

The background image shows a large, sprawling pile of discarded, worn-out black rubber tyres. The pile is situated in an open area with a dirt ground. In the background, there are tall, leafy green trees under a bright blue sky with scattered white clouds. The scene appears to be a storage or disposal site for end-of-life tyres.

STOCKS & FATE OF END OF LIFE TYRES – 2013-14 STUDY

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NATIONAL ENVIRONMENT PROTECTION COUNCIL

STOCKS & FATE OF END OF LIFE TYRES - 2013-14 STUDY

Final Report

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EXECUTIVE SUMMARY

Since late 2009, representatives from the tyre industry and government have been working toward establishing a voluntary, industry-led product stewardship scheme for end-of-life tyres. The Product Stewardship Act 2011, which came into effect in August 2011, set in place the framework for accreditation of product stewardship schemes in Australia, and the Tyre Product Stewardship Scheme was officially launched in January 2014.

Central to measuring the success of the scheme is the establishment of baseline data – that is, data for the 2013-14 financial year on end-of-life tyre destinations. The most recent national study was the *Study into domestic and international fate of end-of-life tyres* (Hyder, 2012) which reported on data for the 2009–10 financial year.

The National Environment Protection Council (NEPC) engaged Hyder Consulting (Hyder) to conduct this Study into the Stocks and Fate of End-of-life Tyres in Australia 2013-14 (the Study). The Study is effectively an update of the previous study (Hyder, 2012) and where appropriate we have retained the same methodology to ensure comparability between studies.

This report presents the sources and fate of end-of-life tyres in Australia for the 2013-14 financial year. In this study the destinations for end-of -life tyres have been categorised as follows:

- Domestic: recycling, energy recovery, civil engineering, licensed landfill, legitimate stockpiling, managed on-site and unknown.
- International: reuse and retreading, recycling and energy recovery.

It is noted that data categorised as “unknown” represents the balance of tyres for which the destination cannot be identified.

The findings of the current study (summarised in Table 1-1 on p.3) indicate that approximately 51 million equivalent passenger units (EPU) of tyres entered the waste stream in 2013-14 (compared to 48.5 million EPU tyres entering the waste stream in 2009-10), which equates to around 408,000 tonnes. Of these, approximately 5% were recovered locally (either through recycling, energy recovery or civil engineering) compared to 16% in 2009-10; 32% were exported compared to 18% in 2009-10; approximately 16% went to licenced landfills; and 2% were stockpiled for future recovery. Approximately 14% of end-of-life tyres were categorised as having “unknown” destination (compared to 66% in 2009-10), and anecdotal evidence suggests that approximately 31% of Australian tyres (predominantly large, off the road (OTR) tyres) are landfilled at mining sites (however it is noted that it was not possible to verify this quantity due to the lack of available data regarding such on-site disposal).

The current study has highlighted the following major factors influencing the fate of Australian end-of-life tyres:

- local landfill prices and regulatory controls;
- constrained local markets and limited demand for TDP/ TDF;
- global commodity prices and demand;
- highly volatile international energy markets;
- increased competition for collection fees, restricting the income available to offset tyre recyclers' high processing costs; and
- high transportation costs often required to access recovery options.

The domestic market for tyre derived products (TDP) and tyre derived fuel (TDF) in Australia has contracted to less than a third of the level in the previous (2009-10) study, from 16.4% to only 5.1%. The sector has become increasingly reliant on the international energy market, with exports increasing from 18% in 2009-10 to more than 32% in 2013-14. This has been highlighted by the more recent market conditions observed in

2015, where a drop in commodity prices and the Australian dollar, coupled with the closure of a number of Malaysian pyrolysis plants has led to a global decline in the demand for TDF. Industry sources report that this has led to a situation where recyclers are now making a loss in exporting their product, where previously a small margin could be made. Recently, there have been widespread reports that businesses are struggling to find buyers for their product, leading to increased stockpiling and a number of companies going out of business, as the sector faces market conditions far worse than have been experienced before.

The Study has found there is very little data to verify the fate of OTR tyres, but anecdotal evidence indicates that most OTR tyres continue to be predominantly managed “in-pit” at mining sites or otherwise stockpiled where they are used. The most common reason cited is the “tyranny of distance” with most mining sites located a significant distance from established tyre recyclers or ports and, lacking a viable alternative, these tyres are being landfilled or managed on-site.

The current market conditions highlight the case for the development of stronger local markets for TDP and TDF in order to reduce the industry’s exposure to changing global conditions. Support for development of end markets will be a key focus of TSA and a number of state government agencies over the coming years.

Hyder has identified a range of opportunities which decision makers should consider to support development of Australian tyre recycling markets, including:

Opportunity	Potential Initiatives
Support increased local recycling	<ul style="list-style-type: none"> ▪ Development of quality standards for end products ▪ Ongoing support for product testing and case study development ▪ Highlight and showcase key projects of significance to leverage government procurement practices in developing stronger end markets (refer to Section 4.5.1).
Provide a more consistent national approach to tyre regulation	<ul style="list-style-type: none"> ▪ Support development of a consistent national approach to tyre regulations. ▪ Develop a nationwide framework that would allow individuals to easily identify their obligations and compliance requirements across the various jurisdictions.
Support increased uptake of TDP locally through increased production of crumb rubber asphalt	<ul style="list-style-type: none"> ▪ Develop targets for use of crumb rubber asphalt in road surfacing (refer to Section 4.5.2). ▪ Support further R&D to continue to improve confidence in the product within the market.
Support improved price transparency for tyre disposal or “recycling charges”	<ul style="list-style-type: none"> ▪ Encourage greater transparency amongst tyre retailers of levies or “environmental charges” to consumers. ▪ TSA funding for independent financial modelling of collection and recycling fees, to determine appropriate pricing required to offset legitimate recycling.
Support increased OTR recycling	<ul style="list-style-type: none"> ▪ State Governments review the waste management requirements of major mine sites, to ensure that recycling options be taken up, where available and viable.
Work to ensure that only tyres of adequate quality are being exported to international second-hand markets	<ul style="list-style-type: none"> ▪ Develop a quality standard for used tyre exports, to ensure that Australian tyre exports are not of poor quality and potentially impacting road safety in other countries, particularly Asia and Africa (refer Section 4.2.1).

Table 1-1 Summary of domestic and international destination of end-of-life tyres (2013-14)

Destination		Passenger		Truck		OTR		Total	
Domestic	Material recycling	350,060	2.3%	1,476,182	9.3%	36,571	0.2%	1,862,813	3.6%
	Energy recovery	10,800	0.1%	313,700	2.0%	3,000	0.02%	327,500	0.6%
	Civil engineering	223,125	1.5%	200,000	1.3%	-	0.0%	423,125	0.8%
	Licensed landfill	3,873,987	25.3%	3,834,178	24.1%	279,438	1.4%	7,987,603	15.6%
	Legitimate stockpiling	381,475	2.5%	246,275	1.5%	521,250	2.6%	1,149,000	2.3%
	Unknown	38,423	0.3%	5,161,971	32.4%	1,744,643	8.8%	6,945,037	13.6%
	Managed on-site (unverified)	-	0.0%	-	0.0%	15,701,783	79.4%	15,701,783	30.8%
	Sub-total	4,877,870	31.8%	11,232,306	70.5%	18,286,683	92.4%	34,396,860	67.4%
International	Reuse and retreading	3,212,256	20.9%	823,986	5.2%	492,276	2.5%	4,528,518	8.9%
	Recycling/ Energy Recovery	7,245,622	47.2%	3,864,832	24.3%	1,005,560	5.1%	12,116,014	23.7%
	Sub-total	10,457,878	68.2%	4,688,818	29.5%	1,497,836	7.6%	16,644,532	32.6%
Total		15,335,748		15,921,124		19,784,519		51,041,392	

Note: All units are in Equivalent passenger unit (EPUs).

ACRONYMS

This section provides a list of acronyms used throughout the report.

Acronym	Definition
ABS	Australian Bureau of Statistics
AHECC	Australian Harmonized Exports Commodity Classification
ARRB	Australian Road Research Board
ATIC	Australian Tyre Industry Council
ATRA	Australian Tyre Recyclers Association
CAPEX	Capital expenditure
DER	WA Department of Environment and Regulation
EPA	Environment Protection Authority
EPU	Equivalent passenger unit
HTISC	Harmonized Tariff Item Statistical Code
LGA	Local Government Area
MSW	Municipal Solid Waste
NEPC	National Environment Protection Council
OTR	Off-the-road
R&D	Research and development
TDF	Tyre derived fuel
TDP	Tyre derived product
TSA	Tyre Stewardship Australia

GLOSSARY

This section provides a definition for terms commonly used in this report.

Term	Definition
Casing:	The rigid, inner of a tyre upon which a tread is placed.
Civil engineering:	In the context of end-of-life tyres, this is a form of recycling in which whole, shredded or chipped end-of-life tyres are used in various construction applications, including road embankments, retaining wall construction and in landfill drainage systems.
Disposal	Solid waste that is disposed of to landfill, incinerated or destroyed without energy recovery.
End-of-life tyre:	A tyre that is deemed no longer capable of performing the function for which it was originally made.
Energy recovery:	In the context of end-of-life tyres means the combustion of tyres as a fuel for an industrial process and/or electricity generation
Equivalent passenger unit (EPU):	A standard measure for the quantity of tyres (see section 2 for further explanation).
Illegal dumping:	The unlawful disposal of tyres to land or water.
In-use:	Tyres that are in demand for the purpose for which they were originally made.
Landfill:	A site used for the controlled and legal deposit of solid waste onto or into land.
Legitimate stockpiling	For the purposes of this report, legitimate stockpiling is the stockpiling of tyres on private land, with the permission of the landowner, in compliance with the relevant state or local government regulations and requirements, either with or without any immediate plans to process those tyres.
Recycling:	In the context of end-of-life tyres, a process to recover constituent materials from end-of-life tyres and use those materials to produce other products.
Retreading:	The preparation of used tyres for re-use by replacing the outer tread.
Re-use:	In the context of end-of-life tyres, the use of discarded tyres for the purpose for which they were originally made, for example use of retreaded tyres or second-hand tyres
Tyre derived fuel (TDF):	The use of whole and shredded tyres as a fuel; tyres that have been converted into a product for use as a fuel, in particular liquid fuels.
Tyre derived product (TDP):	Any product produced from rubber, steel, textiles or other material recovered from recycling end-of-life tyres.

