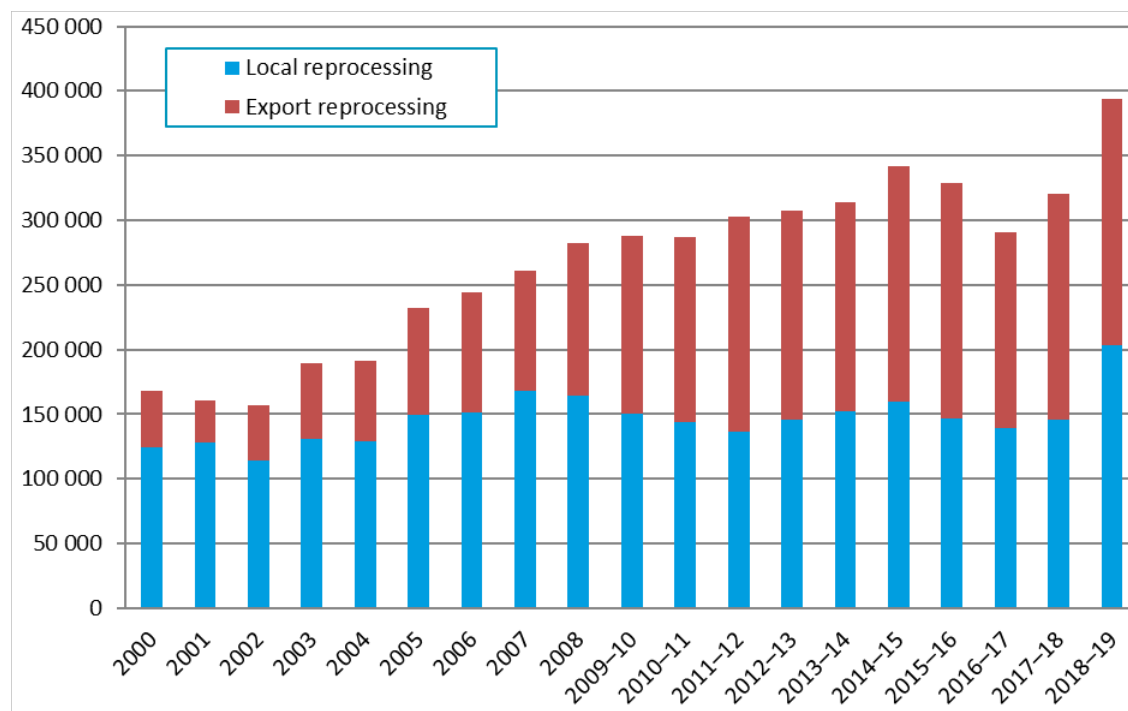
**Table E-1 – Annual Australian consumption and recovery of plastics**

Year	Plastics consumption	Plastics recovery	Plastics recovery rate
	(tonnes)	(tonnes)	(%)
2000	N/A	167 700	N/A
2001	N/A	160 900	N/A
2002	N/A	157 300	N/A
2003	N/A	189 400	N/A
2004	N/A	191 000	N/A
2005	N/A	232 000	N/A
2006	N/A	244 000	N/A
2007	N/A	261 100	N/A
2008	N/A	282 000	N/A
2009–10	N/A	288 200	N/A
2010–11	N/A	287 400	N/A
2011–12	N/A	302 600	N/A
2012–13	N/A	307 300	N/A
2013–14	N/A	313 700	N/A
2014–15	3 167 000	341 800	10.8%
2015–16	2 912 000	328 900	11.3%
2016–17	2 955 400	291 000	9.8%
2017–18	3 407 300	320 000	9.4%
2018–19	3 435 200	393 800	11.5%

Presented in Figure E-1 is the quantity of plastics recovered in Australia across the period between 2000 to 2018–19. The proportion of plastics exported for reprocessing in 2018–19 was 48%.

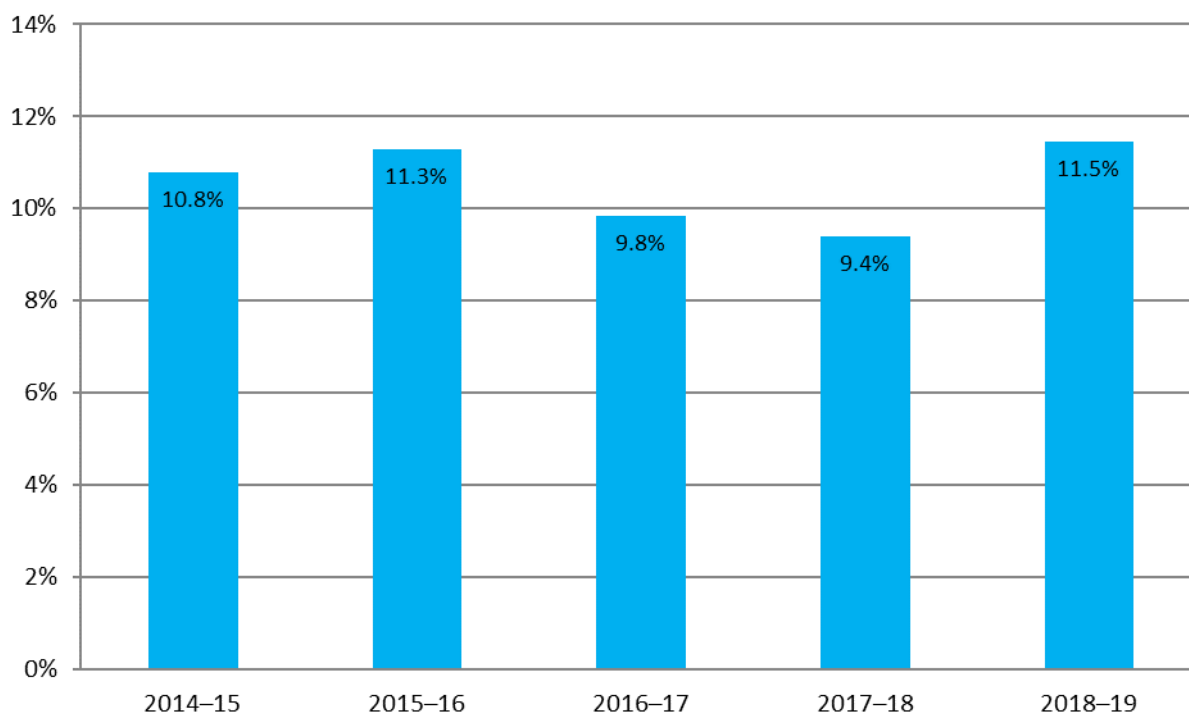


**Figure E-1 – Annual Australian plastics recovery 2000 to 2018–19, by location of reprocessing (tonnes)**



Presented in the Figure E-2 are the annual plastics recovery rates across the period from 2014–15 to 2018–19.

**Figure E-2 – Annual Australian plastics recovery rates 2014–15 to 2018–19**

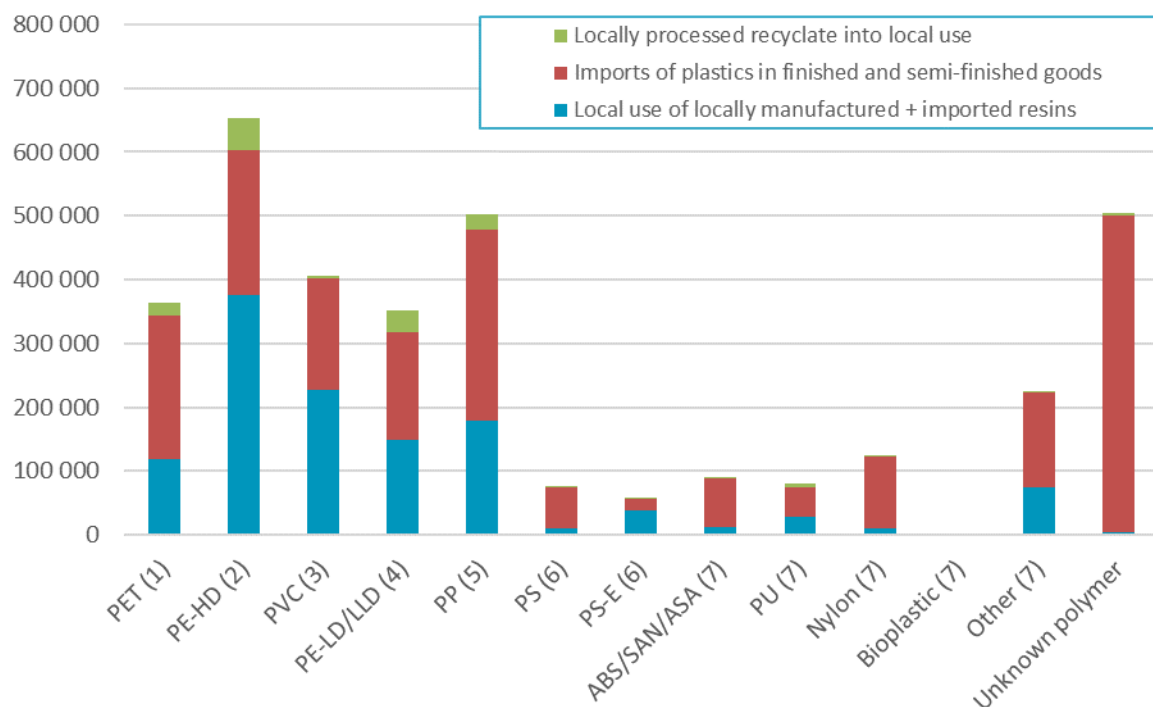




## Overall plastics consumption in 2018–19

Around 60% of plastics consumption was through imported finished and semi-finished goods, with only 36% of consumption through local manufacturing using virgin resins (either locally manufactured or imported), and 4% of consumption using locally processed recycle based resins.

**Figure E-3 – Australian plastics consumption by polymer type and source in 2018–19 (tonnes)**

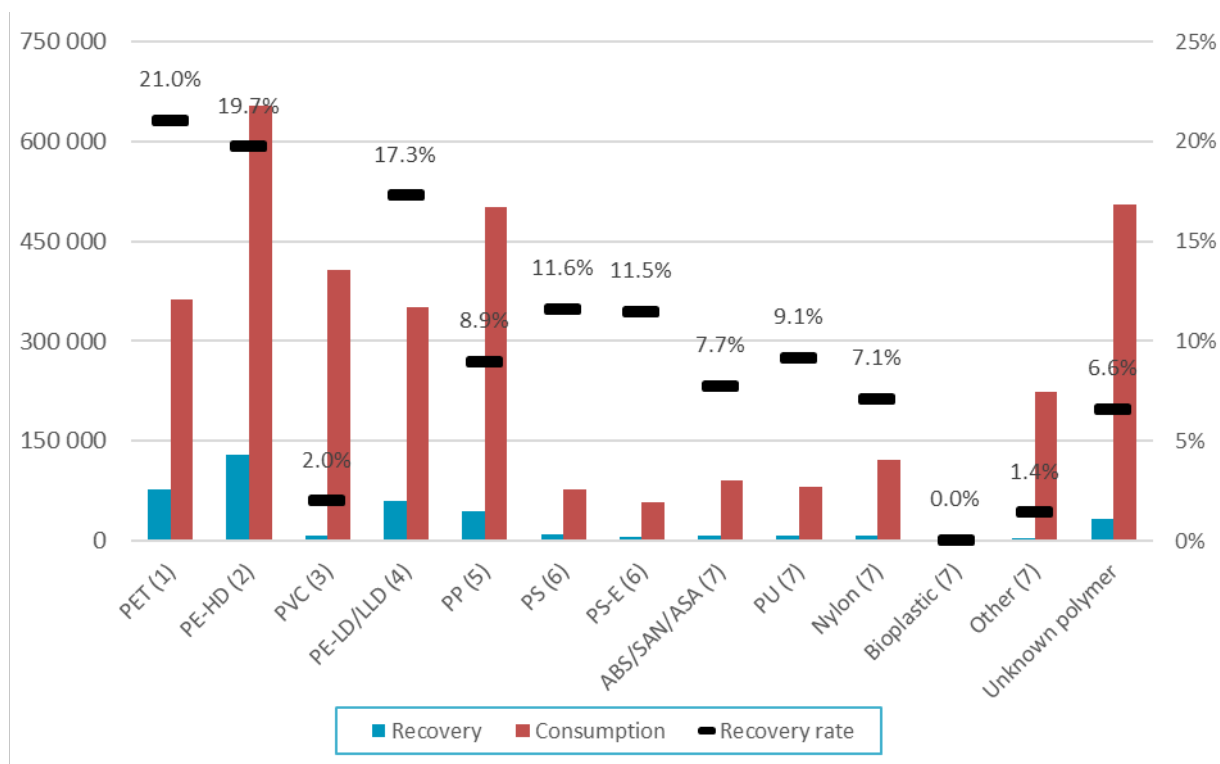




## Plastics consumption and recovery by polymer type in 2018–19

The highest recovery rate observed in 2018–19 was for PET at 21.0% (primarily sourced from packaging), followed by HDPE (also primarily from packaging) at 19.7%. The recovery of these polymers is underpinned by the Australian Packaging Covenant, which is the national product stewardship scheme for packaging. It is important to note that these recovery rates include both pre-consumer packaging manufacturing scrap recovery and post-consumer packaging recovery, and are an overall recovery rate, not a post-consumer recovery rate only.

**Figure E-4 – Plastics consumption and recovery by polymer type in 2018–19 (tonnes and % recovery rate)**





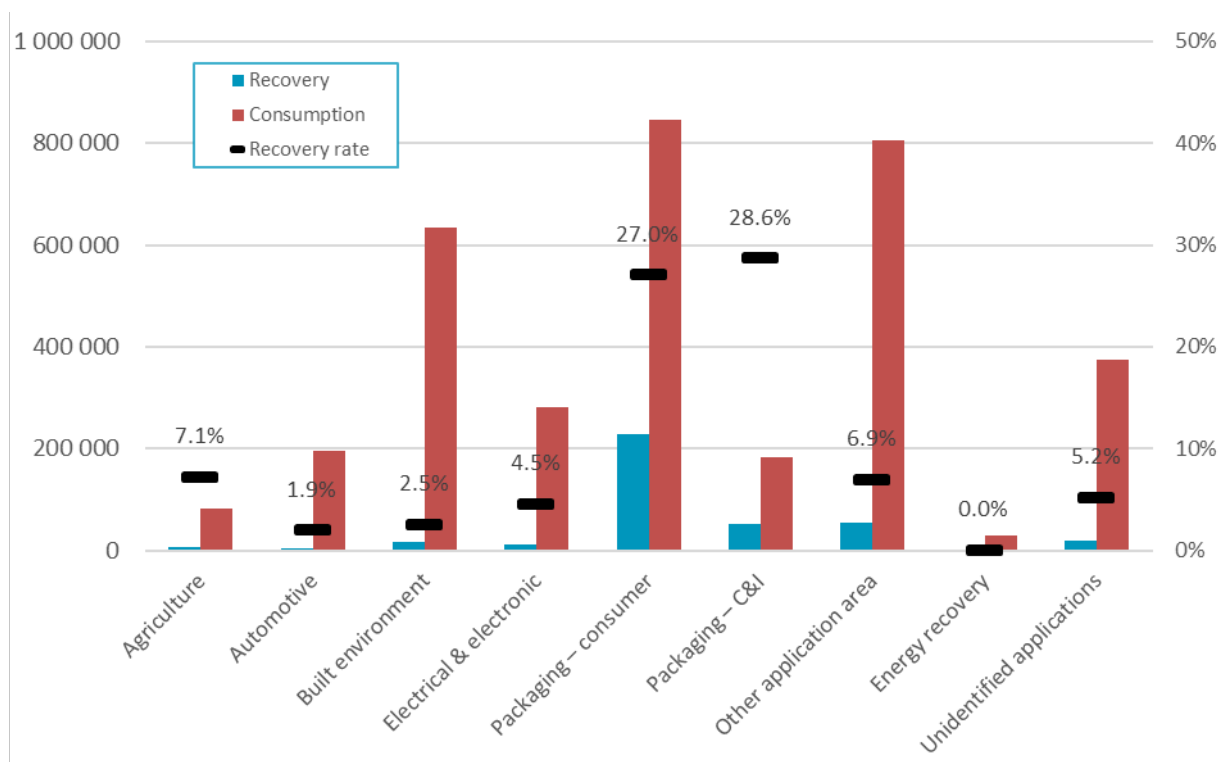
## Plastics consumption and recovery by application area in 2018–19

The quantity of plastic packaging recovery and the recovery rate of 27.3% (combined consumer and commercial and industrial (C&I)) are relatively good compared to all other application areas for plastics. It is important to note that these recovery rates include both pre-consumer manufacturing scrap recovery and post-consumer recovery, and are an overall recovery rate for the application areas, not a post-consumer recovery rate only.

At 7.1% and 6.9%, the recovery rates for plastics recovered agricultural and 'other' applications respectively are the next highest. Clothing recovery makes a significant contribution to the 'other' application area recovery rate.

The recovery rates across all application areas continue to be poor to very poor.

**Figure E-5 – Plastics consumption and recovery by application area in 2018–19 (tonnes and % recovery rate)**

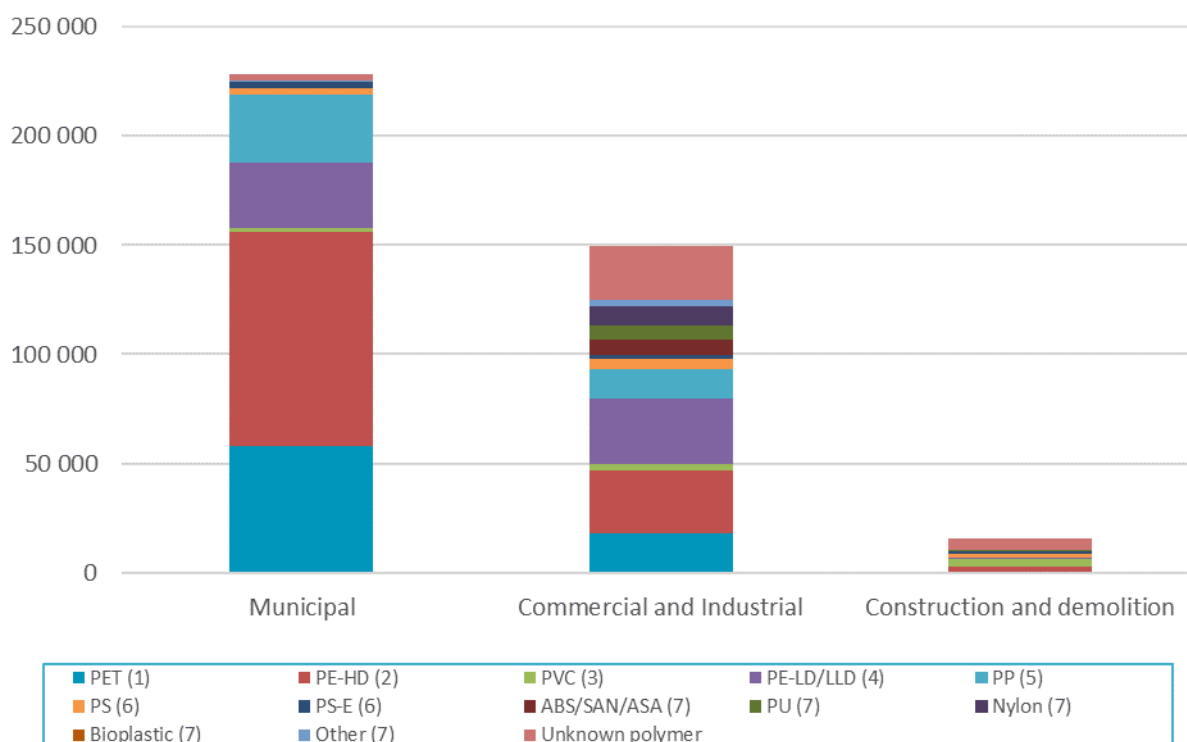




## Plastics recovery by waste stream in 2018–19

In 2018–19, of all plastics recovered in Australia, 58% of plastics were recovered from the municipal sector, 38% from the C&I sector, and 4% from the construction and demolition (C&D) sector.

**Figure E-6 – Waste stream sources of recyclate by polymer type in 2018–19 (tonnes)**





# 1 INTRODUCTION

Since 2000, the Australian Plastics Recycling Survey (APRS) has been conducted each year to collect data on plastics manufacturing, imports, local reprocessing and exports destined for reprocessing. This study has been commissioned by the Australian Government Department of Agriculture, Water and the Environment (DAWE), and state government agencies in New South Wales, Queensland, Victoria and Western Australia.

This report is the national data report for the 2018–19 financial year, and reports on plastics consumption and recovery Australia-wide, across polymer types and the application areas of plastics use.

The survey provides a comprehensive picture of the consumption, flow and recycling of plastics in Australia, the state of reprocessing markets and the status of product stewardship commitments. The survey is a valuable tool for promotion, knowledge of the industry and forward planning. The survey informs policy development and supports the tracking of policy outcomes. It also supports programs to further improve plastics resource efficiency over product life cycles. In more detail this up-to-date and reliable plastics flow data provides:

- an understanding of the current state of demand, use, recovery and recycling across a broad range of sectors and polymer types
- reliable and year-on-year consistent data to governments, industry and the broader community
- information for responses to international surveys
- information on plastic recovery rates by application area for interested stakeholders
- information on the import and export flows of plastics
- information on the use and destination of recovered plastics materials
- information to support the development and tracking of policies and programs to assist further improvement of plastics resource efficiency over whole of life.

In 2015, the methodology for determining plastics consumption was updated and expanded to include estimates of consumption of plastics through imported finished and semi-finished plastic goods, including packaging on imported goods. Prior to the 2014–15 year, the methodology only included imported virgin plastics, and no other plastic product imports. For this reason, plastics consumption estimates prior to 2014–15 are not directly comparable with later estimates and are not provided in this report.

Consumption data is estimated from a variety of sources including:

- Australian based resin manufacturers.
- Australian based resin importers.
- Customs import and export data.
- Plastics reprocessors (returning end-of-life plastics back into use).



As this project was undertaken as a national study and there is currently insufficient data available to break down consumption by jurisdiction, consumption has been split by jurisdiction based on per capita allocations. As such, estimates for jurisdiction based consumption do not include the varying intensity of industry across different jurisdictions nor allow for any variable patterns of domestic consumption.

For all plastic products, recovery is often an important stage of the product life cycle. While there are a range of current technologies available for recovery, in Australia mechanical recycling is the primary process used to recover plastic materials. However, plastics into energy recovery have jumped sharply in 2018–19, and this increase is detailed in this report.

The lifespan of plastic products varies from short-term single-use items, to long-term durable products which may remain in use for many years before reaching end-of-life. This creates a challenge for estimating the recovery rates of plastic products with a lifespan of more than 1–2 years as consumption is not equivalent to the quantity of plastics reaching end-of-life (waste arisings) and are thus available for recovery. This issue and how it is handled is discussed in more detail in Section 3.4 of this report.

The demand for some types of recovered plastics, used in the production of new products, has grown only slowly in strength both domestically and internationally over the last ten years. Reasonably well-developed plastics collection through the kerbside recycling system enables the recovery of many post-consumer household recyclables. There are also established systems for the collection and reprocessing of pre-consumer industrial scrap and many types of post-consumer industrial plastics.

However, away-from-home plastic packaging collection systems, and systems for the recovery of many types of non-packaging plastic items, both residential and non-residential, continue to be underdeveloped, and most of these products continue to be disposed to landfill at end of life.

## 1.1 Definition of ‘plastic’

For clarity, the definition of a ‘plastic’ that has been applied in the survey scope coverage and this report is:

*A plastic material is any of a wide range of synthetic or semi-synthetic organic solids that are mouldable. Plastics are typically organic polymers of high molecular mass, but they often contain other substances. They are usually synthetic, most commonly derived from petrochemicals, but many are either partially natural or fully natural (i.e. biobased).*

The polymer types covered in the study are summarised in the following table.



**Table 1 – Polymer types and PIC**

PIC	Polymer type	Main applications
1	Polyethylene terephthalate (PET)	Rigid packaging and clothing.
2	High density polyethylene (PE-HD)	Rigid and flexible packaging applications, and many other significant applications as well.
3	Poly-vinyl chloride (PVC)	Piping and conduit into the built environment.
4	Low / linear low density polyethylene (PE-LD/LLD)	Flexible packaging formats.
5	Polypropylene (PP)	Packaging, vehicles and many other significant applications as well.
6	Polystyrene (PS) and expanded polystyrene (PS-E)	Packaging, built environment, electrical & electronic devices.
7	Acrylonitrile butadiene styrene / styrene acrylonitrile / acrylonitrile styrene acrylate (ABS/SAN/ASA)	Vehicles and electrical & electronic devices.
7	Polyurethanes (PU)	Vehicles, the built environment and many other applications.
7	Nylons (polyamides)	Clothing, vehicles, the built environment and many other applications.
7	Bioplastics	Rigid and flexible packaging applications.
7	Other aggregated polymer types	-

Refer to Table 8 on page 22 for a quantitative breakdown on the main application areas for each polymer type.

The plastic resin types which make up most of the 'other aggregated' category are various acrylics, acetals, polyethylene oxide, polyisobutylene and other polymers of propylene (other than PP), and polymers of styrene (other than PS, P-ES and ABS/SAN).

## 1.2 Definitions of 'recycling', 'reprocessing' and 'recovery'

In the plastics industry, the term 'recycling' is used to cover a range of activities including collection, sorting, reprocessing, export for reprocessing and manufacture of new products. To avoid double-counting of material flowing through the system to local reprocessors, the focus of data gathering in this survey was placed on the reprocessing stage of the plastics life cycle.

The applied definition of Australian based reprocessing for the survey is the off-site sourcing of waste plastics (including returned product, e.g. EPS waffle pod off-cuts from building sites) which are then converted into either a finished or semi-finished product, or into a chipped format or similar. In-house recovery/regrind, or the baling and compaction of plastics where further reprocessing is required (e.g. size reduction) before the recyclate can be used to manufacture a new product is not reported as reprocessing.

Plastic scrap that is collected and exported for reprocessing and use overseas is defined as reprocessed. Sorting, reprocessing and manufacturing losses that occur overseas are not estimated.

The term 'recovery' is also used in this report and is defined as the amount of material collected for reprocessing (i.e. out-the-gate of reprocessors or to export). Typically, recovered material includes some contaminate materials and also materials intended for reprocessing, but which are lost during the overall recycling process.



### 1.3 Changes in scope inclusions and exclusions in 2018–19

This year all reprocessor reported data has been standardised to an ‘out-the-gate’ basis. This means that reprocessing losses (to landfill) associated with locally reprocessed scrap plastics are excluded from recovery estimates. This adjustment will have the impact of decreasing apparent total recovery by a small amount (estimated to be around 1–2% nationally).

Tyres and other rubber products continue to be excluded from the scope of the APRS.

Paints, adhesives and other coatings continue to be excluded from the scope of the APRS.

### 1.4 Data limitations and assumptions

This report provides data on plastics reprocessing from Australian sources for the 2018–19 financial year. Data for 71 reprocessing facilities nationally, out of 77 facilities known to be active during 2018–19, has been obtained either through surveys or estimated (15 facilities) and incorporated into the survey dataset.

This is a coverage rate of over 90% by number and is estimated to account for >95% of local reprocessing by weight. Considering individual reprocessor stated response accuracies, nationwide it is estimated that local reprocessing quantities provided in this report are within  $\pm 9\%$  of actual reprocessing.

Plastics consumption at the state/territory level are estimated based on per capita allocations, as there is no other good quality data available to break down consumption by jurisdiction. As such, estimates for consumption are approximations only, and do not account for any variations in intensity of industry across different jurisdictions, nor allow for any variable patterns of domestic consumption.

National Television and Computer Recycling Scheme (NTCRS) data incorporated into the study is for the 2017–18 financial year, as 2018–19 data was not available at the time of reporting. The 2017–18 data has been increased by 3% reflecting the 2018–19 target increase relative to 2017–18.

To avoid overstating the accuracy of the data and the subsequent calculations, data in this report has generally been rounded to the nearest 100 tonnes.

In the tables presented in this report, minor discrepancies may occur between totals presented at the bottom and right of tables, and the sums of the component items in tables. Totals are calculated using component item values prior to rounding, and therefore a minor discrepancy may occur from the stated total, and the apparent total that can be calculated from the rounded component item values.



## 2 SURVEY METHOD

### 2.1 Data sources

Plastics consumption and recycling data was obtained from a combination of sources, primarily:

- Australian resin producers (survey).
- Resin importers (survey).
- Australian import and export data (Australian Customs import/export *Harmonized Tariff Item Statistical Code* (HTISC) data extract).
- Australian plastics reproducers (survey).
- Australian plastics export brokers (survey).

Resin producers and importers, reproducers and exporters of used plastics were identified through: previous survey contacts, the project team's industry knowledge, state agency consultation and industry sources.

Import and export flows of plastics were primarily determined through the review and analysis of 2 200 Customs import codes and 1 300 export codes.

Domestic reprocessing figures are obtained from surveying individual Australian plastics reprocessing businesses, and export of recyclate is estimated from data provided by reproducers and exporters, and review and analysis of the relevant Customs export codes.

The recovered plastics data published throughout this report does include scrap plastics being burnt in cement kilns (both locally and overseas) for energy recovery. This type of recovery was restricted to NSW and South Australia. It has jumped significantly from the 2017–18 national total of around 10 000 tonnes, to 75 000 tonnes in 2018–19.

Population data was sourced from the Australian Bureau of Statistics for all states and territories and was used to estimate plastics consumption for each jurisdiction on a per capita basis.



**Table 2 – State/territory populations at 30 June 2019 (ABS, 2019; ABS, 2018)**

Jurisdiction	Population	% of national population
ACT	429 500	1.7%
NSW	8 138 800	32.0%
NT	252 000	1.0%
QLD	5 100 700	20.1%
SA	1 747 400	6.9%
TAS	531 700	2.1%
VIC	6 614 100	26.0%
NSW	2 625 300	10.3%
<b>Total</b>	<b>25 439 500</b>	<b>100.0%</b>

## 2.2 Determination of plastics consumption

Plastics consumption is determined using the approach outlined in Table 3.

**Table 3 – Determination of plastics consumption and related information sources**

±	Consumption flow	Primary information sources
+	Local resin production	Local resin manufacturers
+	Imported resin	Customs import data
+	Imported plastics in finished and semi-finished goods	Customs import data
+	Plastic recyclate back into local use	Local reprocessors
+	Scrap import	Customs import data
-	Export of locally produced resin	Customs export data / Local resin manufacturers
-	Exported plastics in finished and semi-finished goods	Customs export data
=	<b>Domestic consumption</b>	



## 2.3 Determination of plastics recycling

Plastics recycling is determined using the approach outlined in Table 4.

**Table 4 – Determination of plastics recycling and related information sources**

±	Recycling flow	Primary information sources
+	Recyclate to local reprocessors (to local use)	Local reprocessors
+	Recyclate to local reprocessors (to export)	Local reprocessors
+	Recyclate (unprocessed scrap) to overseas reprocessors	Customs export data
=	Total recovery	

## 2.4 Reporting categories

### 2.4.1 Polymer types

The polymer types covered by this study, and the identifying Plastics Identification Code (PIC) have been previously outlined on page 10 of this report.