INTRODUCTION

Since late 2009, representatives from the tyre industry and government have been working toward establishing a voluntary, industry-led product stewardship scheme for end-of-life tyres. The Product Stewardship Act 2011, which came into effect in August 2011, set in place the framework for accreditation of product stewardship schemes in Australia, and the Tyre Product Stewardship Scheme was officially launched in January 2014.

Tyre Stewardship Australia (TSA) has been formed to implement the national Tyre Product Stewardship Scheme; the key objectives of the scheme are to:

- increase resource recovery and recycling and minimise the environmental, health and safety impacts of end-of-life tyres generated in Australia, and
- develop Australia's tyre recycling industry and markets for tyre derived products.

Central to measuring the success of the scheme is the establishment of baseline data – that is, data for the 2013-14 financial year on end-of-life tyre destinations. The most recent national study was the *Study into domestic and international fate of end-of-life tyres* (Hyder, 2012) which reported on data for the 2009–10 financial year.

The National Environment Protection Council (NEPC) engaged Hyder Consulting (Hyder) to conduct this Study into the Stocks and Fate of End-of-life Tyres in Australia 2013-14 (the Study).

This Study seeks to establish baseline data for the Tyre Product Stewardship Scheme and inform the Scheme's processes by:

- Reviewing and updating the method and tools to update tyres data and trends;
- Consistent with the developed method, obtaining data on, and analysing the trends in the sources and fate of end-of-life tyres; and
- Assessing current and future markets for Australian tyre derived products.

The Study is effectively an update of the previous study (Hyder, 2012) and where appropriate we have retained the same methodology to ensure comparability between studies. This report summarises the outcomes from the data collection, calculations and market assessment undertaken in accordance with the methodology outlined in Hyder's *Project Plan* (Appendix B). It is noted that only data for the 2013-14 financial year was compiled for this report; collection of data for the years 2010-2013 was beyond the scope of this Study. As such, there is a gap between published datasets for end-of-life tyres, which is indicated throughout this report as "outside of scope".

Hyder would like to recognise the input of Tyres Reclaimed who were retained for the specific purpose of data collection within key market segments. It is noted that the role of Tyres Reclaimed in this study was limited to supporting Hyder's data collection. All data verification, analysis and reporting was undertaken independently by Hyder. The primary objective of Tyres Reclaimed's involvement in the study was to engage with members of the tyre export industry which, in previous studies, either have not been identified, or have not been willing to participate. Better engagement with that sector has proven invaluable in improving the completeness of the current study.

Figure 1-1 overleaf presents the lifecycle pathway of tyres, and defines the major stages for which data has been collected and reported in this study.

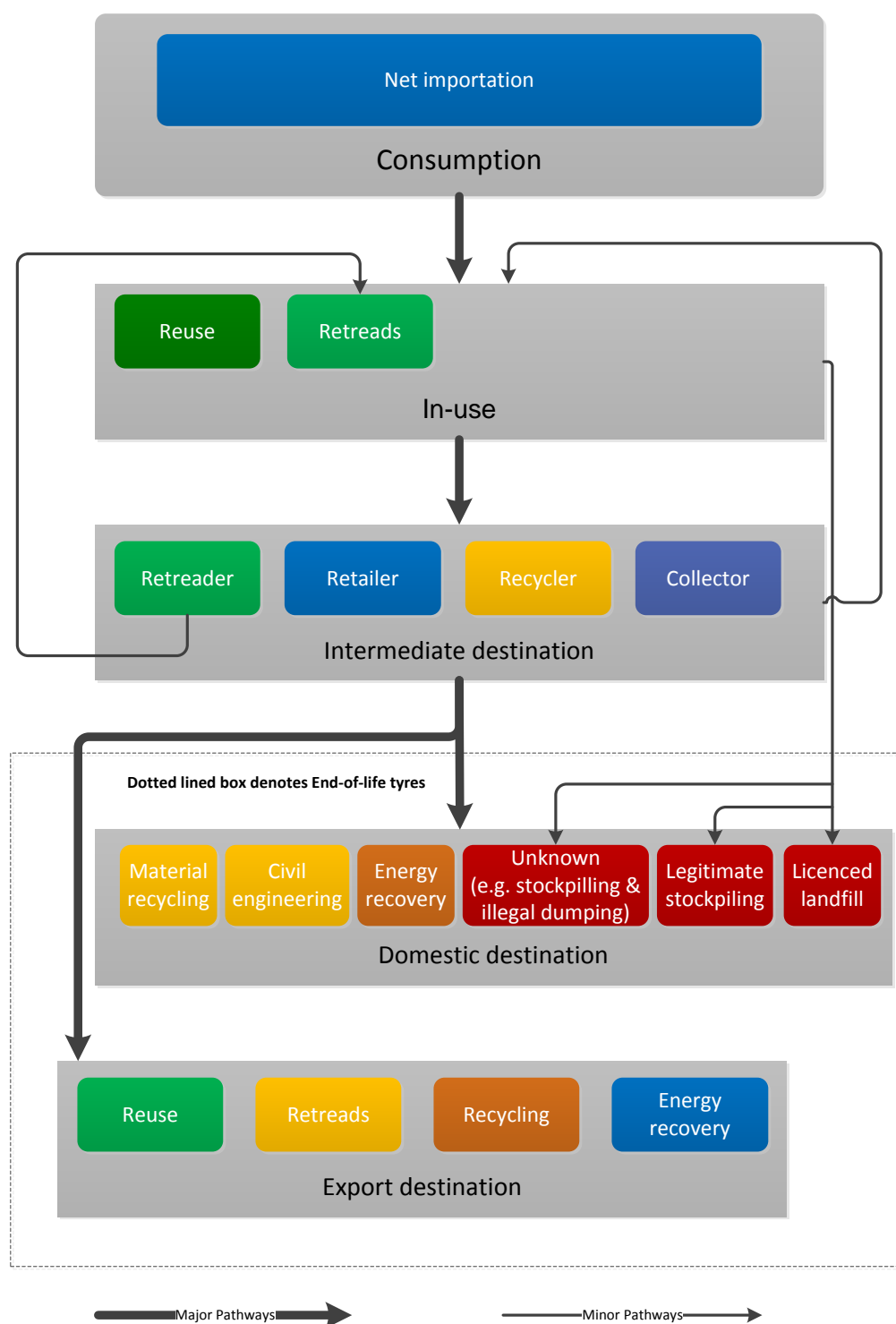


Figure 1-1 Major life cycle pathway of tyres

Note: For the purposes of this study, tyres that are exported from Australia for reuse or retreading are considered to be end-of-life tyres, as, given they are no longer in-use in Australia, and are no longer available to the Australian market, they can be considered to have reached end-of-life. This is consistent with the previous study (see Section 2.4).

2 DATA COLLECTION AND ANALYSIS

This section provides an overview of the outcomes of the data collection and analysis. The methodology used to collect and analyse data is provided in Appendix B. Parts of the methodology are reproduced or summarised within each data results section, to provide greater clarity for the reader.

2.1 ASSUMPTIONS

It is noted that the data presented in this study is reliant on a wide range of data sources, which vary in terms of quality and reliability. Some of the data required for this study is either not available or not collated and recorded in a consistent manner across jurisdictions. For instance, data on tyre recycling, recovery, landfilling and export is rarely categorised into the three main tyre categories considered in this study (i.e. passenger, truck, OTR). Furthermore, while every attempt has been made to source the best available data for this study, in some instances, data was not readily available and it was necessary to make assumptions. Where assumptions were necessary, Hyder has made every attempt to base these on a reputable source. Some of the assumptions potentially have a significant impact on the overall material flow model outcomes.

2.2 TYRE CLASSIFICATION, DEFINITIONS AND REPORTING

2.2.1 TYRE TYPES AND SIZES

All data in this section is expressed in equivalent passenger units (EPUs), which is a standardised measure for the quantity of tyres, based on the weight of a typical passenger car tyre. The measure allows data which is reported as a number of tyres, to be converted to a total weight and vice-versa.

Consistent with the previous study (Hyder Consulting, 2012), an EPU has been taken to be 9.5 kg for a new tyre, and 8.0 kg for a used tyre. Accordingly, the EPU for a tyre in-use, and for a tyre put into re-use, has been taken to be the mid-point between the EPU for a new tyre and the EPU for a used tyre, being 8.75 kg.

Table 2-2 presents the EPU weights that have been assumed for tyres at different stages in the lifecycle of a tyre.

Table 2-2 EPU of tyres by lifecycle point

Stage of use		EPU
Consumption	New	9.5 kg
	Second-hand	8.75 kg
	Retreads	9.5 kg
In-use		8.75 kg
Intermediate destination		8.0 kg
End-of-life destination		8.0 kg

For the purposes of this report (consistent with the previous study), tyres are classified into three main categories:

- Passenger tyres, including those used on passenger vehicles, motorcycles and caravans, as well as trailers for domestic use
- Truck tyres, including those used on buses, light and heavy commercial vehicles, prime movers, trailers and semi-trailers, and fire fighting vehicles
- Off-the-road (OTR) tyres, including those used on machinery or equipment used in industries such as agricultural, mining and construction and demolition.

The calculation of EPUs per vehicle has been made on the assumption that all vehicles, either assembled or unassembled, have a full complement of tyres fitted, including spare tyres. The calculation of EPUs through the lifecycle of tyres includes both the outer tyre and the inner tube for pneumatic tyres.¹

During the course of the study, the average weight of a passenger tyre was reviewed. A number of reprocessors reported that the average weight of a used passenger tyre may now be higher than previously, with indications ranging between 8.5kg and 10kg. However, further consultation with industry sources indicated that an EPU of 8kg for used tyres remains relevant, and furthermore Hyder understands that data collected on behalf of Australian Tyre Recyclers Association (ATRA), the largest industry association for tyre reprocessors, assumes an EPU weight of 8kg. However it is noted that different groups and bodies adopt varying figures for EPU weights, for a variety of purposes.