### 2.4.2 Application areas

The application area destinations (for consumption) and sources (for recycling) used in this report are:

- Agriculture
- Automotive
- Built environment
- Electrical & electronic
- Packaging – consumer
- Packaging – C&I (or 'business to business')
- Other application area
- Energy recovery
- Unidentified applications

'Energy recovery' is a new application area in 2018–19. It has been adopted due to the significant growth in scrap plastics into energy production in 2018–19.

The major applications within each application area are summarised in Table 5.



**Table 5 – Major product types in each application area**

Application area	Product types
Agriculture	Flexible film
	Twine and rope
	Irrigation pipe
	Other agricultural applications
Automotive	Vehicle body
	Tyres
	Other automotive
Built environment	Pipes and cables
	Windows and doors
	Insulation
	Fit-out
	Carpet and other floor coverings
	Other built environment
Electrical & electronic	TVs and computers
	Power tools
	Toys
	White goods and small appliances
	Other electrical and electronic
Packaging – consumer	Flexible packaging
	Rigid packaging
	Other packaging
Packaging – C&I	Flexible packaging
	Rigid packaging
	Other packaging
Other application area	Household products
	Furniture
	Clothing and footwear
	Rope, cable, twine and thread
	Textiles
	All other applications
Energy recovery	Energy production
Unidentified applications	Unidentified applications



### 2.4.3 Waste streams

In this report, the following waste stream sources of recyclate are applied: municipal, C&I and C&D.

## 2.5 Plastic retail carry bag consumption

Refer to Section 3.5 of this report for the scope and method used to determine plastic retail carry bag consumption estimates.



## 3 AUSTRALIAN CONSUMPTION AND RECOVERY OF PLASTICS

### 3.1 Annual consumption and recovery of plastics

Data for total annual plastics consumption (2014–15 to 2018–19) and total annual plastics recovery (2000 to 2018–19) are presented in Table 6.

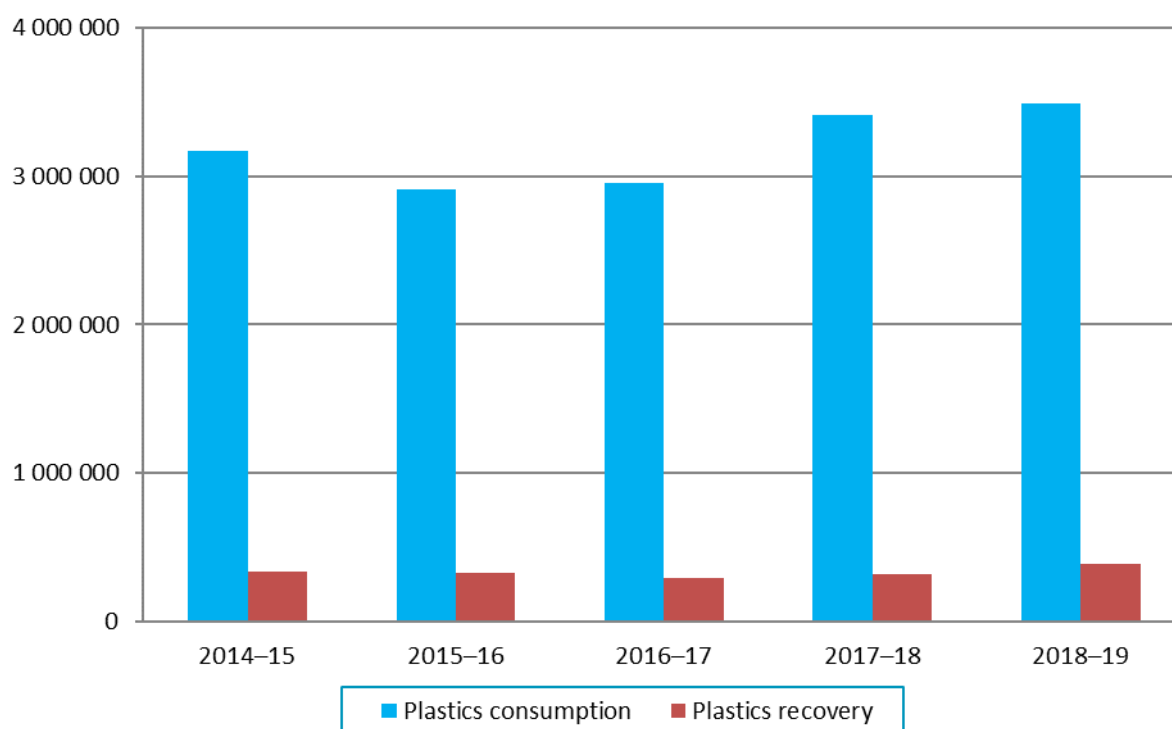
The total consumption of plastics in Australia in 2018–19 was estimated at 3 435 200 tonnes with recovery of 393 800 tonnes, giving a recovery rate in 2018–19 of 11.5%.

**Table 6 – Annual Australian plastics consumption and recovery 2000 to 2018–19**

Year	Plastics consumption	Plastics recovery	Plastics recovery rate
	(tonnes)	(tonnes)	(%)
2000	N/A	167 700	N/A
2001	N/A	160 900	N/A
2002	N/A	157 300	N/A
2003	N/A	189 400	N/A
2004	N/A	191 000	N/A
2005	N/A	232 000	N/A
2006	N/A	244 000	N/A
2007	N/A	261 100	N/A
2008	N/A	282 000	N/A
2009–10	N/A	288 200	N/A
2010–11	N/A	287 400	N/A
2011–12	N/A	302 600	N/A
2012–13	N/A	307 300	N/A
2013–14	N/A	313 700	N/A
2014–15	3 167 000	341 800	10.8%
2015–16	2 912 000	328 900	11.3%
2016–17	2 955 400	291 000	9.8%
2017–18	3 407 300	320 000	9.4%
2018–19	3 435 200	393 800	11.5%

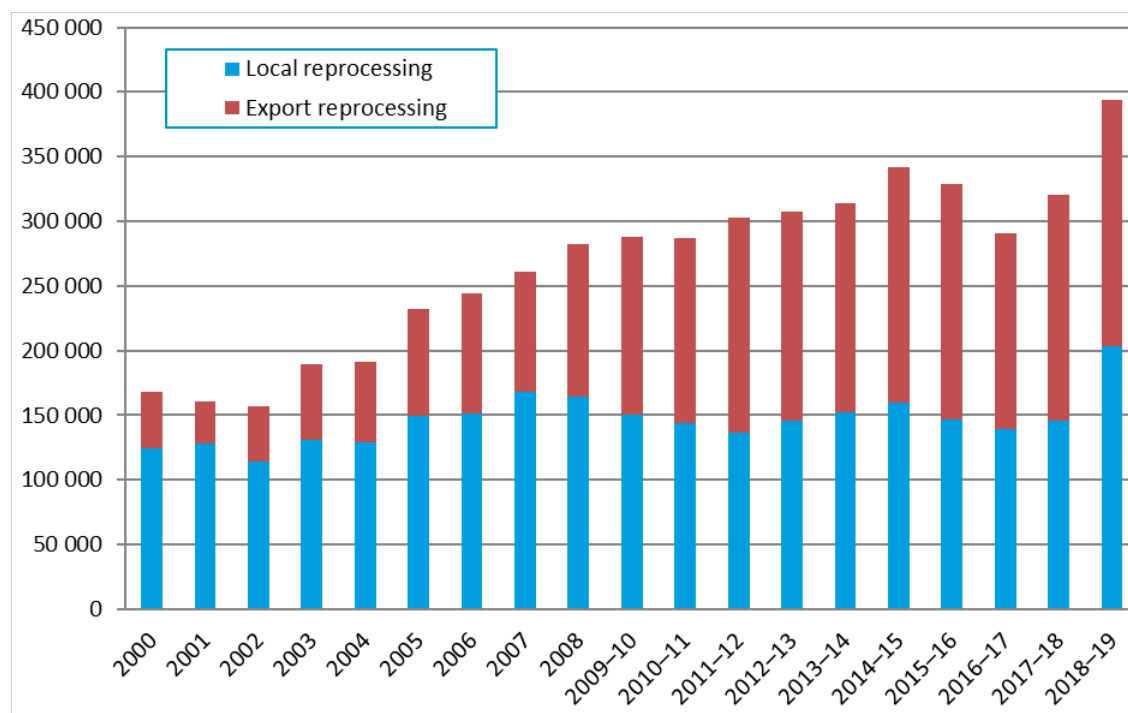


**Figure 1 – Annual Australian plastics consumption and recovery 2014–15 to 2018–19 (tonnes)**



Presented in Figure 2 is the quantity of plastics recovered in Australia across the period from 2000 to 2018–19.

**Figure 2 – Annual Australian plastics recovery 2000 to 2018–19**

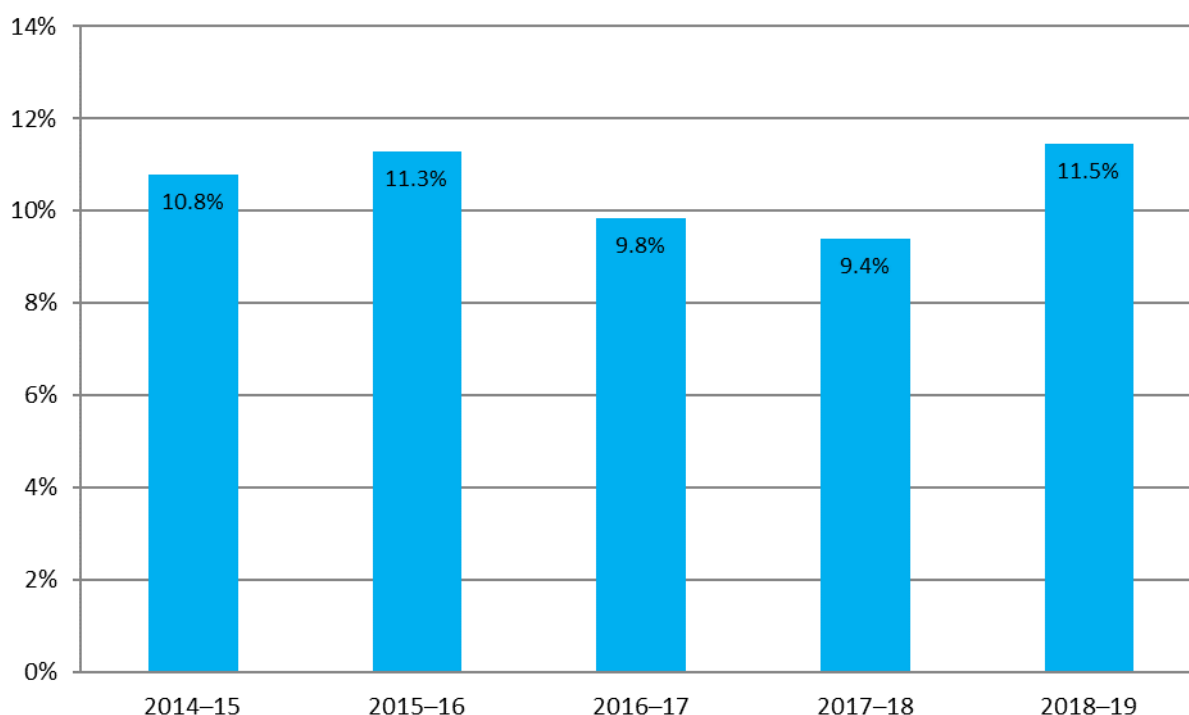




The level of export for reprocessing for 2018–19 was 48.4% and is down markedly from 2017–18 (54.5%). This is due to a relatively large increase in local plastics reprocessing, and the increase in scrap plastics to local energy recovery. For comparative purposes, in 2000 the level of export for reprocessing was 26.0%.

Presented in Figure 3 are the annual plastics recovery rates across the period from 2014–15 to 2018–19.

**Figure 3 – Annual Australian plastics recovery rates 2014–15 to 2018–19**



It is important to note that the ‘recovery rate’ is an approximation calculated by dividing plastics recovery in any given year, by consumption in that year. A true recovery rate (or diversion rate) is calculated by dividing recovery by end-of-life arisings (i.e. the quantity of plastics that is available to be diverted to recovery from landfill). The approximation of dividing recovery by consumption is adequate for short lived plastic applications, such as packaging, however it is less appropriate for plastics going into longer lived applications, such as the built environment as it would be generally anticipated that less plastic is reaching end-of-life, than is going into use.

For this reason, the estimated recovery rates are probably conservative and the true recovery rate is likely to be somewhat higher. More detailed analysis and discussion on the recovery rate approximation approach and implications are provided in Section 3.4 of this report.



## 3.2 Plastics consumption in 2018–19

Australian plastics consumption data for 2018–19 is summarised in Table 7 and Figure 4.

**Table 7 – Australian plastics consumption by polymer type and source in 2018–19 (tonnes)**

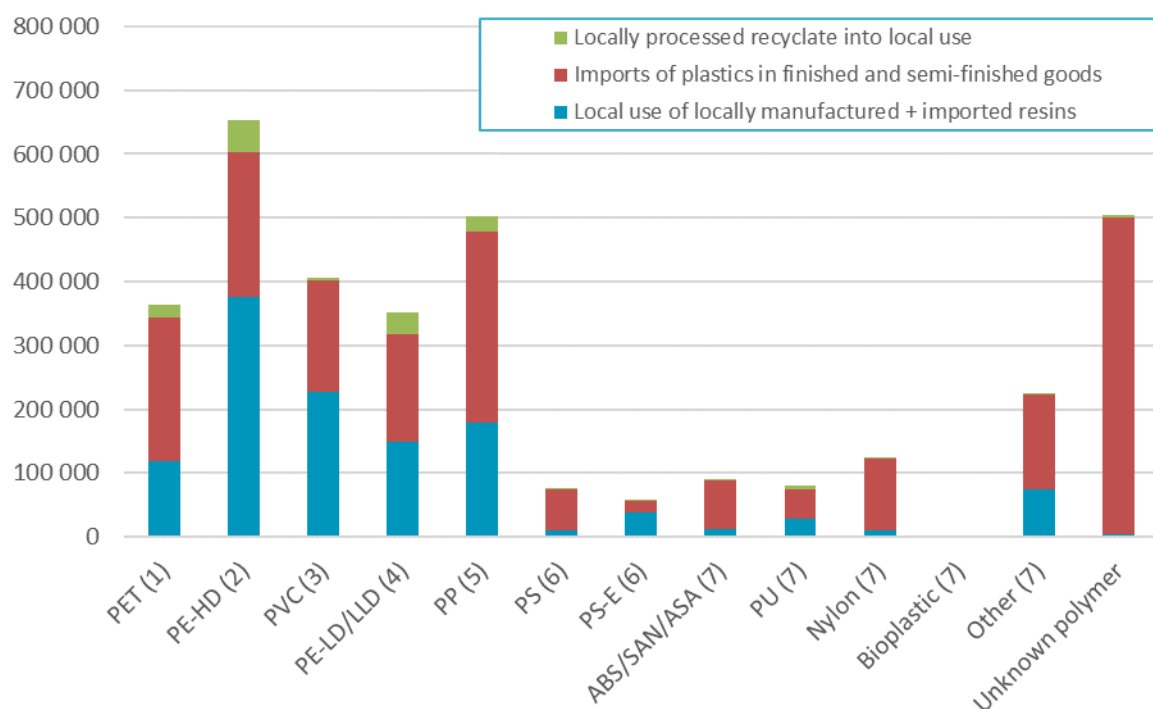
Polymer type	Local use of locally manufactured + imported resins	Imports of plastics in finished and semi-finished goods	Locally processed recycle into local use <sup>1</sup>	Australian consumption
PET (1)	118 400	224 800	20 000	<b>363 200</b>
PE-HD (2)	375 100	227 700	51 000	<b>653 800</b>
PVC (3)	228 100	172 900	5 600	<b>406 600</b>
PE-LD/LLD (4)	148 300	170 200	33 400	<b>351 900</b>
PP (5)	178 100	299 400	24 400	<b>501 900</b>
PS (6)	9 200	65 900	2 000	<b>77 100</b>
PS-E (6)	38 700	17 700	1 500	<b>57 900</b>
ABS/SAN/ASA (7)	12 600	76 800	800	<b>90 200</b>
PU (7)	27 600	46 700	6 900	<b>81 200</b>
Nylon (7)	9 600	112 100	100	<b>121 700</b>
Bioplastic (7)	1 300	0	0	<b>1 300</b>
Other (7)	74 400	148 200	700	<b>223 300</b>
Unknown polymer	3 200	496 900	5 000	<b>505 100</b>
<b>Total</b>	<b>1 224 800</b>	<b>2 059 100</b>	<b>151 300</b>	<b>3 435 200</b>

1. Includes 30 000 tonnes of scrap plastics into local energy recovery.

In 2018–19, around 60% of plastics consumption was through imported finished and semi-finished goods, with only 40% of consumption through local manufacturing using either virgin resins (both locally manufactured and imported) or recycle based resins. The last decade has seen the local manufacturers of PET, PVC, PS and EPS resins cease production, and at the current time the only major resin types still produced in Australia are HDPE, LDPE and PP.



**Figure 4 – Australian plastics consumption by polymer type and source in 2018–19 (tonnes)**



Presented in Table 8, Table 9 and Figure 5 is the consumption of plastics nationally in 2018–19, by application area. Consumption estimates of under 100 tonnes are reported as “<100”.



**Table 8 – Application area destinations of all plastics by polymer type in 2018–19 (tonnes)**

Polymer type	Agriculture	Automotive	Built environment	Electrical & electronic	Packaging – consumer	Packaging – C&I	Other applic. area	Energy recovery	Unidentified applications	Total
PET (1)	3 700	4 800	24 200	<100	152 200	4 600	137 500	<100	36 200	<b>363 200</b>
PE-HD (2)	13 600	5 500	169 900	16 800	239 000	81 800	81 900	14 400	30 900	<b>653 800</b>
PVC (3)	100	17 800	264 700	44 800	15 300	200	40 700	700	22 200	<b>406 600</b>
PE-LD/LLD (4)	54 500	<100	16 900	4 400	168 200	66 900	22 300	8 100	11 700	<b>351 900</b>
PP (5)	6 800	70 500	26 900	41 900	166 000	18 200	120 000	1 200	50 300	<b>501 900</b>
PS (6)	100	<100	7 400	54 400	9 100	200	5 800	<100	<100	<b>77 100</b>
PS-E (6)	<100	<100	26 300	12 400	5 100	11 600	2 400	<100	<100	<b>57 900</b>
ABS/SAN/ASA (7)	<100	32 700	1 500	42 900	2 500	<100	10 400	<100	<100	<b>90 200</b>
PU (7)	<100	21 600	18 800	2 800	<100	<100	37 500	400	200	<b>81 200</b>
Nylon (7)	2 500	14 400	17 000	<100	<100	<100	76 600	<100	11 100	<b>121 700</b>
Bioplastic (7)	200	<100	<100	<100	1 100	<100	<100	<100	<100	<b>1 300</b>
Other (7)	500	21 700	40 500	7 400	9 000	200	44 600	<100	99 400	<b>223 300</b>
Unknown polymer	700	8 700	21 100	52 600	78 400	<100	226 300	5 000	112 300	<b>505 100</b>
<b>Total</b>	<b>82 700</b>	<b>197 700</b>	<b>635 200</b>	<b>280 400</b>	<b>845 900</b>	<b>183 700</b>	<b>806 000</b>	<b>29 800</b>	<b>374 300</b>	<b>3 435 200</b>



**Table 9 – Application area destinations of all plastics by polymer type in 2018–19 (%)**

Polymer type	Agriculture	Automotive	Built environment	Electrical & electronic	Packaging – consumer	Packaging – C&I	Other applic. area	Energy recovery	Unidentified applications	Total
PET (1)	1.0%	1.3%	6.7%	0.0%	41.9%	1.3%	37.9%	0.0%	10.0%	<b>100.0%</b>
PE-HD (2)	2.1%	0.8%	26.0%	2.6%	36.6%	12.5%	12.5%	2.2%	4.7%	<b>100.0%</b>
PVC (3)	0.0%	4.4%	65.1%	11.0%	3.8%	0.1%	10.0%	0.2%	5.5%	<b>100.0%</b>
PE-LD/LLD (4)	15.5%	0.0%	4.8%	1.2%	47.8%	19.0%	6.3%	2.3%	3.3%	<b>100.0%</b>
PP (5)	1.3%	14.0%	5.4%	8.3%	33.1%	3.6%	23.9%	0.2%	10.0%	<b>100.0%</b>
PS (6)	0.2%	0.0%	9.6%	70.6%	11.8%	0.2%	7.5%	0.0%	0.1%	<b>100.0%</b>
PS-E (6)	0.0%	0.0%	45.5%	21.4%	8.8%	20.1%	4.1%	0.0%	0.1%	<b>100.0%</b>
ABS/SAN/ASA (7)	0.0%	36.3%	1.7%	47.6%	2.8%	0.1%	11.6%	0.0%	0.0%	<b>100.0%</b>
PU (7)	0.0%	26.6%	23.1%	3.4%	0.0%	0.0%	46.2%	0.5%	0.2%	<b>100.0%</b>
Nylon (7)	2.1%	11.8%	14.0%	0.0%	0.1%	0.0%	62.9%	0.0%	9.1%	<b>100.0%</b>
Bioplastic (7)	15.4%	0.0%	0.0%	0.0%	84.6%	0.0%	0.0%	0.0%	0.0%	<b>100.0%</b>
Other (7)	0.2%	9.7%	18.1%	3.3%	4.0%	0.1%	20.0%	0.0%	44.5%	<b>100.0%</b>
Unknown polymer	0.1%	1.7%	4.2%	10.4%	15.5%	0.0%	44.8%	1.0%	22.2%	<b>100.0%</b>
<b>Total</b>	<b>2.4%</b>	<b>5.7%</b>	<b>18.5%</b>	<b>8.2%</b>	<b>24.6%</b>	<b>5.3%</b>	<b>23.5%</b>	<b>0.9%</b>	<b>10.9%</b>	<b>100.0%</b>



**Figure 5 – Application area destinations of all plastics by polymer type in 2018–19 (tonnes)**

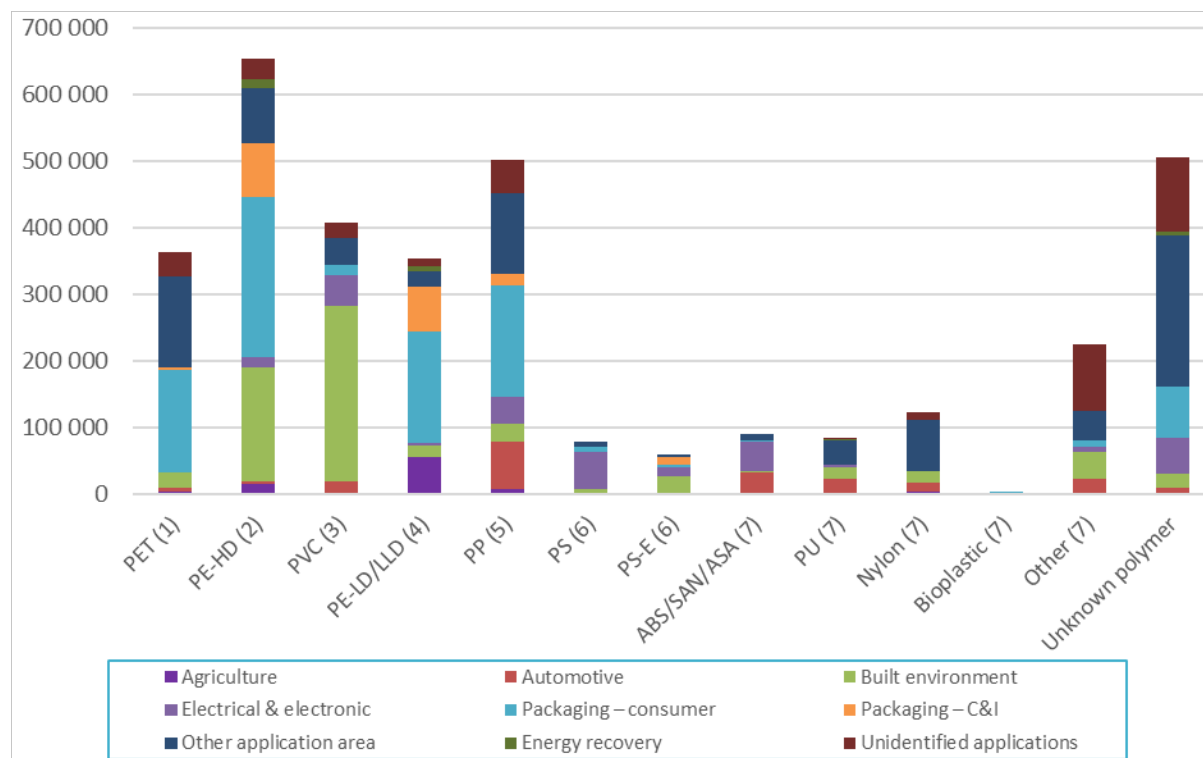


Table 9 shows that the consumption of:

- PET is predominately split between packaging and other applications (mainly clothing and other textiles).
- HDPE and LDPE are predominately consumed in packaging applications, but with a quarter of HDPE also going into the built environment.
- PVC consumption dominated by built environment applications.
- PP consumption is dominated by automotive (imports), packaging and other application areas.
- A large proportion of PS goes into electrical and electronic applications.
- Nearly half of EPS goes into the built environment, with most of the rest going into packaging and electrical & electronic applications.



### 3.3 Plastics recovery in 2018–19

#### 3.3.1 Recovery quantities

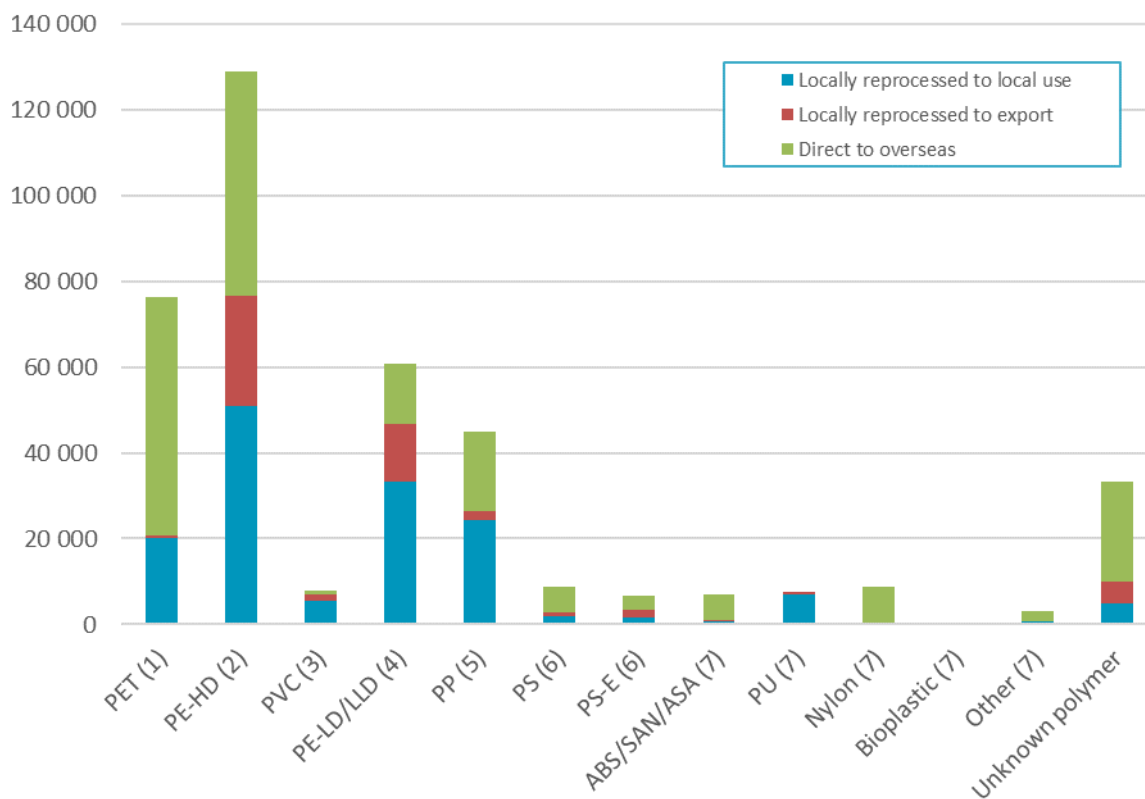
Presented in Table 10 and Figure 6 is overall plastics recovery, in terms of the destination of recovered recyclate for reprocessing (i.e. local reprocessing or export for reprocessing).

**Table 10 – Australian plastics reprocessing destination by polymer type in 2018–19 (tonnes)**

Polymer type	Locally reprocessed to local use	Locally reprocessed to export	Direct to overseas	Total recovery
PET (1)	20 000	600	55 800	<b>76 400</b>
PE-HD (2)	51 000	25 500	52 400	<b>128 900</b>
PVC (3)	5 600	1 500	900	<b>8 000</b>
PE-LD/LLD (4)	33 400	13 400	14 000	<b>60 800</b>
PP (5)	24 400	1 900	18 500	<b>44 800</b>
PS (6)	2 000	900	6 000	<b>8 900</b>
PS-E (6)	1 500	1 900	3 200	<b>6 600</b>
ABS/SAN/ASA (7)	800	200	5 900	<b>7 000</b>
PU (7)	6 900	600	0	<b>7 400</b>
Nylon (7)	100	200	8 400	<b>8 600</b>
Bioplastic (7)	0	0	0	<b>0</b>
Other (7)	700	0	2 400	<b>3 100</b>
Unknown polymer	5 000	5 000	23 200	<b>33 200</b>
<b>Total</b>	<b>151 300</b>	<b>51 800</b>	<b>190 700</b>	<b>393 800</b>



**Figure 6 – Australian plastics reprocessing destination by polymer type in 2018–19 (tonnes)**



### Application area sources of recyclate

Presented in Table 11 and Figure 7 are national sources of recyclate in 2018–19 by polymer type and application area.

Plastics recovery from packaging applications dominates overall recovery, with packaging from consumer and C&I sources making up 58% and 13% of total recovery in terms of weight. Recovery from all other application areas contribute around 29% of the total, with major recovery routes being C&D material recovery (into energy recovery), e-waste recycling and the export of used clothing.