Therefore, in order to maintain consistency with the previous study, and allow greater comparison between studies and external datasets, the EPUs stated above have been retained for the purposes of this study.

2.2.2 CONVERSION OF IMPORT/ EXPORT DATA TO EPUS

Allocation of EPU values to import and export codes

Data on the import and export of loose and fitted tyres was obtained for the 2013-14 financial year. Due to the range of relevant codes, representing new, in-use and used tyres, either loose or fitted (i.e. part of a vehicle), it was necessary to allocate EPU values to each code in order to convert the data to EPUs.

In order to convert the quantity of tyre imports and exports by unit (e.g. number of vehicles) to EPUs, it was necessary to assess each code to determine:

- which classification of tyre the code relates to;
- the state of usage and therefore EPU weight;
- the EPU for a typical tyre under that code; and
- the number of tyres to be attributed to each unit within the code.

These factors were used to determine an “EPU value per unit” which enabled conversion of the import/ export data to EPUs.

A similar assessment was conducted as part of the previous study (Hyder 2012), however given the five year timeframe between the two studies, significant changes have occurred in the structuring of the export and import codes obtained from the ABS. The discussion below

¹ Consistent with the previous study, this study does not cover tyre types smaller than those classified as passenger tyres. Examples of tyres excluded from the study are tyres from bicycles and other cycles; mowers and wheelbarrow; carriages for disabled persons; baby carriages; etc.

describes the procedure that was undertaken to ensure the most accurate interpretation of the data, whilst maintaining consistency between this and previous studies, as much as possible.

In order to ensure that meaningful comparisons could be made between current and previous studies, there was a need to ensure that the methodology utilised in this report incorporated the same assumptions that were made in the previous study (Hyder Consulting, 2012) where these were still relevant. A thorough assessment of the import and corresponding export codes of the Australian Harmonized Exports Commodity Classification (AHECC) and Combined Australian Customs Tariff Nomenclature and Statistical Classification (Customs Tariff) was undertaken. It should be noted that the import codes are given to a higher level of detail, and therefore there are a number of import codes that correlate to a subset of corresponding export codes. Since the previous study changes have been made to the AHECC and Customs Tariff, which came into effect 1 January 2012 including the removal and introduction of a number of new import codes.

Firstly, all export and import codes were checked against the EPU values determined for the previous study. This involved also checking the descriptions provided and noting where there were changes or discrepancies. Where matching import code descriptions were found – the reciprocal import and export codes from both studies were assessed and updated as necessary. There were also a number of new import codes that did not exist in the previous study. Some of these codes needed to be matched with corresponding export codes which was done based on a review of the respective descriptions. In undergoing this checking process; a number of import codes and export codes were rearranged compared with the previous study.

Following the creation of a coherent set of corresponding import and export codes, it was necessary to assess whether the EPU value per tyre for each import code was valid and assign new values where necessary. Again, the previous study was used to inform the EPU values adopted in this study. However as noted above, a number of new codes and changed codes meant that there needed to be a review of some assigned EPU values.

In the instance that the code's description or number did not match with any from the previous study (new or amended codes), an appropriate EPU value was assigned based on Hyder's interpretation and assessment of the code description. EPU values were matched to the most appropriate tyre type as published in the previous study, and in the *Tyre Stewardship Australia Guidelines* (Tyre Stewardship Australia, 2014), presented in Appendix A.

On some occasions it was found that there was a need to re-evaluate the EPUs assigned in previous years, based on updated information. While emphasis was placed on maintaining a consistent approach between the studies, where it was deemed appropriate, EPUs were altered to improve the validity of the assumptions that were made in the previous study. While such alterations have the potential to compromise the uniformity between studies, it was important to ensure that there was absolute confidence in the EPU values being assigned. Any such alterations were made only on occasions where there was an obvious need to update the EPU value based on the respective description.

For the most part, the methodology utilised in the previous study has been followed and therefore changes to assumptions and process were minimal. Nevertheless, the undertaking of this checking process highlighted that comparisons to previous studies should be done so with an understanding of the changes that were made to both the raw ABS data (import and export codes) and to some of the assumptions regarding the assigning of EPU values.

Unit of Measurement

The unit of quantity provided for each of the codes relevant to tyres differs according to the way it is tracked by Customs. That is, while some used tyre codes are measured by weight, most other codes are measured only by number (i.e. of tyres or vehicle). While a "gross weight" in tonnes is provided for all codes (even those that are measured by number), it is not possible to

rely on the recorded gross weight, as this does not represent the entire weight for imports. As explained by the ABS:

For exports, details of gross weight are available for each commodity. For imports, details of gross weight are not available for individual commodities because only the total gross weight is reported for each Customs entry, regardless of how many separate lines / commodities that entry may contain. Gross weight is assigned to the first line / commodity in the entry to enable commodity estimates to be produced. Gross weight data for imports, therefore, should only be disseminated on a regional (i.e. port, state, country) or type of transport (i.e. sea, air, parcel post) basis.

Therefore, although the data provided by ABS may include a gross weight, this weight generally mis-represents the quantity of tyres imported, since any commodity entries not listed as the first commodity for a customs entry will not have the gross weight recorded for that entry.

It was therefore necessary to convert imports and exports for the majority of codes by the number of tyre units (rather than weight). Where codes are measured by weight, the reported weight was used to calculate the EPU for that code.

2.2.3 GEOGRAPHIC DISTRIBUTION OF TYRES

Remoteness classifications have been applied using the Remoteness Structure from the *Australian Standard Geographical Classification (ASGC)* (Cat. No. 1216) published by the Australian Bureau of Statistics (Australian Bureau of Statistics, July 2011)). Consistent with the previous study, the Remoteness Structure has been used for local government areas, refined to a three-tiered remoteness classification as shown in Table 2-3.

Table 2-3 **Remoteness classification**

ABS Remoteness Structure	Remoteness classification for tyres
Major cities	Metropolitan
Inner regional	Regional
Outer regional	Remote
Remote	
Very Remote	

2.3 CONSUMPTION

For the purposes of this study, consumption refers to the sale of whole tyres for the purpose for which they were designed. As detailed in Hyder's methodology (refer Appendix B), consumption of tyres is calculated based on the net importation of loose and fitted tyres, sourced from the Australian Bureau of Statistics (ABS). The net import of tyres has been calculated by balancing the import of loose and fitted tyres with the export of loose and fitted tyres in corresponding import and export product categories (refer to Appendix B for further detail).

Table 2-4 below presents the current and historical consumption of tyres by tyre type, using the findings of this study and the past studies (Hyder, 2009 and 2012). This data is graphically presented in Figure 2-2 and Figure 2-3 overleaf.

Table 2-4 Summary of Historical Tyre Consumption Data (EPUs, 2008 – 2014)

Year	Consumption (EPU)			Per Capita Consumption (EPU)		
	Passenger	Truck	OTR	Passenger	Truck	OTR
2007-08	15,403,000	15,338,000	19,605,000	0.72	0.72	0.92
2008-09	14,348,657	13,606,309	21,222,273	0.66	0.62	0.97
2009-10	17,779,029	16,431,037	18,250,723	0.80	0.74	0.82
2010-2013	Outside of scope					
2013-14	16,265,047	19,334,939	20,935,480	0.69	0.82	0.89

Source: Based on Australian Bureau of Statistics data.

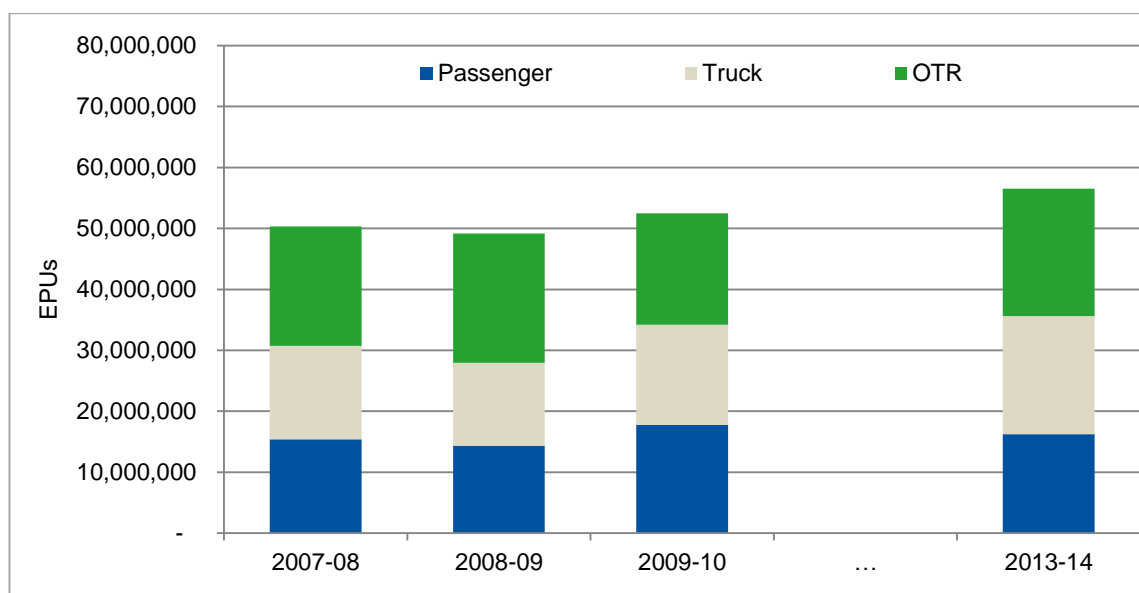


Figure 2-2 Consumption of tyres (EPUs, 2008-2014)

Source: Based on Australian Bureau of Statistics data.

Overall consumption of tyres has increased since the previous study, but varies by tyre type. When the 2013-14 data is compared to the 2009-10 period, there has been an apparent 9% reduction in passenger tyres compared to increases for truck tyres (18%) and OTR (15%). The per capita consumption rates have followed the same trends but the values are generally comparable to those seen historically.