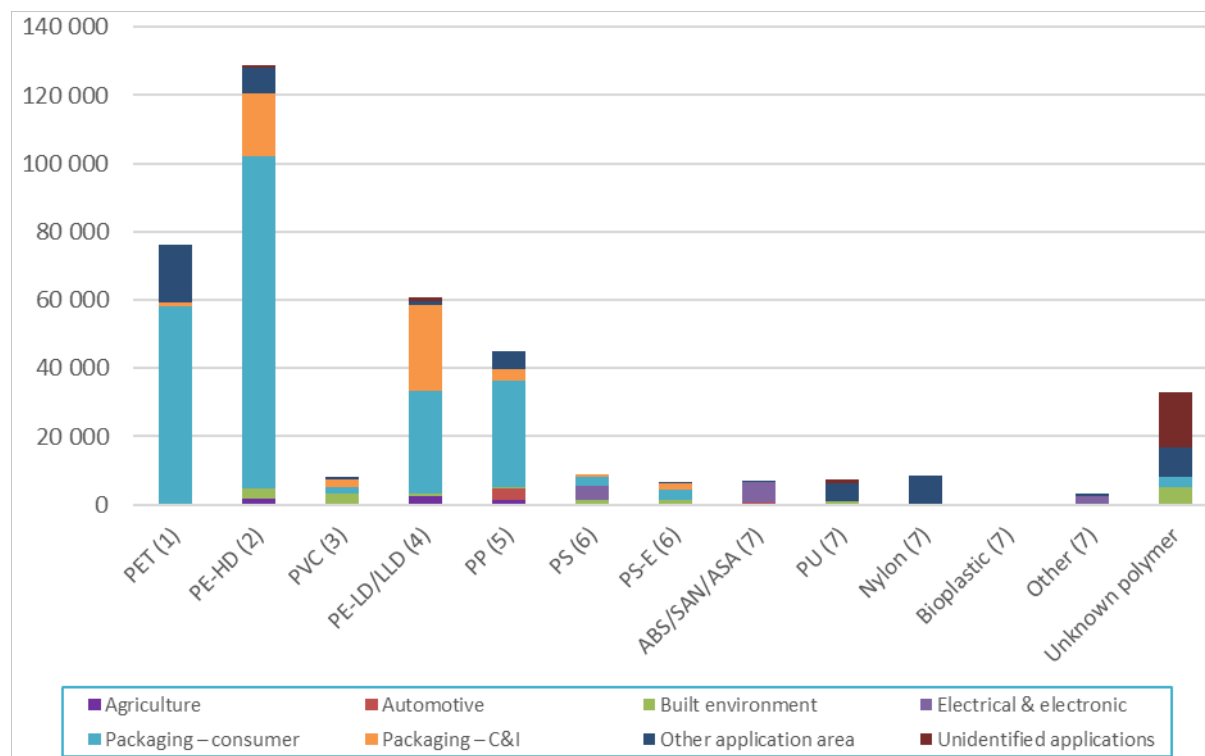


**Table 11 – Application area sources of recyclate by polymer type in 2018–19 (tonnes)**

Polymer type	Agriculture	Automotive	Built environment	Electrical & electronic	Packaging – consumer	Packaging – C&I	Other applic. area	Energy recovery	Unidentified applications	Total
PET (1)	0	0	0	100	58 200	1 000	17 000	0	0	<b>76 400</b>
PE-HD (2)	1 700	0	2 900	0	97 700	18 200	7 500	0	1 000	<b>128 900</b>
PVC (3)	0	0	3 300	0	1 700	2 200	800	0	0	<b>8 000</b>
PE-LD/LLD (4)	2 600	0	500	0	30 300	25 100	1 200	0	1 100	<b>60 800</b>
PP (5)	1 500	3 200	500	0	31 000	3 500	5 100	0	0	<b>44 800</b>
PS (6)	100	0	1 400	4 000	2 800	600	0	0	0	<b>8 900</b>
PS-E (6)	0	0	1 200	0	3 300	1 900	200	0	0	<b>6 600</b>
ABS/SAN/ASA (7)	0	600	0	6 000	100	0	300	0	0	<b>7 000</b>
PU (7)	0	0	800	0	0	0	5 600	0	900	<b>7 400</b>
Nylon (7)	0	0	0	0	0	0	8 600	0	0	<b>8 600</b>
Bioplastic (7)	0	0	0	0	0	0	0	0	0	<b>0</b>
Other (7)	0	0	0	2 400	200	0	500	0	0	<b>3 100</b>
Unknown polymer	0	0	5 000	0	3 300	0	8 500	0	16 300	<b>33 200</b>
<b>Total</b>	<b>5 900</b>	<b>3 800</b>	<b>15 600</b>	<b>12 600</b>	<b>228 600</b>	<b>52 600</b>	<b>55 400</b>	<b>0</b>	<b>19 300</b>	<b>393 800</b>



**Figure 7 – Application area sources of recyclate by polymer type in 2018–19 (tonnes)**



### Application area destinations of recyclate

Presented in Table 12 and Figure 8 are the destinations of locally reprocessed recyclate in 2018–19 by polymer type and application area. This data is obtained through the survey of local reprocessors and includes processed scrap plastics that local reprocessors sell into both local and export markets.

The data reported here excludes unprocessed scrap plastics sent directly to export as sufficiently detailed information on the destination applications is not available either through the DFAT/Customs reported data or through export brokers.

The quantity of scrap plastics to local reprocessors in 2018–19 (including product subsequently sold to export markets of 51 800 tonnes) was 203 100 tonnes, and the direct to export quantity was 190 700 tonnes.

Scrap plastics into energy recovery has gone from a little under 7% of local reprocessing in 2017–18, a level at which it was fairly steady over the last 4–5 years, to 35% in 2018–19. This large jump was due to new capacity coming on-line in NSW.

The manufacture of recycled content containing packaging (across both consumer and C&I packaging formats) accounted for 55 200 tonnes or 27% of processed scrap plastics. The manufacture of products for the built environment consumed another 19% of processed scrap plastics.

Refer to Section 5.5 for more detail on the major and minor uses of recycled plastics in Australia, by polymer type.

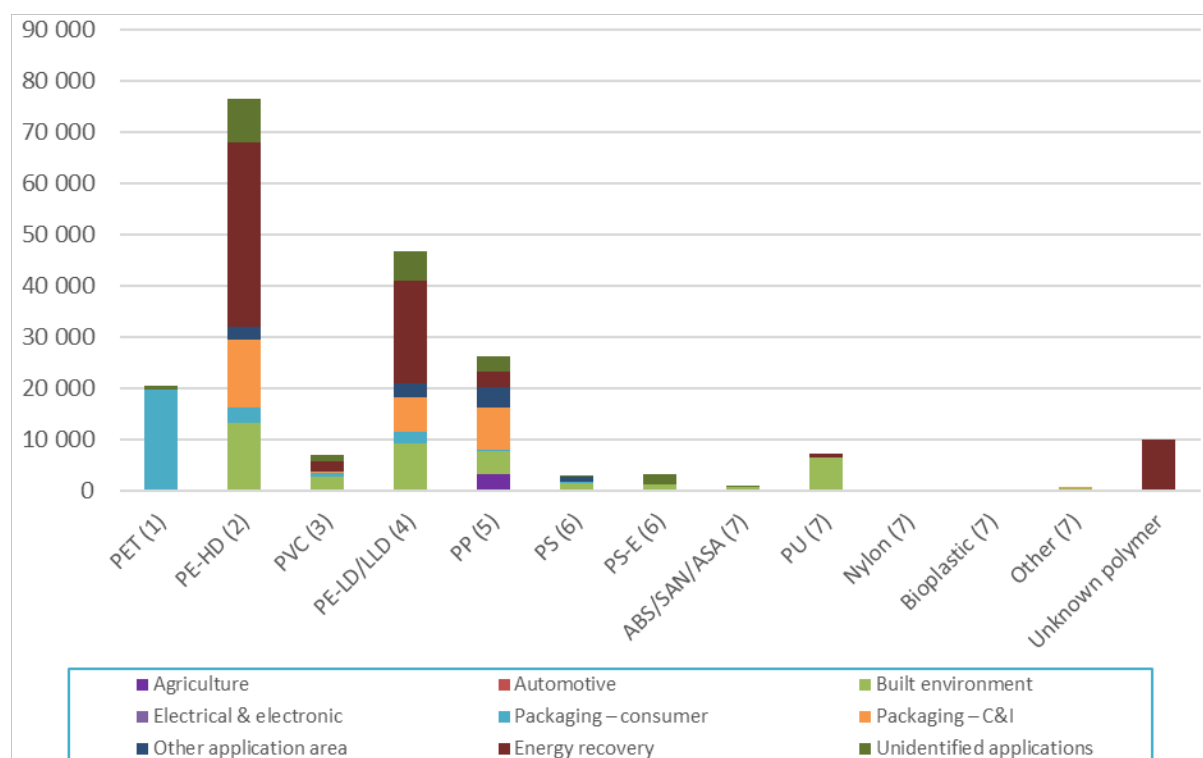


**Table 12 – Application area destinations of recyclate from local reprocessors, by polymer type, in 2018–19 (tonnes)**

Polymer type	Agriculture	Automotive	Built environment	Electrical & electronic	Packaging – consumer	Packaging – C&I	Other applic. area	Energy recovery	Unidentified applications	Total
PET (1)	0	0	0	0	19 700	0	0	0	800	20 600
PE-HD (2)	200	0	13 000	0	3 100	13 200	2 600	35 900	8 600	76 500
PVC (3)	0	0	2 700	0	800	200	100	1 900	1 400	7 100
PE-LD/LLD (4)	100	0	9 100	0	2 400	6 600	2 800	20 100	5 600	46 800
PP (5)	3 200	0	4 500	0	300	8 300	4 000	3 100	2 900	26 400
PS (6)	100	0	1 500	0	100	200	900	0	100	2 900
PS-E (6)	0	0	1 200	0	0	0	200	0	2 000	3 400
ABS/SAN/ASA (7)	0	400	300	0	0	100	100	0	200	1 000
PU (7)	0	0	6 500	0	0	0	0	900	0	7 400
Nylon (7)	0	0	0	0	0	0	100	0	100	200
Bioplastic (7)	0	0	0	0	0	0	0	0	0	0
Other (7)	0	0	500	0	0	200	0	0	0	700
Unknown polymer	0	0	0	0	0	0	0	10 000	0	10 000
<b>Total</b>	<b>3 600</b>	<b>400</b>	<b>39 300</b>	<b>0</b>	<b>26 500</b>	<b>28 700</b>	<b>10 900</b>	<b>72 000</b>	<b>21 800</b>	<b>203 100</b>



**Figure 8 – Application area destinations of recyclate from local reprocessors, by polymer type, in 2018–19 (tonnes)**



### 3.3.2 Recovery rates by polymer type

Presented in Table 13 and Figure 9 are plastics recovery rates by polymer type during 2018–19. The overall national recovery rate was 11.5%, a notable jump on the 2017–18 rate of 9.4%, which was almost entirely due to the large increase in scrap plastics to an energy recovery fate.

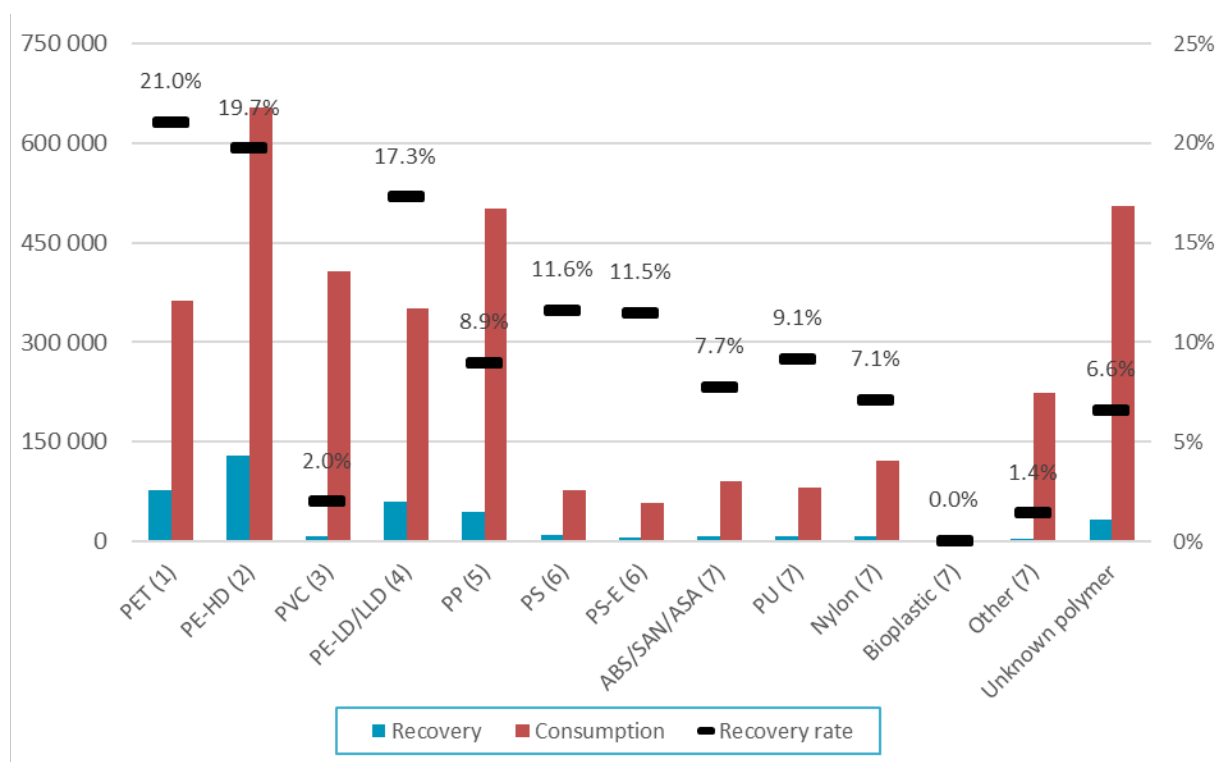
The highest recovery rate observed in 2018–19 was for PET at 21.0% (primarily sourced from packaging), followed by HDPE (also primarily from packaging) at 19.7%. The recovery of these polymers is underpinned by the Australian Packaging Covenant, which is the national product stewardship scheme for packaging. It is important to note that these recovery rates include both pre-consumer packaging manufacturing scrap recovery and post-consumer packaging recovery, and are an overall recovery rate, not a post-consumer recovery rate only.



**Table 13 – Plastics consumption and recovery by polymer type in 2018–19 (tonnes and % recovery rate)**

Polymer type	Recovery	Consumption	Recovery rate
PET (1)	76 400	363 200	21.0%
PE-HD (2)	128 900	653 800	19.7%
PVC (3)	8 000	406 600	2.0%
PE-LD/LLD (4)	60 800	351 900	17.3%
PP (5)	44 800	501 900	8.9%
PS (6)	8 900	77 100	11.6%
PS-E (6)	6 600	57 900	11.5%
ABS/SAN/ASA (7)	7 000	90 200	7.7%
PU (7)	7 400	81 200	9.1%
Nylon (7)	8 600	121 700	7.1%
Bioplastic (7)	0	1 300	0.0%
Other (7)	3 100	223 300	1.4%
Unknown polymer	33 200	505 100	6.6%
<b>Total</b>	<b>393 800</b>	<b>3 435 200</b>	<b>11.5%</b>

**Figure 9 – Plastics consumption and recovery by polymer type in 2018–19 (tonnes and % recovery rate)**





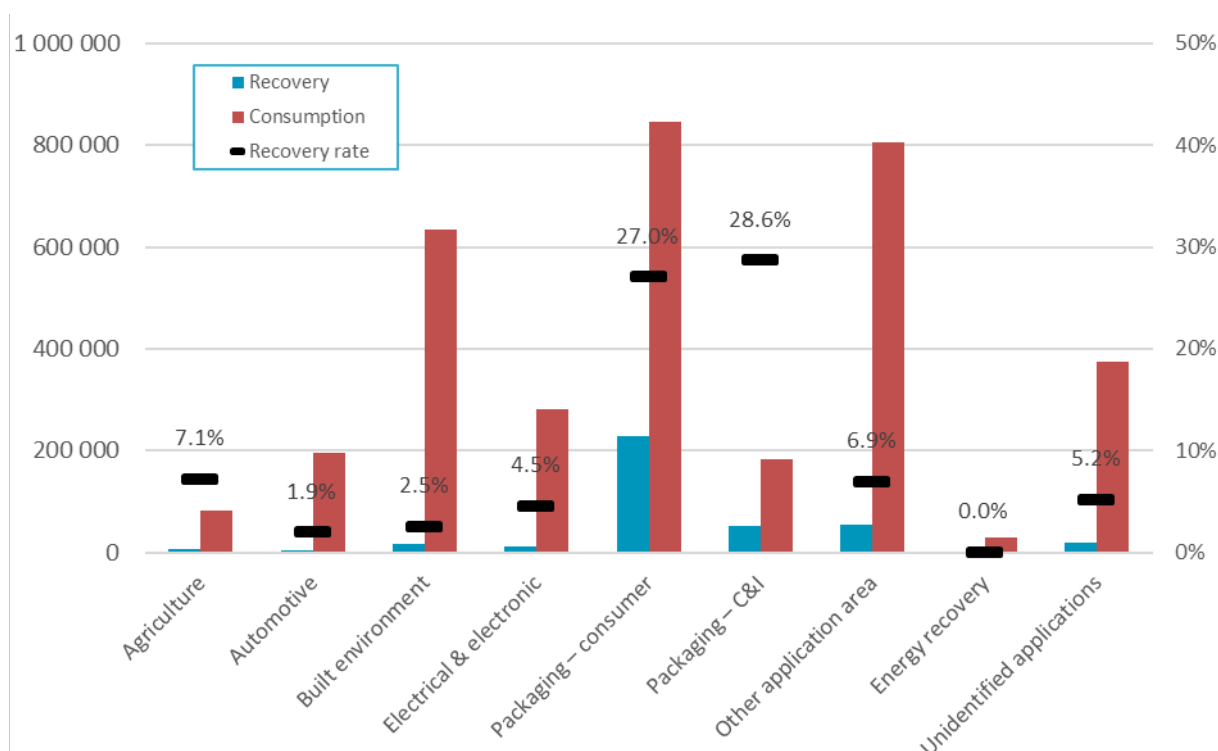
### 3.3.3 Recovery rates by application area

Presented in Table 14 and Figure 10 is summary data of plastics consumption and recovery in terms of the application areas for plastics.

**Table 14 – Plastics consumption and recovery by application area in 2018–19 (tonnes and % recovery rate)**

Application area	Recovery	Consumption	Recovery rate
Agriculture	5 900	82 800	7.1%
Automotive	3 800	196 800	1.9%
Built environment	15 600	635 300	2.5%
Electrical & electronic	12 600	280 500	4.5%
Packaging – municipal	228 600	846 000	27.0%
Packaging – C&I	52 600	183 800	28.6%
Other application area	55 400	805 900	6.9%
Unidentified applications	0	29 800	0.0%
<b>Total</b>	<b>393 800</b>	<b>3 435 200</b>	<b>11.5%</b>

**Figure 10 – Plastics consumption and recovery by application area in 2018–19 (tonnes and % recovery rate)**



The quantity of plastic packaging recovery and the recovery rate of 27.3% (combined consumer and C&I) are relatively good compared to all other application areas for plastics. As stated earlier it is important to note that these recovery rates include both pre-consumer packaging manufacturing scrap recovery and post-consumer packaging recovery, and are an overall recovery rate, not a post-consumer recovery rate only.



At 7.1% and 6.9% the recovery rates for plastics recovered agricultural and 'other' applications respectively are the next highest. Clothing recovery makes a significant contribution to the 'other' application area recovery rate.

The recovery rates across all application areas continue to be poor to very poor.

### 3.3.4 Recovery by waste stream

When assessed from a waste/disposal stream perspective, discarded materials are often divided into three waste streams, which are:

- Municipal sector – this sector is dominated by kerbside collections.
- C&I sector – this sector includes both manufacturing scrap and post-consumer industrial recovery (e.g. LDPE pallet film).
- C&D sector.

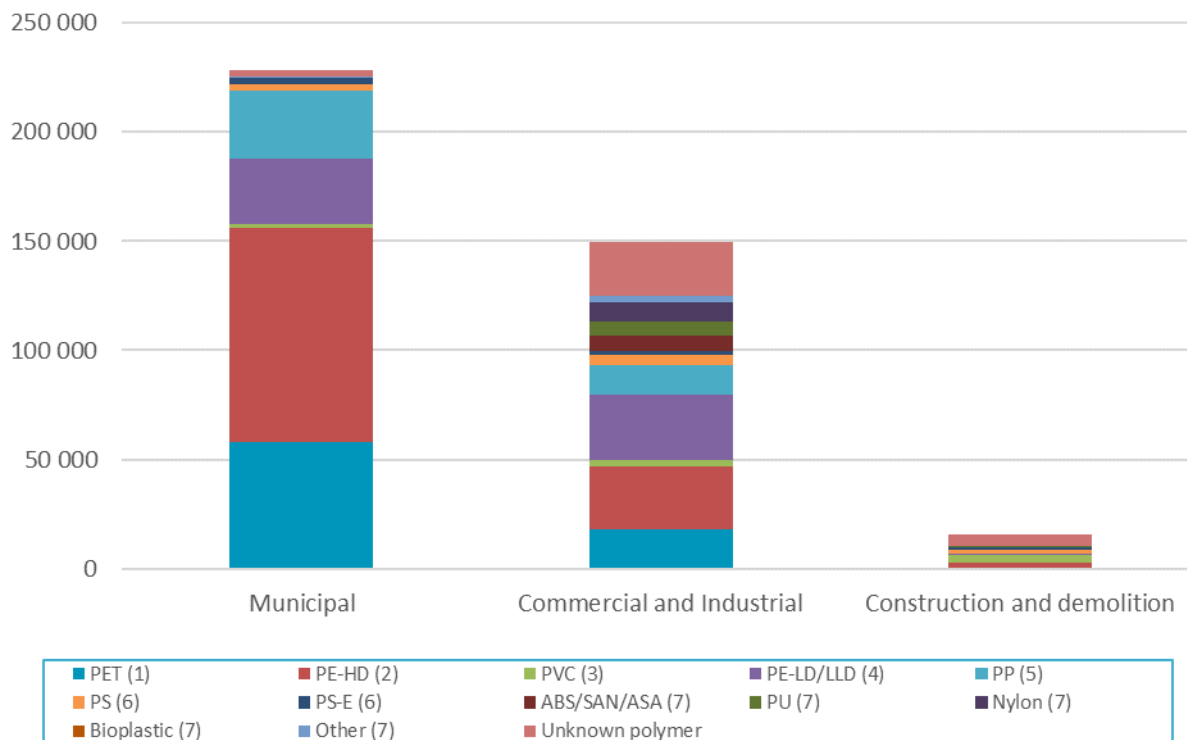
Presented in Table 15 and Figure 11 is plastics recovery by waste stream during 2018–19. In aggregate, 58% of plastics were recovered from the municipal sector, 38% from the C&I sector, and 4% from the C&D sector.

**Table 15 – Waste stream sources of recycle by polymer type in 2018–19 (tonnes)**

Application area	Municipal	Commercial and Industrial	Construction and demolition	Total
PET (1)	58 200	18 200	0	76 400
PE-HD (2)	97 700	28 400	2 900	128 900
PVC (3)	1 700	3 000	3 300	8 000
PE-LD/LLD (4)	30 300	30 000	500	60 800
PP (5)	31 000	13 300	500	44 800
PS (6)	2 800	4 800	1 400	8 900
PS-E (6)	3 300	2 100	1 200	6 600
ABS/SAN/ASA (7)	100	6 900	0	7 000
PU (7)	0	6 600	800	7 400
Nylon (7)	0	8 600	0	8 600
Bioplastic (7)	0	0	0	0
Other (7)	200	2 900	0	3 100
Unknown polymer	3 300	24 800	5 000	33 200
<b>Totals</b>	<b>228 600</b>	<b>149 600</b>	<b>15 600</b>	<b>393 800</b>



**Figure 11 – Waste stream sources of recyclate by polymer type in 2018–19 (tonnes)**





### 3.4 Impact of using consumption as a proxy for end-of-life arisings

In the calculations undertaken for this report the 'recovery rate' is an approximation calculated by dividing plastics recovery in any given year, by consumption in that year. A true recovery rate (or diversion rate) is calculated by dividing recovery by end-of-life arisings (i.e. the quantity of plastics that is available to be diverted to recycling from landfill). The approximation of dividing recovery by consumption is adequate for short-lived plastic applications, such as packaging. However, it is less appropriate for plastics going into longer lived applications, such as the built environment, as it would be generally anticipated that in any given year less plastic is reaching end-of-life, than is going into use. For this reason, the estimated recovery rates are probably conservative and the true recovery rate is likely to be somewhat higher.

Presented in Table 16 and Figure 10 are the application area recovery rates by polymer type in 2018–19 with the impact of using consumption as a proxy for end-of-life arisings highlighted.

The recovery rates for plastics coming out of agricultural and packaging applications are likely to be fairly accurate, and the recovery rate for plastics coming out of automotive and electrical & electronic applications useful indicators of the actual recovery rates. The recovery rates for plastics coming out of built environment applications are not accurate and in particular may be understating the true recovery rates. This is due to both the increase in use of these products, the generally increasing proportion of plastics in these products over time, and the potentially long lag time before they enter the waste stream.

In future years it is planned that a material flow analysis approach will be incorporated into the modelling to provide more accurate estimates of annual end-of-life arisings, and thus more accurate estimates of recovery rates as well. However, this update was not possible within the scope of the 2018–19 project.



**Table 16 – Application area recovery rates by polymer type in 2018–19 (%)**

Polymer type	Agriculture	Automotive	Built environment	Electrical & electronic	Packaging – municipal	Packaging – C&I	Other applic. area	Energy recovery	Unidentified applications	Polymer recovery rate
PET (1)	0.0%	0.0%	0.0%	NR	38.3%	22.8%	12.4%	N/A	N/A	21.0%
PE-HD (2)	12.3%	0.0%	1.7%	0.2%	40.9%	22.3%	9.1%	N/A	N/A	19.7%
PVC (3)	0.0%	0.0%	1.2%	0.0%	11.3%	NR	2.0%	N/A	N/A	2.0%
PE-LD/LLD (4)	4.9%	0.0%	2.8%	0.0%	18.0%	37.6%	5.3%	N/A	N/A	17.3%
PP (5)	22.2%	4.5%	1.9%	0.0%	18.7%	19.5%	4.2%	N/A	N/A	8.9%
PS (6)	NR	0.0%	19.0%	7.3%	30.5%	NR	0.9%	N/A	N/A	11.6%
PS-E (6)	0.0%	0.0%	4.7%	0.1%	65.2%	16.1%	6.7%	N/A	N/A	11.5%
ABS/SAN/ASA (7)	0.0%	1.7%	0.0%	13.9%	3.5%	0.0%	3.1%	N/A	N/A	7.7%
PU (7)	0.0%	0.0%	4.5%	0.0%	0.0%	0.0%	15.0%	N/A	N/A	9.1%
Nylon (7)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.2%	N/A	N/A	7.1%
Bioplastic (7)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	N/A	N/A	0.0%
Other (7)	0.0%	0.0%	0.0%	32.8%	2.1%	0.0%	1.1%	N/A	N/A	1.4%
Unknown polymer	0.0%	0.0%	23.7%	0.0%	4.2%	0.0%	3.8%	N/A	N/A	6.6%
<b>Total</b>	<b>7.1%</b>	<b>1.9%</b>	<b>2.5%</b>	<b>4.5%</b>	<b>27.0%</b>	<b>28.6%</b>	<b>6.9%</b>	<b>N/A</b>	<b>N/A</b>	<b>11.5%</b>

Green values	Consumption is a good proxy for end-of-life arisings
Orange values	Consumption is probably an adequate proxy for end-of-life arisings
Red values	Consumption is a poor or unknown proxy for end-of-life arisings

NR – 'Not reported'. Where consumption for a given polymer/application area combination is under 100 tonnes the recovery rate is not reported as the uncertainty in the quantity of consumption for these values is typically too high to provide a reliable estimate. Also where underlying calculation sensitivities are too high to reliably report a recovery rate.

Note: Zero (0%) recovery rate values in the table above are effectively 'green' cells, as no recovery for recycling has been reported, and therefore uncertainty in relation to consumption has no impact on the recovery rate calculation.



## 3.5 Plastic retail carry bag consumption

### 3.5.1 Introduction

As an add-on task to the main time-series APRS study this year, an assessment of national consumption of plastic retail carry bags in 2018–19 has been undertaken, with a focus on single-use bags.

The plastic retail carry bag is used across many retail sectors, including; supermarket and grocery stores, other food retailing, clothing retailing, department stores, consumer goods retailing, fast food, convenience stores, and numerous other sectors.

Australian manufacturing of single-use HDPE retail carry bags effectively ceased in 2017, and since that time almost all bags have been imported, and only small and occasional runs of local HDPE bag manufacturing occurring. A larger proportion of single-use and reusable LDPE carry bag manufacture still occurs locally (around 5–10% of consumption in 2018–19, down from 10–20% in 2016–17).

Until the middle of 2018 the most commonly used single-use plastic bags were made of high-density polyethylene (HDPE) plastic (e.g. the standard grey supermarket single-use bag). Other commonly used plastic bags include low density polyethylene (LDPE) plastic (e.g. the reusable heavier-duty supermarket bags and the 'boutique' type plastic bags, and non-woven polypropylene (PP) bags intended for multiple uses (e.g. the typical 'green' bag and insulated cooler tote bags).

With the exception of a small proportion of reusable LDPE bags, virtually all retail shopping bags are now imported into Australia and have been since 2012.

Over the last decade the following single-use plastic carry bag bans have been implemented:

- SA 2009
- ACT 2011
- NT 2011
- TAS 2013
- WA 1 July 2018
- QLD 1 July 2018
- VIC 1 November 2019.

At different time period the bans that were in place nationally covered the following percentages of the Australian population:

- 11.8% of the Australian population across 2016–17.
- 42.0% of the Australian population across 2018–19 (Coles and Woolworths had also phased out single-use shopping bags across this period).
- 68.0% of the Australian population from 1 November 2019.

There is no plastic bag ban currently proposed for NSW. However, the national single-use bag phase-out by Coles and Woolworths has significantly reduced plastic bag consumption in NSW.



### 3.5.2 Scope and method

#### Scope

The scope of the assessment undertaken in this section of the report is the determination of:

- 2018–19 national estimated plastic bag consumption by bag type.
- Comparisons with available historical consumption estimates.

#### Method

The following information sources were drawn upon to determine national level plastic retail carry bag use:

- Customs import data – Review of plastic retail carry bags import data to determine HDPE and LDPE bag imports.
- Surveys of major supermarket operators to request data on plastic bag placed into the market.
- Domestic consumption and production – Interviews and surveys with major local bag manufacturers and importers.

### 3.5.3 Retail carry bag consumption

Based on reported import data, supermarket survey responses and local bag manufacturer/importer advice, the national market for retail carry bags is summarised in the following table.

**Table 17 – Australian use of single-use and reusable plastic carry bags in 2018–19**

Product	Weight	Number	Average weight	Per capita use	Indicative accuracy
	(tonnes)	(million units)	(g/unit)	(units/person.yr)	(±%)
Single use HDPE bag (supermarket type)	7 000	1 295	5.4	50.9	±20% or less
Reusable LDPE bag (supermarket type)	13 100	450	29.1	17.7	±10% or less
Reusable non-woven PP bag	5 400	53	101.1	2.1	±20% or less
Single use produce bag	4 400	1 772	2.5	69.7	±50% or less
Single use LDPE bag (boutique type)	1 300	45	28.9	1.8	±50% or less
<b>Total</b>	<b>31 200</b>	<b>3 615</b>	<b>8.6</b>	<b>142.1</b>	<b>-</b>

1. Includes non-woven PP cooler bags and polyester bags.

In 2017, estimates of plastic retail carry bag use, with the same scope as that covered in Table 17 above, were also determined for the 2016–17 financial year. In that 12-month period an estimated 45 800 tonnes of single-use and reusable plastic carry bags, or 7.84 billion bags, were placed onto the market. This indicates that over the two year period from 2016–17 to 2018–19, plastic retail carry bag use has decreased 32% by weight and 54% by number.