The figure below shows the relationship between tyre consumption per capita and GDP. The data does not suggest a strong correlation between these datasets, although the fall in GDP in 2008-09 corresponds to a slight dip in consumption of tyres.

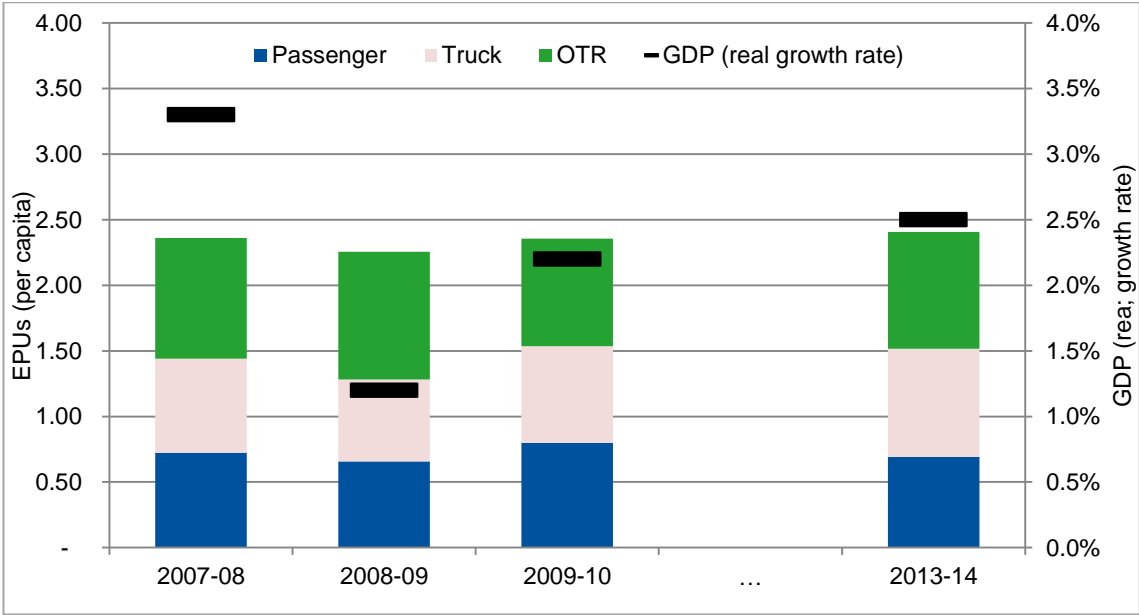


Figure 2-3 Consumption of tyres per capita and economic growth (2008-2014)
Source: Based on Australian Bureau of Statistics data.

2.4 IN-USE

As detailed in Hyder's methodology (refer Appendix B), the total number of tyres in-use for passenger and truck tyres was determined by extrapolating data on the number of passenger vehicles and trucks registered for use in each state and territory. This data is sourced from the *ABS Motor Vehicle Census* (Australian Bureau of Statistics, 2014). Given OTR vehicles are not generally registered, the total number of OTR tyres in-use was estimated using the average lifespan of OTR tyres and historic sales figures for OTR tyres. Refer to Appendix B for further detail.

Figure 2-4 below presents the number of tyres in-use by jurisdiction, Figure 2-5 shows the number of tyres in-use by jurisdiction per capita and Figure 2-6 overleaf presents the number of tyres in use by tyre type.

The number of tyres in use has increased steadily since 2004-05, with the exception of 2007-08 when the quantity in-use declined slightly.

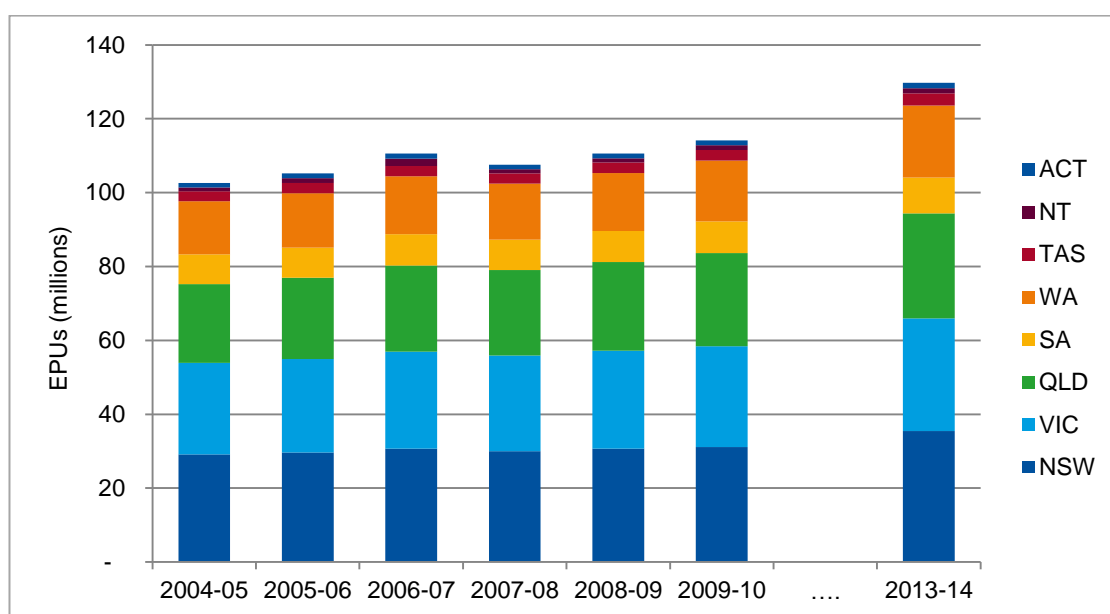


Figure 2-4 Quantity (EPUs) of tyres in use by jurisdiction, current and historical (2005-2014)
Source: Based on Australian Bureau of Statistics data.

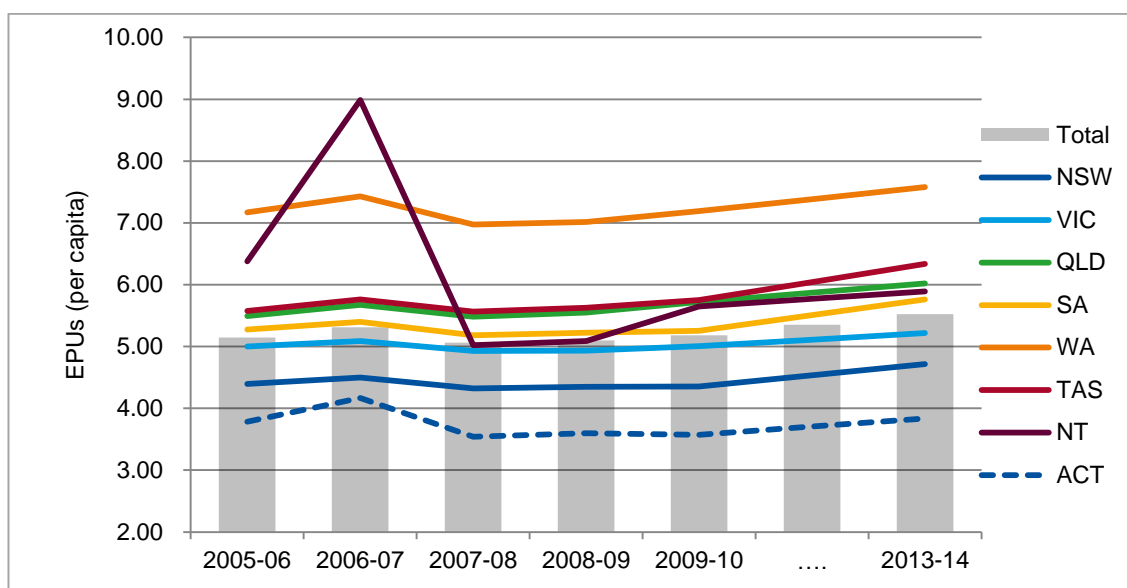


Figure 2-5 Quantity (EPUs) of tyres in use by jurisdiction (per capita), current and historical (2005-2014)

Notes:

Based on Australian Bureau of Statistics data.

Data between 2009-10 and 2013-14 has been extrapolated for the purposes of this graph.

The spike in the number of tyres in-use in the NT and ACT around 2005-06 and 2006-07 is a result of an increase in the reported number of registrations of passenger vehicles and trucks over this period in ABS publication Motor vehicle census (Cat. No. 93090). The reason for this spike in reported registrations of passenger vehicles and trucks in the NT and ACT is unknown.