Across the period of 2002–2007, annual reviews of national single-use HDPE carry bags (only) were undertaken to track the progress of a phase-out initiative by the former Environment Protection and Heritage Council (EPHC) (Hyder, 2008). For comparison purposes the data from this EPHC reporting activity, also the available 2016–17 data (Envisage & SRU, 2018), and the analysis undertaken for this project are summarised in the table below.

**Table 18 – Australian use of single-use HDPE carry bags**

Year	Number of bags	Weight of bags
	(billions)	(tonnes)
2002	5.95	32 700
2003	5.24	28 800
2004	4.73	26 000
2005	3.92	21 500
2006	3.36	18 100
2007	3.93	21 200
2016–17	5.66	30 700
2018–19	1.30	7 000

It can be seen from the available time-series data that single-use HDPE plastic bag consumption has fallen by 77% since 2016–17, driven by the WA and QLD bans from 1 July 2018. In addition, both Woolworths and Coles phased out free single-use plastic shopping bags from their stores nationally from July 2018.



## 4 CONSUMPTION AND RECYCLING BY STATE/TERRITORY

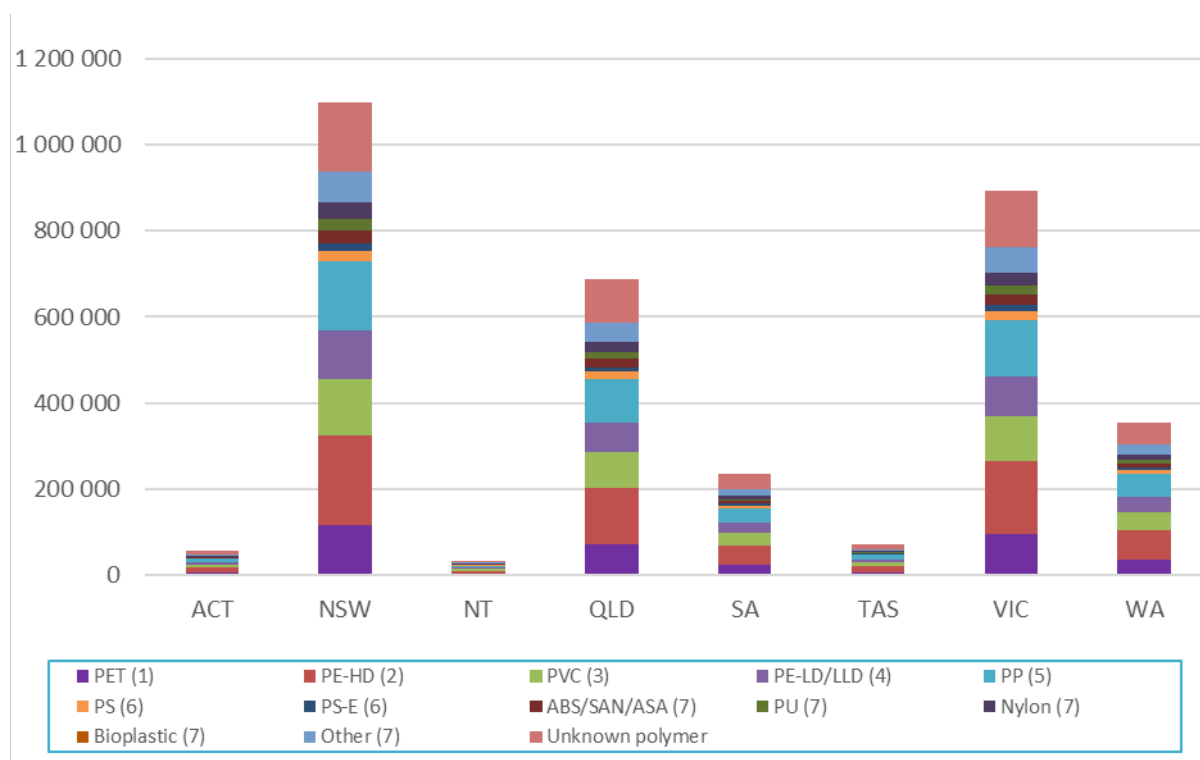
This section contains the analysis of each Australian jurisdiction's consumption and recycling of plastics, as well as data on reprocessor numbers in each jurisdiction and interstate flows of waste plastics for reprocessing.

### 4.1 Plastics consumption by state/territory

Throughout this report, consumption data for each jurisdiction is estimated based upon the jurisdiction's population as a proportion of the national population. The population data used for this purpose is provided in Table 213 on page 3.

Presented in Figure 12 and Table 19 is plastics consumption by jurisdiction and polymer type in 2018–19.

**Figure 12 – Plastics consumption by jurisdiction and polymer type in 2018–19 (tonnes)**





**Table 19 – Plastics consumption by jurisdiction and polymer type in 2018–19 (tonnes)**

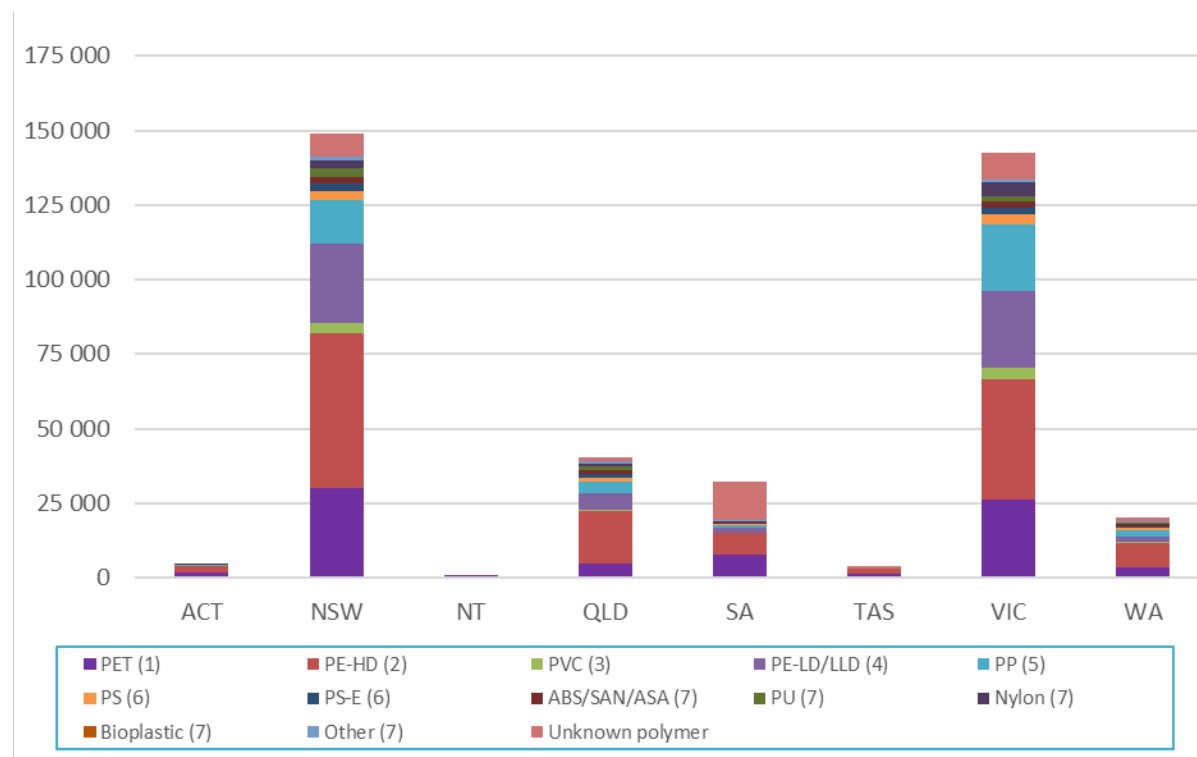
Polymer type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Total
PET (1)	6 100	116 200	3 600	72 800	24 900	7 600	94 400	37 500	<b>363 200</b>
PE-HD (2)	11 000	209 200	6 500	131 100	44 900	13 700	170 000	67 500	<b>653 800</b>
PVC (3)	6 900	130 100	4 000	81 500	27 900	8 500	105 700	42 000	<b>406 600</b>
PE-LD/LLD (4)	5 900	112 600	3 500	70 500	24 200	7 400	91 500	36 300	<b>351 900</b>
PP (5)	8 500	160 600	5 000	100 600	34 500	10 500	130 500	51 800	<b>501 900</b>
PS (6)	1 300	24 700	800	15 500	5 300	1 600	20 000	8 000	<b>77 100</b>
PS-E (6)	1 000	18 500	600	11 600	4 000	1 200	15 100	6 000	<b>57 900</b>
ABS/SAN/ASA (7)	1 500	28 900	900	18 100	6 200	1 900	23 500	9 300	<b>90 200</b>
PU (7)	1 400	26 000	800	16 300	5 600	1 700	21 100	8 400	<b>81 200</b>
Nylon (7)	2 100	38 900	1 200	24 400	8 400	2 500	31 700	12 600	<b>121 700</b>
Bioplastic (7)	<100	400	<100	300	<100	<100	300	100	<b>1 300</b>
Other (7)	3 800	71 400	2 200	44 800	15 300	4 700	58 100	23 000	<b>223 300</b>
Unknown polymer	8 500	161 600	5 000	101 300	34 700	10 600	131 300	52 100	<b>505 100</b>
<b>Total</b>	<b>58 000</b>	<b>1 099 000</b>	<b>34 000</b>	<b>688 800</b>	<b>236 000</b>	<b>71 800</b>	<b>893 100</b>	<b>354 500</b>	<b>3 435 200</b>



## 4.2 Plastics recovery by source state/territory

Presented in Figure 13 and Table 20 is plastics recovery by source jurisdiction and polymer type in 2018–19.

**Figure 13 – Recovery by source jurisdiction and polymer type in 2018–19 (tonnes)**





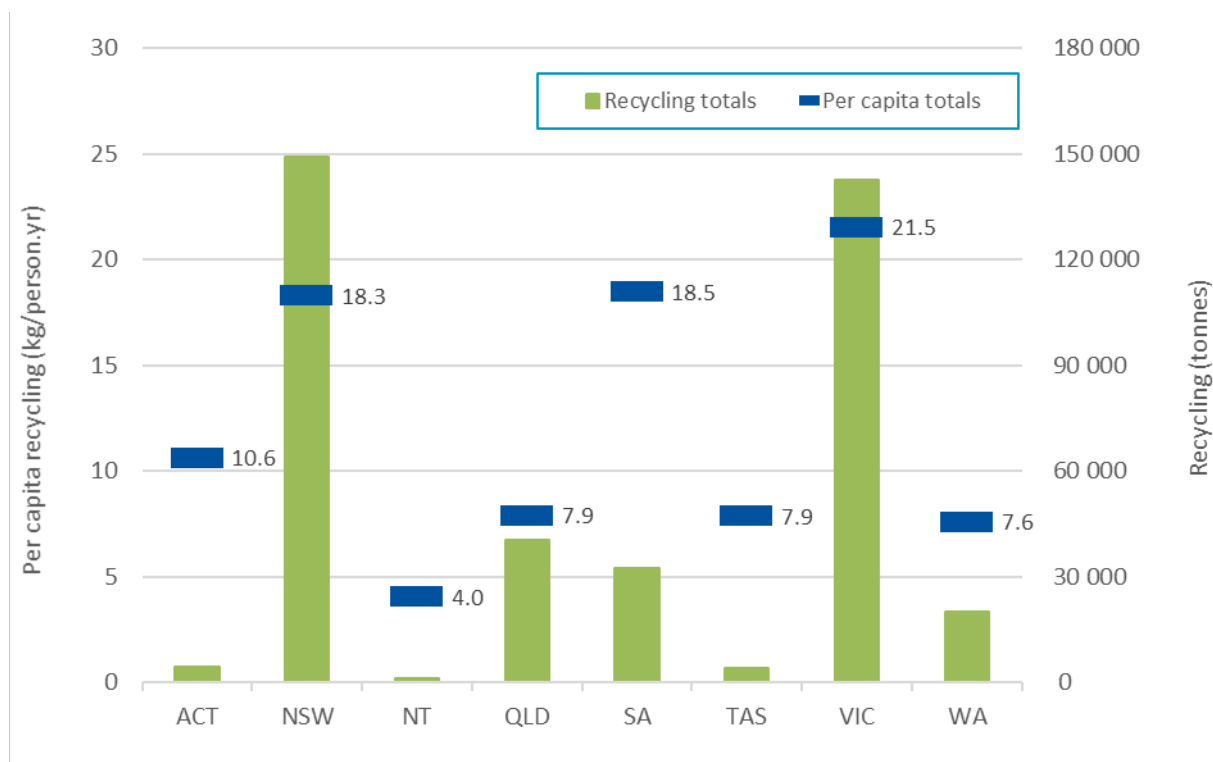
**Table 20 – Recycling by source jurisdiction and polymer type in 2018–19 (tonnes)**

Polymer type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Australia
PET (1)	1 800	30 200	800	4 800	7 800	1 400	26 200	3 600	<b>76 400</b>
PE-HD (2)	1 900	51 900	<100	17 700	7 400	1 600	40 400	8 100	<b>128 900</b>
PVC (3)	<100	3 400	<100	300	<100	<100	4 000	200	<b>8 000</b>
PE-LD/LLD (4)	<100	26 400	<100	5 600	1 500	<100	25 400	1 700	<b>60 800</b>
PP (5)	500	14 900	<100	3 900	800	<100	22 300	2 400	<b>44 800</b>
PS (6)	200	2 900	<100	1 100	400	<100	3 400	800	<b>8 900</b>
PS-E (6)	<100	2 300	<100	1 200	100	<100	2 400	400	<b>6 600</b>
ABS/SAN/ASA (7)	100	2 200	<100	1 300	400	100	2 000	700	<b>7 000</b>
PU (7)	<100	3 300	<100	1 600	100	100	1 800	500	<b>7 400</b>
Nylon (7)	<100	2 600	<100	900	400	<100	4 600	200	<b>8 600</b>
Bioplastic (7)	<100	<100	<100	<100	<100	<100	<100	<100	<b>&lt;100</b>
Other (7)	<100	1 000	<100	500	200	<100	1 100	300	<b>3 100</b>
Unknown polymer	<100	7 900	<100	1 500	13 100	600	8 900	1 200	<b>33 200</b>
<b>Recycling totals</b>	<b>4 600</b>	<b>149 000</b>	<b>1 000</b>	<b>40 300</b>	<b>32 300</b>	<b>4 200</b>	<b>142 500</b>	<b>20 000</b>	<b>393 800</b>



Presented in Figure 14 is per capita recycling in each jurisdiction nationally. The national average of recovery for recycling was 15.5 kg/person in 2018–19 (compared with 12.8 kg/person in 2017–18).

**Figure 14 – Per capita recycling by source jurisdiction in 2018–19 (tonnes)**



Presented in Table 21 and Figure 15 are recovery rates by source jurisdiction and polymer type in 2018–19. Victoria has the highest recovery rate at 16.0%, followed by SA on 13.7%. It is worth noting that the Victorian rate is contributed to by the relatively large amounts of manufacturing scrap generated in and recovered from Victoria.