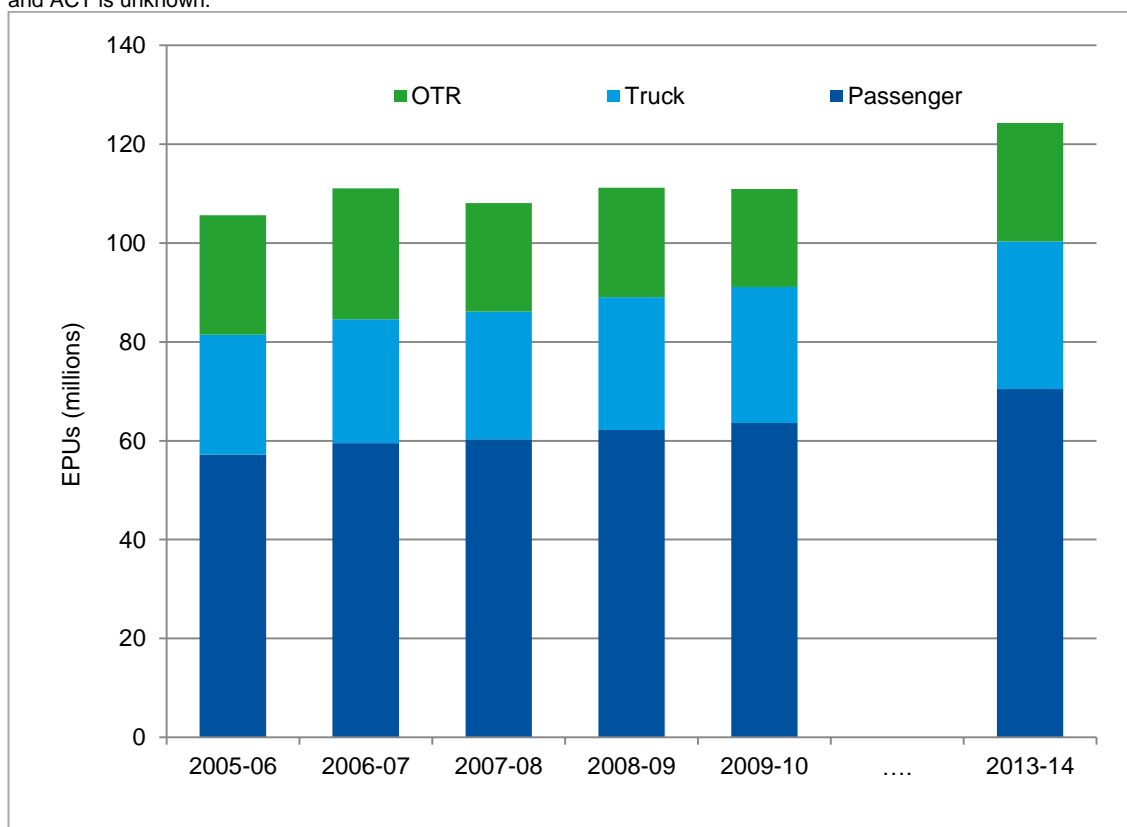


Figure 2-6 Quantity (EPUs) of tyres in use by tyre type, current and historical (2006-2014)

Source: Based on Australian Bureau of Statistics data.

Figure 2-7 and Table 2-5 show the distribution of tyres in-use by remoteness for each state and territory, while Figure 2-8 and Table 2-6 show the distribution of tyres in-use by tyre type for each state and territory.

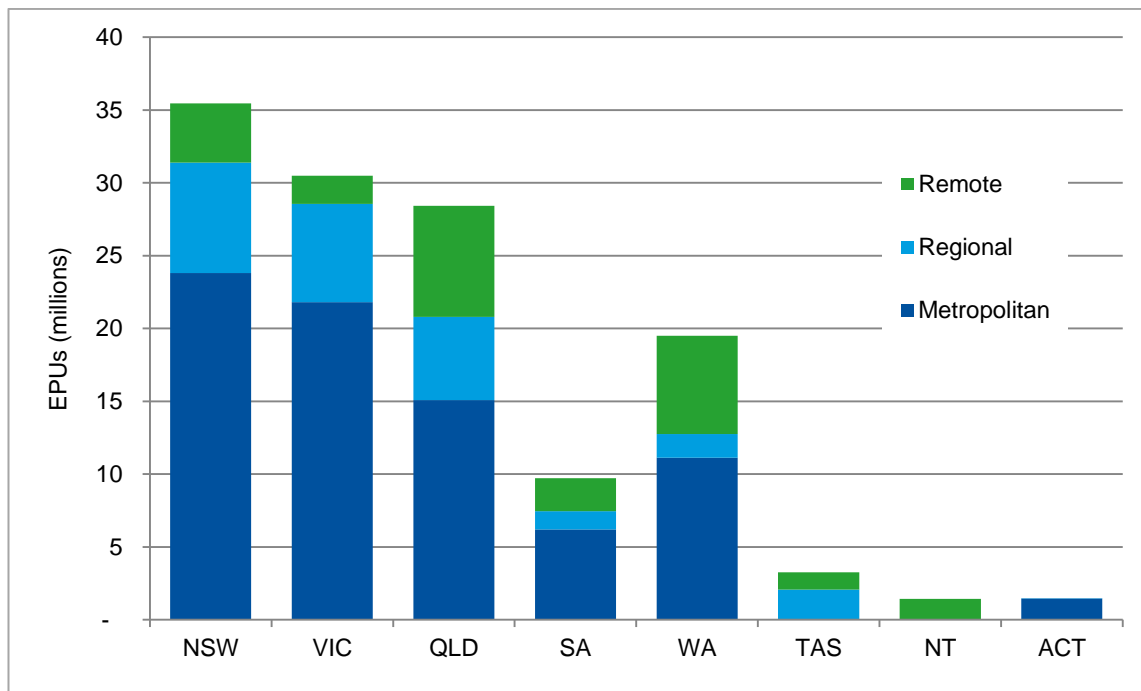


Figure 2-7 In-use by jurisdiction and remoteness (2013-14)
Source: Based on Australian Bureau of Statistics data.

Table 2-5 Quantity (EPUs) of tyres in use by jurisdiction and remoteness (2013-14)

Jurisdiction	Metropolitan	Regional	Remote	Total
NSW	23,811,087	7,582,897	4,068,246	35,462,229
VIC	21,817,282	6,733,870	1,932,842	30,483,994
QLD	15,086,825	5,711,171	7,636,154	28,434,150
SA	6,215,054	1,244,719	2,253,452	9,713,224
WA	11,132,982	1,628,621	6,737,873	19,499,476
TAS	0	2,076,168	1,184,380	3,260,547
NT	0	0	1,443,492	1,443,492
ACT	1,463,822	16,814	0	1,480,636
Total	79,527,051	24,994,258	25,256,439	129,777,748

Source: Based on Australian Bureau of Statistics data.

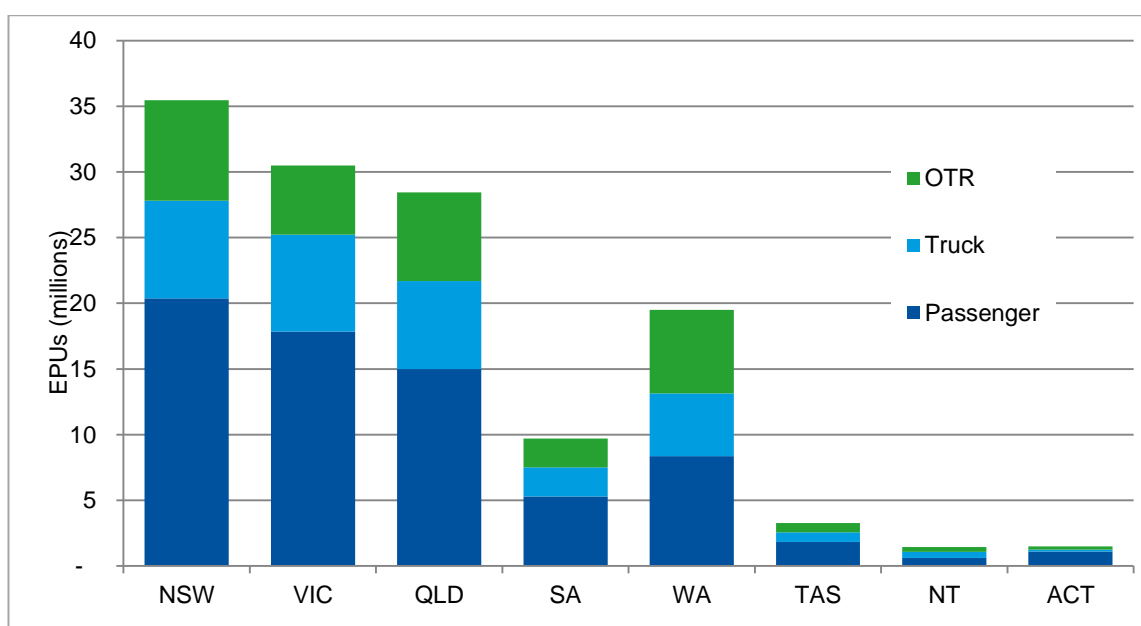


Figure 2-8 In use by jurisdiction and tyre type (2013-14)
Source: Based on Australian Bureau of Statistics data.

Table 2-6 EPU in use by jurisdiction and tyre type (2013-14)

Jurisdiction	Passenger (EPU)	Truck	OTR	Total
NSW	20,383,713	7,436,260	7,642,256	35,462,229
VIC	17,849,682	7,382,606	5,251,706	30,483,994
QLD	14,986,578	6,713,479	6,734,093	28,434,150
SA	5,300,185	2,202,283	2,210,756	9,713,224
WA	8,371,578	4,776,028	6,351,871	19,499,476
TAS	1,835,892	723,010	701,645	3,260,547
NT	623,856	463,720	355,917	1,443,492
ACT	1,110,090	145,925	224,621	1,480,636
Total	70,461,573	29,843,309	29,472,866	129,777,748

Source: Based on Australian Bureau of Statistics data.

2.4.1 RETREADS

Consideration of retreaded tyres in the current study is consistent with the previous Hyder (2012) study. For the purposes of calculating the number of tyres in-use, tyres that are retreaded can be considered to be a subset of the number of tyres that are in-use (see Figure 1-1). Since the number of tyres that are retreaded does not change the number of tyres in-use (they are a substitute for new tyres), Hyder's methodology also assumes that the number of

tyres that are retreaded has no bearing on the method that has been used to calculate the lifespan of tyres or, subsequently, the number of end-of-life tyres (see below).

As such, consistent with the previous Hyder (2012) study, data on retreaded tyres has not been included in the calculation of tyres in-use or end-of-life tyres in Australia². This method is comparable with that used by the Rubber Manufacturers Association in the United States. However it is not consistent with that used by the European Tyre and Rubber Manufacturers Association (ETRMA) and the Japan Automobile Tyre Manufacturers Association (JATMA), who include retreads in the calculation of end-of-life tyres.

Although excluded from the calculation of recovery of domestic end-of-life tyres, for informative purposes, a summary of data ranges obtained from the survey of retreaders on the number of tyres retreaded in Australia is provided in Table 2-7 below. It is noted however that only a limited number of retreaders provided a response to Hyder's survey and the results should be treated as estimates only.

Table 2-7 Range estimates of retreading (2013-14)

Domestic retreading	Tyre Type		
	Passenger (EPUs - thousands)	Truck (EPUs -thousands)	OTR (EPUs - thousands)
2009-10	200–250	4,500–5,000	100–300
2013-14	50-75	60-100	40-300

The data suggests that domestic retreading has decreased by approximately 90-95% since the previous study (Hyder, 2012). This was consistent with industry reports that the practice of retreading in Australia has contracted considerably, and that the majority of retreadable casings are now exported for retreading rather than being retained in Australia. Refer to Section 4.2.1 for further discussion.

² Consistent with the previous study, tyres that are exported from Australia for reuse or retreading are considered to be end-of-life tyres, and are therefore included in the end-of-life tyre data in the following section.

2.5 END-OF-LIFE ARISING

As detailed in Hyder's methodology (refer Appendix B), the total number of end-of-life tyres was calculated using the average lifespan of tyres and tyre consumption quantities. Consistent with the previous study, the average lifespan of passenger and truck tyres was determined by calculating the ratio of the number of tyres in-use and the number of new tyre sales. The number of end-of-life tyres was then estimated to be the number of new tyre sales (i.e. tyre consumption) at the point in time which is equal to the average lifespan of tyres prior to the end of the study period (31 July 2014). Refer to Appendix B for further detail.

Figure 2-9 summarises the end-of-life arisings by tyre type both for the current and previous studies (Hyder, 2009 and 2012). The same data is presented in approximate tonnes in Figure 2-10 below.

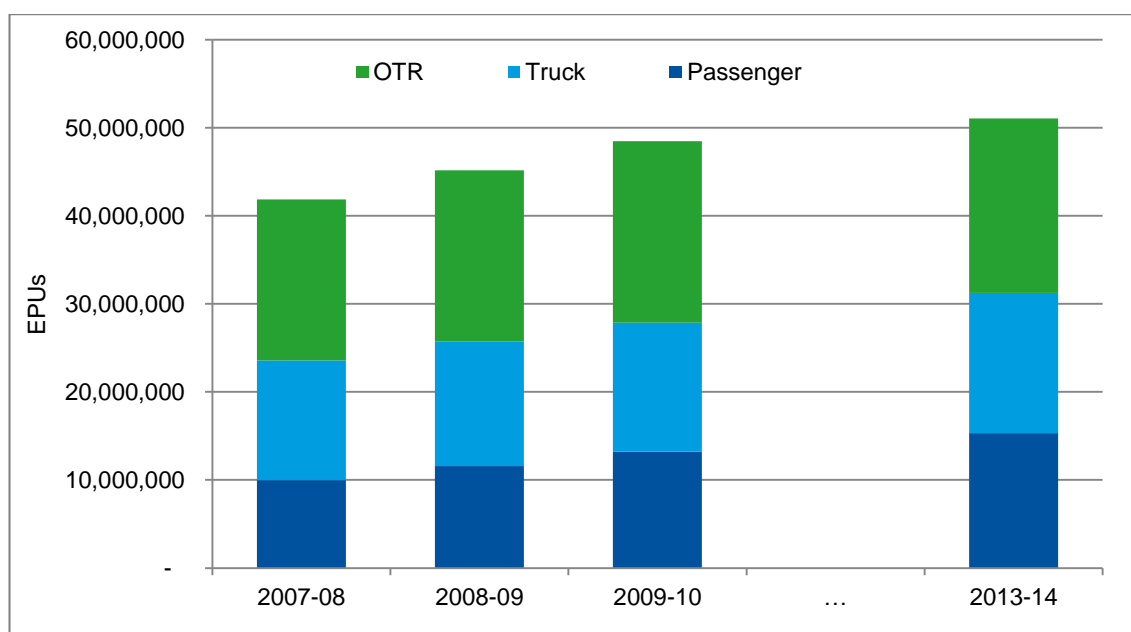


Figure 2-9 End-of-life arisings by tyre type (EPUs, 2008 – 2014)

Source: Based on Australian Bureau of Statistics data.

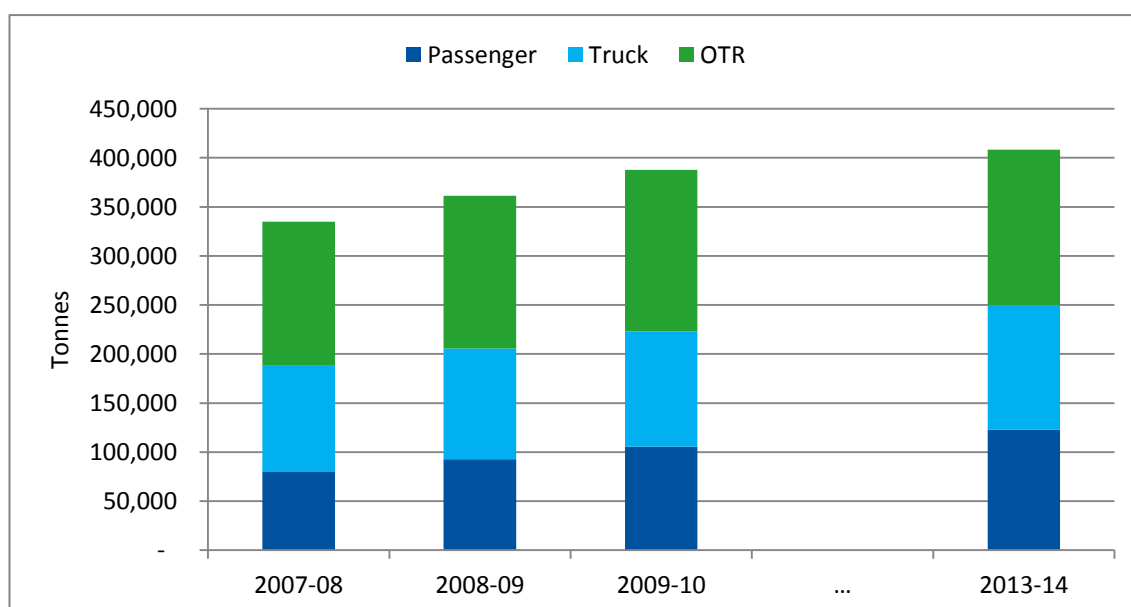


Figure 2-10 End-of-life arisings by tyre type (approximate tonnes, 2008 – 2014)

Source: Based on Australian Bureau of Statistics data.

Figure 2-11 presents the calculation of the lifespan of passenger tyres, which shows an overall decreasing trend from 2007-08 through 2009-10, but then no significant change to 2013-14.

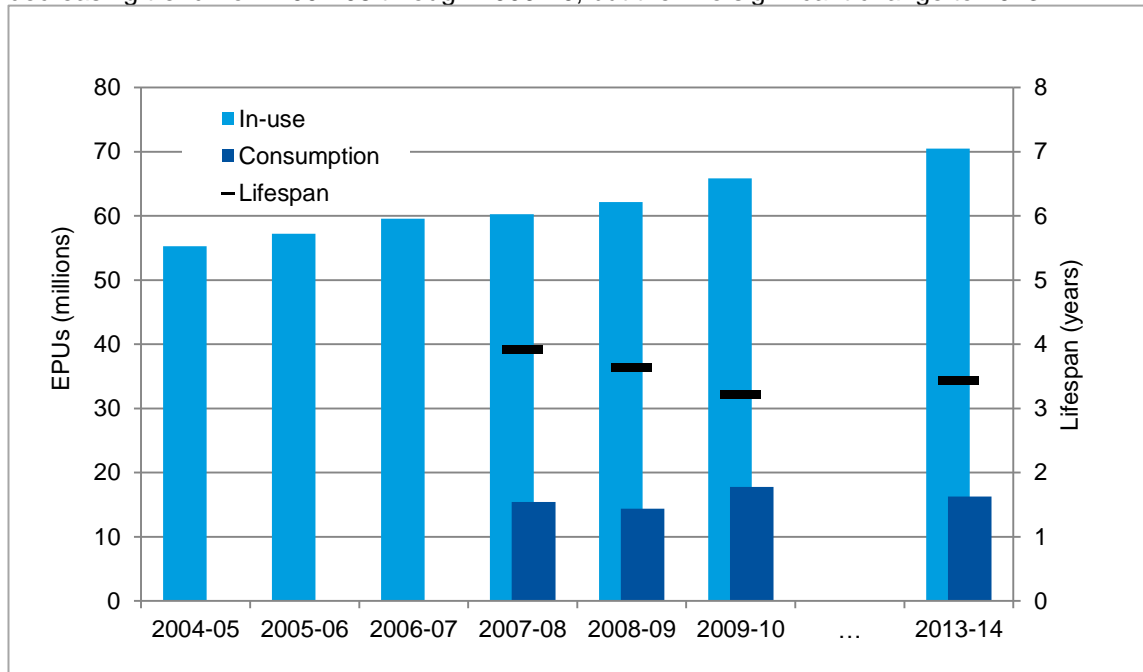


Figure 2-11 Calculation of the lifespan of passenger tyres (2005-2014)

Source: Based on Australian Bureau of Statistics data.

Figure 2-12 illustrate the calculation of the lifespan of truck tyres, which has fluctuated but with no clear trend, compared to passenger tyres.