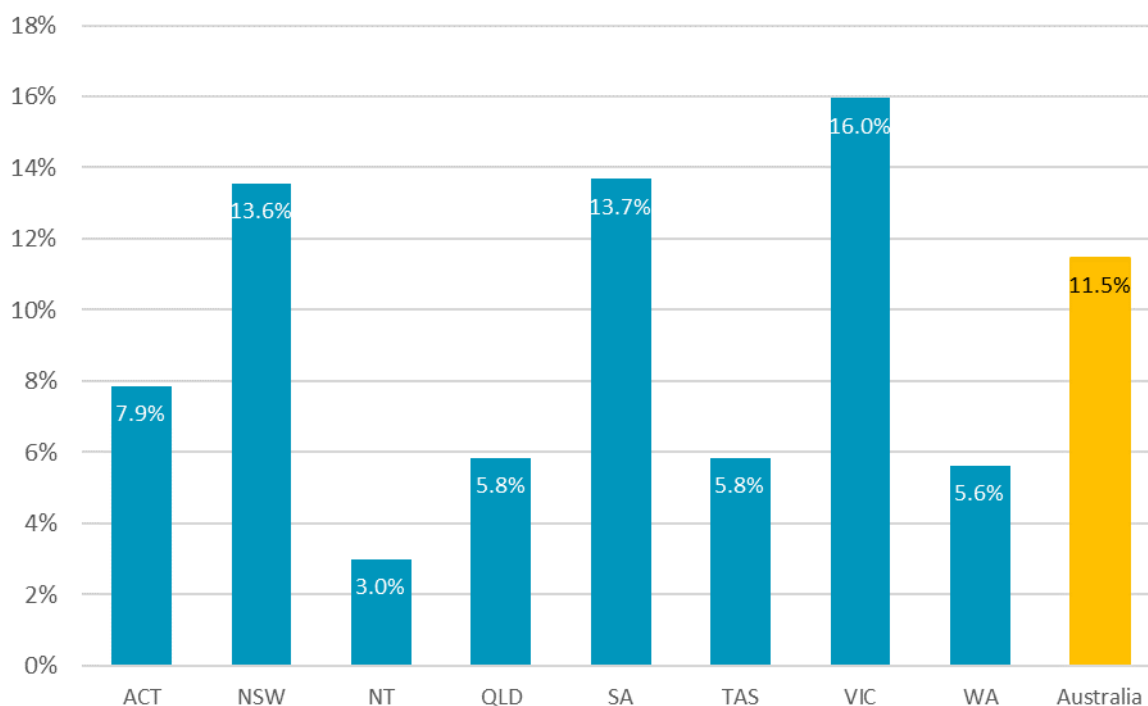


**Table 21 – Recovery rates by source jurisdiction and polymer type in 2018–19 (tonnes)**

Polymer type	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Australia
PET (1)	28.7%	26.0%	22.7%	6.6%	31.1%	17.8%	27.7%	9.5%	<b>21.0%</b>
PE-HD (2)	17.0%	24.8%	0.6%	13.5%	16.4%	11.9%	23.8%	11.9%	<b>19.7%</b>
PVC (3)	0.7%	2.6%	0.0%	0.3%	0.2%	0.1%	3.8%	0.5%	<b>2.0%</b>
PE-LD/LLD (4)	0.2%	23.5%	0.3%	7.9%	6.3%	0.8%	27.8%	4.8%	<b>17.3%</b>
PP (5)	5.3%	9.3%	0.6%	3.9%	2.3%	0.9%	17.1%	4.6%	<b>8.9%</b>
PS (6)	14.9%	11.7%	4.8%	7.3%	8.3%	4.9%	17.1%	9.5%	<b>11.6%</b>
PS-E (6)	8.1%	12.6%	0.1%	10.3%	3.2%	4.5%	16.3%	6.6%	<b>11.5%</b>
ABS/SAN/ASA (7)	6.8%	7.7%	6.9%	7.1%	6.8%	6.9%	8.5%	8.0%	<b>7.7%</b>
PU (7)	0.0%	12.7%	0.0%	9.7%	2.3%	7.4%	8.4%	6.0%	<b>9.1%</b>
Nylon (7)	0.0%	6.7%	0.0%	3.6%	4.3%	0.9%	14.4%	1.5%	<b>7.1%</b>
Bioplastic (7)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	<b>0.0%</b>
Other (7)	1.1%	1.3%	1.1%	1.1%	1.1%	1.1%	2.0%	1.1%	<b>1.4%</b>
Unknown polymer	0.0%	4.9%	0.0%	1.5%	37.9%	5.6%	6.8%	2.2%	<b>6.6%</b>
<b>Recovery rate</b>	<b>7.9%</b>	<b>13.6%</b>	<b>3.0%</b>	<b>5.8%</b>	<b>13.7%</b>	<b>5.8%</b>	<b>16.0%</b>	<b>5.6%</b>	<b>11.5%</b>



**Figure 15 – Recovery rates by source jurisdiction in 2018–19 (tonnes)**



### 4.3 Cross border recycle flows

Presented in Table 22 and Figure 16 is data on recycle movements to intrastate (same state), interstate and overseas reprocessors by source jurisdiction in 2018–19.

The most noteworthy change from 2017–18 is the large jump in NSW reprocessing from 86 100 tonnes in 2017–18 to 149 000 tonnes in 2018–19. This is largely attributable to energy recovery related activity in NSW.

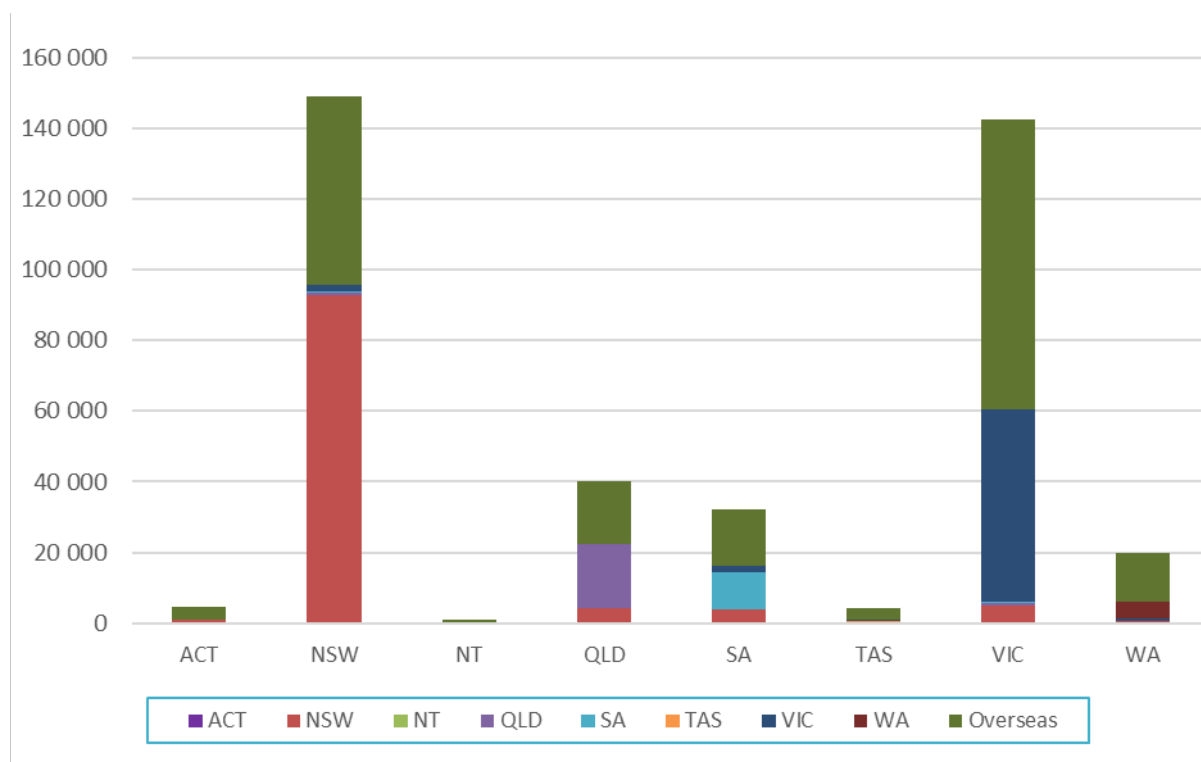


**Table 22 – Recyclate to intrastate (same state), interstate and overseas reprocessors by source jurisdiction in 2018–19 (tonnes)**

Destination jurisdiction	Source jurisdiction								Total
	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	
ACT	0	0	0	0	0	0	0	0	0
NSW	1 100	92 800	0	4 100	4 000	200	5 100	600	107 900
NT	0	0	0	0	0	0	0	0	0
QLD	0	700	0	18 200	0	0	700	0	19 700
SA	0	200	0	0	10 500	0	300	200	11 200
TAS	0	0	0	0	0	500	0	0	500
VIC	0	1 900	0	200	1 700	200	54 500	600	59 100
WA	0	0	0	0	0	0	0	4 800	4 800
Overseas	3 500	53 400	1 000	17 800	16 100	3 300	81 900	13 800	190 700
<b>Total</b>	<b>4 600</b>	<b>149 000</b>	<b>1 000</b>	<b>40 300</b>	<b>32 300</b>	<b>4 200</b>	<b>142 500</b>	<b>20 000</b>	<b>393 800</b>



**Figure 16 – Recyclate to intrastate (same state), interstate and overseas reprocessors by source jurisdiction in 2018–19 (tonnes)**



#### 4.4 Reprocessor numbers by state/territory

Presented in Table 23 is data on the numbers of reprocessors identified as operating in each state or territory. Data is provided for 71 reprocessing facilities nationally, out of 77 reprocessors known to be operating during 2018–19.

Many reprocessors handle more than one polymer type, resulting in improved depth to the reprocessing market. For example, in NSW there are 18 reprocessing facilities included in the survey dataset, however between them these facilities handled a total of 39 polymer types in aggregate across the facilities.



**Table 23 – Reprocessor counts by facility location and polymer types reprocessed in 2018–19**

	ACT	NSW	NT	QLD	SA	TAS	VIC	NSW	Total
<b>Number of reprocessors</b>	<b>0</b>	<b>18</b>	<b>0</b>	<b>11</b>	<b>7</b>	<b>3</b>	<b>27</b>	<b>5</b>	<b>71</b>
<b>Polymer reprocessed</b>	<b>Number of reprocessors in the jurisdiction reprocessing the polymer type</b>								
PET (1)	0	1	0	1	0	0	6	2	10
PE-HD (2)	0	8	0	7	0	2	17	3	37
PVC (3)	0	5	0	1	1	0	6	2	14
PE-LD/LLD (4)	0	7	0	3	0	1	12	2	25
PP (5)	0	7	0	5	0	1	12	3	28
PS (6)	0	1	0	1	3	0	8	1	14
PS-E (6)	0	4	0	4	2	1	3	0	14
ABS/SAN/ASA (7)	0	3	0	1	0	0	4	2	10
PU (7)	0	2	0	0	0	0	1	0	3
Nylon (7)	0	0	0	0	0	0	3	1	4
Bioplastic (7)	0	0	0	0	0	0	0	0	0
Other (7)	0	1	0	0	0	0	3	1	5
Unknown polymer	0	0	0	0	1	0	0	0	1
<b>Total count</b>	<b>0</b>	<b>39</b>	<b>0</b>	<b>23</b>	<b>7</b>	<b>5</b>	<b>75</b>	<b>17</b>	<b>166</b>



## 5 MARKET COMMENTARY

### 5.1 Business operations

The following is a synthesis of comments received from plastics reprocessors, with respect to business operations related aspects for scrap plastics during 2018–19:

- Energy costs are still going up significantly, as are insurance costs (both reported as significant issues in 2017–18). The number of insurance providers servicing the reprocessing market has reduced.
- Hard to get equipment as manufacturers behind on their orders and are focussed on servicing other larger customers overseas.
- The high cost of recycling means lots of the lower grade polymer is not, and will not, be recycled.
- Around 5–10 reprocessors nationally are installing increased reprocessing capacity, mostly anticipated to be fully operational during the 2019–20 year.

### 5.2 Product and packaging design

The following is a synthesis of comments received from plastics reprocessors, with respect to design related aspects for scrap plastics during 2018–19. This was a significantly more common theme in 2018–19 relative to past years:

- Packaging manufacture using a single polymer only (e.g. bottle, lid and label) would dramatically increase value. There is not enough market for the poor quality mixed polymer, whereas single polymer can be reprocessed more easily and has good markets. The manufacturing industry should be responsible for making product that is easily recyclable.
- A number of reprocessors raised that government legislation is required to drive improvements in product design to improve recyclability.
- A number of reprocessors raised that PVC packaging is a continuing issue in recycling streams and causes issues in both rigid and flexible packaging recovery chains.

### 5.3 Increasing virgin resin competition

The following is a synthesis of comments received from plastics reprocessors, with respect to, what is effectively competition from virgin resins. This was a significantly more common theme in 2018–19 relative to past years:

- A common theme was that the recycling industry needs more support and/or regulation from government to drive the use of recycled plastics in new product manufacture. Virgin resin is still the default material and this needs to change.
- Virgin polymer is too cheap, so it's hard to find customers who will pay a similar price for a recycle based resin.



- Virgin resins are often preferred for aesthetic reasons and concerns about quality. Virgin resin prices are flat or trending downwards, while reprocessed plastic prices have upwards pressure due to trends towards increased operational and capital costs.
- A price signal to value low carbon products is required.
- There are large increases in global virgin resin capacity currently coming online, which are likely to push down virgin resin prices over the next few years.

## 5.4 Export market competition

The following is a synthesis of comments received from plastics reprocessors, with respect to export market related conditions for scrap plastics during 2018–19. This was a significantly less common theme in 2018–19 relative to past years:

- Export markets are reduced, and export prices are lower. Significant growth in the local market is required to reduce exposure to the volatilities of overseas markets.
- Significant recovery and growth in export markets is not anticipated.



## 5.5 End market uses

After reprocessing, recycled plastics are used to manufacture new products, with new applications often quite different from those of the original use. Outlined in Table 24 are many of the typical uses of recycled plastics in Australia.

**Table 24 – Typical uses of recycled plastics in Australia**

Polymer	Major uses of recycled polymer	Minor uses of recycled polymer
PET	Beverage bottles	Timber substitutes, geo-textiles, pallets and fence posts.
PE-HD	Films, pallets, wheelie bins, irrigation hose and pipes	Cable covers, extruded sheet, moulded products, shopping and garbage bags, slip sheets, drip sheets for water, wood substitutes and mixed plastics products (e.g. fence posts, bollards, kerbing, marine structures and outdoor furniture), materials handling and roto-moulded water tanks.
PVC	Pipe, floor coverings	Hose applications and fittings, pipes including foam core pipes, profiles and electrical conduit, general extrusion and injection moulding, clothing, fashion bags and shoes.
PE-LD/LLD	Film (incl. builders' and agricultural film, concrete lining, freight packaging, garbage bags, shopping bags), agricultural piping	Trickle products, vineyard cover, pallets, shrink wrap, roto-moulding, slip sheets, irrigation tube, timber substitutes, cable covers, builders' film, garbage bags, carry bags, and other building industry applications.
PP	Crates boxes and plant pots	Electrical cable covers, building panels and concrete reinforcement stools (bar chairs and shims), furniture, irrigation fittings, agricultural and garden pipe, drainage products (such as drain gates) and tanks, builders film, kerbing, bollards, concrete reinforcing and a wide variety of injection moulded products.
PS	Bar chairs and industrial spools	Office accessories, coat hangers, glasses, building components, industrial packing trays, wire spools and a range of extrusion products.
PS-E	Waffle pods for under slab construction of buildings	Synthetic timber applications (including photo frames, decorative architraves, fence posts), XPS (extruded polystyrene) insulation sheeting, and lightweight concrete.
ABS/SAN/ASA	Injection moulded products	Automotive components, laminate edging, sheet extrusion, coffin handles, drainage covers, auto parts and a range of injection moulded products.
Polyurethane	Carpet underlay	Mattresses.
Nylon	Injection moulded products	Furniture fittings, wheels and castors and a range of injection moulded products.
Other and mixed	Timber substitute products in general and piping	Fence posts, bollards, garden stakes, kerbing, marine structures, post and rail systems, scaffold pads, piggery boards, shipping dunnage, rail bridge transoms.



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