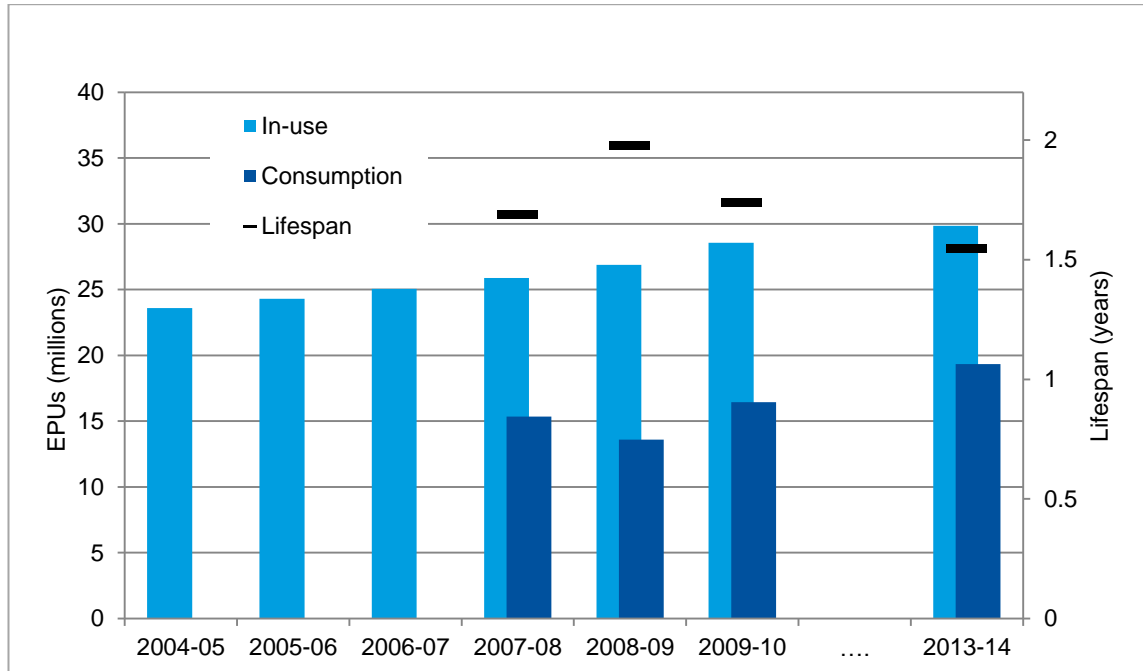


Figure 2-12 Calculation of the lifespan of truck tyres (2005 – 2014)

Source: Based on Australian Bureau of Statistics data.

The data indicates that the lifespan of a passenger tyre has been decreasing over time, from a lifespan of nearly 4 years in 2007-08, to between 3.2 and 3.4 years in 2009-10 and 2013-14 respectively. This is consistent with industry reports that the lifespan of tyres is decreasing.

There have been some reports that the lifespan of tyres has been impacted due to a reduction in the quality and durability of some tyres. The tyre industry has suggested that a significant number of sub-standard tyres (i.e. non-compliant with the relevant Australian Design Rules) are imported to Australia each year. Sub-standard tyres represent a safety concern for motorists and generally enter the waste stream more quickly than other tyres.

The lifespan of truck tyres shows a generally consistent trend with the lifespan fluctuating between approximately 1.7 and 2 years.

The lifespan of OTR tyres is not able to be calculated in the same way as passenger and truck tyres due to the absence of registration data. For the purposes of this study the lifespan of OTR tyres was assumed to be twelve months, which was confirmed by industry sources and is consistent with the previous study. As such, the end-of-life arisings for OTR tyres in 2013–14 was determined to be equal to the consumption of new OTR tyres in 2012–13.

Table 2-8 below summarises the distribution of end-of-life tyres by tyre type for each state and territory, which is presented graphically in Figure 2-13. The same data is presented in tonnes in Table 2-9 overleaf.

Table 2-8 End-of-life arisings by jurisdiction and tyre type (EPUs, 2013–14)

Jurisdiction	Passenger	Truck	OTR	Total
NSW	4,436,453	3,967,175	5,043,214	13,446,842
VIC	3,884,929	3,938,551	3,427,902	11,251,382
QLD	3,261,783	3,581,578	4,559,469	11,402,830
SA	1,153,569	1,174,897	1,481,117	3,809,583
WA	1,822,049	2,547,966	4,422,481	8,792,495
TAS	399,576	385,719	469,748	1,255,044
NT	135,780	247,390	241,286	624,456
ACT	241,608	77,850	139,303	458,760
Total	15,335,748	15,921,124	19,784,519	51,041,392

Source: Based on Australian Bureau of Statistics data.

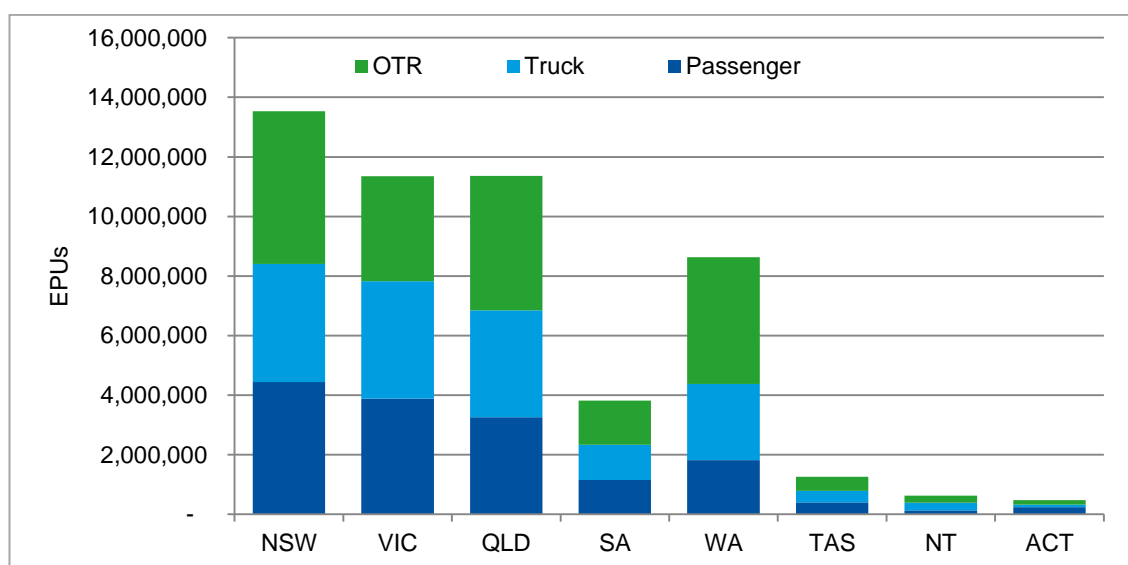


Figure 2-13 End-of-life arisings by jurisdiction and tyre type (EPUs, 2013-14)

Source: Based on Australian Bureau of Statistics data.

Table 2-9 End-of-life arisings by jurisdiction and tyre type (approximate tonnes, 2013-14)

Jurisdiction	Passenger	Truck	OTR	Total
NSW	35,492	31,737	41,041	108,270
VIC	31,079	31,508	28,203	90,791
QLD	26,094	28,653	36,164	90,911
SA	9,229	9,399	11,872	30,500
WA	14,576	20,384	34,111	69,071
TAS	3,197	3,086	3,768	10,050
NT	1,086	1,979	1,911	4,977
ACT	1,933	623	1,206	3,762
Total	122,686	127,369	158,276	408,331

Source: Based on Australian Bureau of Statistics data.

Table 2-10 and Figure 2-14 shows the distribution of end-of-life tyres by remoteness for each state and territory by tyre type for each state and territory.

Table 2-10 End-of-life arisings by jurisdiction and remoteness (EPU's, 2013-14)

Jurisdiction	Metropolitan	Regional	Remote	Total
NSW	9,007,170	2,877,228	1,562,444	13,446,842
VIC	8,043,068	2,489,325	718,989	11,251,382
QLD	6,027,280	2,285,908	3,089,642	11,402,830
SA	2,430,860	488,700	890,023	3,809,583
WA	4,983,632	730,724	3,078,139	8,792,495
TAS	0	798,438	456,606	1,255,044
NT	0	0	624,456	624,456
ACT	453,471	5,290	0	458,760
Total	30,945,480	9,675,613	10,420,299	51,041,392

Notes:

Source: Based on Australian Bureau of Statistics data.

Under the ABS Remoteness Structure (refer to Section 2.2.3), none of the LGAs in Tasmania or Northern Territory are classified as metropolitan, hence there were no end-of-life arisings in metropolitan areas in these jurisdictions.

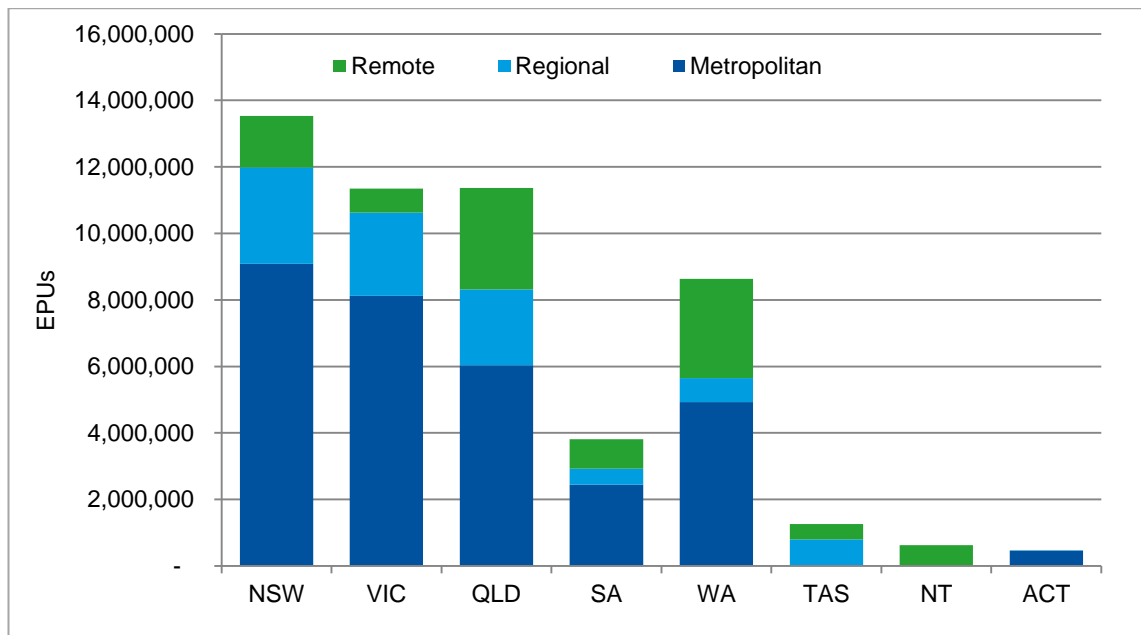


Figure 2-14 End-of-life arisings by jurisdiction and remoteness (2013–14)

Source: Based on Australian Bureau of Statistics data.

2.6 DOMESTIC DESTINATION OF END-OF-LIFE TYRES

As detailed in Hyder's methodology (refer Appendix B), the fate of tyres reaching an end-of-life destination in Australia has been estimated based on the results of an industry survey. Refer to Appendix B for further detail).

Table 2-11 and Figure 2-15 provides a breakdown of the domestic destination of end-of-life tyres and tyre derived product (TDP). A more detailed discussion of each destination is provided in the following sections.

Table 2-11 Domestic destination of end-of-life tyres by tyre type (EPUs, 2013-14)

Type	Material recycling	Energy recovery	Civil engineering	Licensed landfill ¹	Legitimate stockpiling	Managed on-site ² (unverified)	Unknown data ³	Total
Passenger	350,060	10,800	223,125	3,873,987	381,475	-	38,423	4,877,870
Truck	1,476,182	313,700	200,000	3,834,178	246,275	-	5,161,971	11,232,306
OTR	36,571	3,000	0	279,438	521,250	15,701,783	1,744,643	18,286,683
Total	1,862,813	327,500	423,125	7,987,603	1,149,000	15,701,783	6,945,037	34,396,860

Notes:

1. It is noted that a complete set of data for licenced landfilling of tyres was not available (refer to Section 2.6.2), as such a proportion of licenced landfill data has been based on a number of assumptions. Where state data was not available, this has been estimated by extrapolating other state data using population data, by assuming consistent per capita landfilling of tyres. Furthermore, the quantity of tyres landfilled as part of shredder flock has been estimated based on advice from industry sources.
2. Although Hyder was unable to verify exact quantities, a number of sources have advised that more than 90% of OTR tyres are managed on-site (refer to Section 4.2.5 for further discussion). Hyder has therefore applied a conservative estimate of 90% to determine the quantity of tyres managed on-site, however it is noted that this quantity remains unverified.
3. Unknown data constitutes the balance of tyres which have not been recorded as recycled, recovered for energy, landfilled or exported.

A breakdown of the domestic destination of end-of-life tyres by state/ jurisdiction has not been provided as, given the limited number of players in some sectors, it could reveal commercially sensitive information.

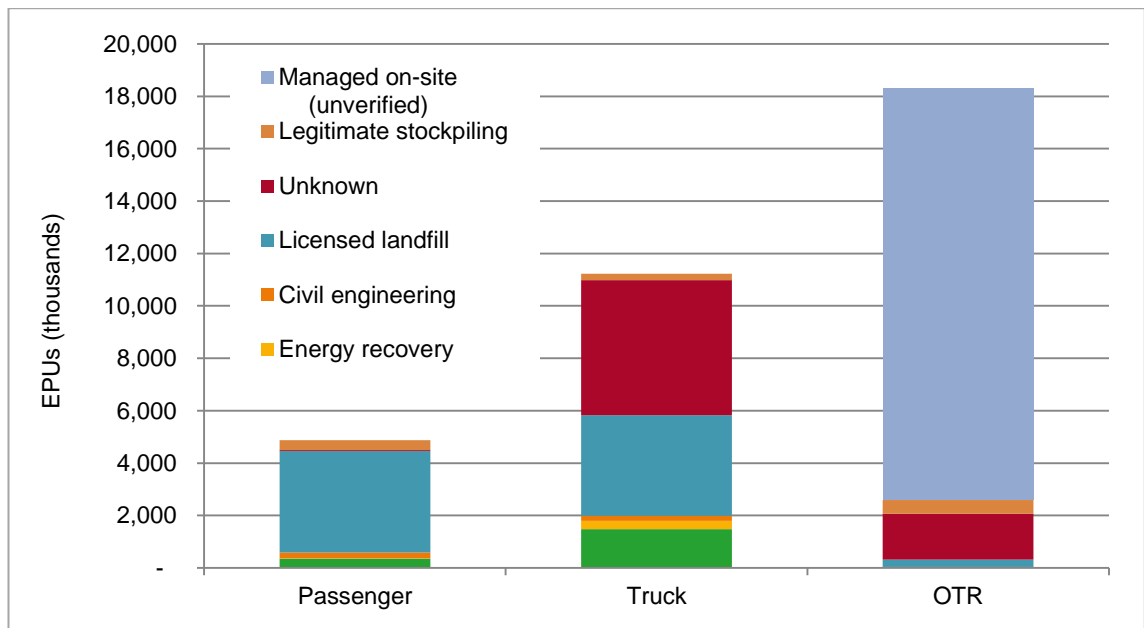


Figure 2-15 Domestic destination of end-of-life tyres by tyre type (2013-14)

Figure 2-16 and Table 2-12 provide a comparison of the domestic destination of end-of-life tyres for the 2009-10 and 2013-14 financial years (data presented in EPU).

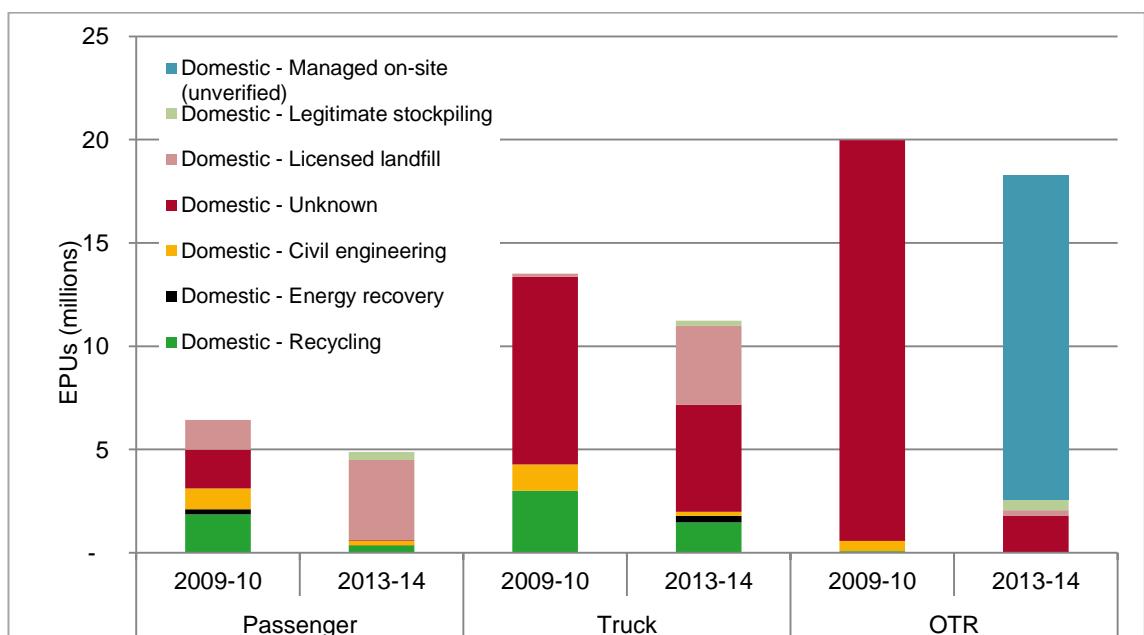


Figure 2-16 Domestic destination of end-of-life tyres by tyre type (2009–10 and 2013-14)

Table 2-12 Domestic destination of end-of-life tyres by tyre type (EPUs, 2009–10 and 2013-14)

Domestic Destination	Passenger		Truck		OTR		Total	
	2009-10	2013-14	2009-10	2013-14	2009-10	2013-14	2009-10	2013-14
Recycling	1,853,750	350,060	2,999,750	1,476,182	75,000	36,571	4,928,500	1,862,813
Energy recovery	250,000	10,800	-	313,700	-	3,000	250,000	327,500
Civil engineering	1,016,625	223,125	1,276,375	200,000	500,000	-	2,793,000	423,125
Licensed landfill	1,450,073	3,873,987	161,119	3,834,178	-	279,438	1,611,192	7,987,603
Legitimate stockpiling	-	381,475	-	246,275	-	521,250	-	1,149,000
Unknown	1,865,043	38,423	9,078,286	5,161,971	19,400,840	1,744,643	30,344,169	6,945,037
Managed on-site (unverified)		-		-		15,701,783		15,701,783

Table 2-13 Domestic destination of end-of-life tyres by tyre type (tonnes, 2009–10 and 2013-14)

Domestic Destination	Passenger		Truck		OTR		Total	
	2009-10	2013-14	2009-10	2013-14	2009-10	2013-14	2009-10	2013-14
Recycling	14,830	2,800	23,998	11,809	600	293	39,428	14,830
Energy recovery	2,000	86	-	2,510	-	24	2,000	2,000
Civil engineering	8,133	1,785	10,211	1,600	4,000	-	22,344	8,133
Licensed landfill	11,601	30,992	1,289	30,673	-	2,236	12,890	11,601
Legitimate stockpiling	-	3,052	-	1,970	-	4,170	-	-
Unknown	14,920	307	72,626	41,296	155,207	13,957	242,753	14,920
Managed on-site (unverified)		-		-		125,614		-

2.6.1 DOMESTIC RECOVERY OF TYRES

Reported domestic recycling and recovery of end-of-life tyres (including material recycling, energy recovery and civil engineering) has reduced significantly compared to the previous study, from 16% in 2009-10 to 5.1% in 2013-14. This is consistent with information provided by industry sources, who reported that Australian reproprocessors are now extremely reliant on international fuel markets, due to the limited size of the local market for recovered products. This is further discussed in Section 4.

It is also noted that, a number of respondents were unable to provide a breakdown of tyres by tyre type, in these instances assumptions (based on quantities reported by similar reproprocessors or collectors) were necessary to complete the dataset.

2.6.2 LICENSED LANDFILL

Due to the lack of publicly available national waste data (the most recent published data is for the 2010-11 period), state governments were requested to provide data on landfilling of tyres in each jurisdiction.

At the time of reporting, data had been received from 7 of the 8 jurisdictions, however some states acknowledged that the data provided was incomplete or potentially unreliable. As such there was a need to extrapolate the data for three states based on population data, assuming a consistent per capita disposal rate. Hyder acknowledges that this assumption could be subject to a high degree of uncertainty given the differing regulatory standards and market conditions that affect the landfilling of tyres. In some instances, the quantity of tyres reported as landfilled by reproprocessors exceeded that reported by the relevant jurisdiction, in these instances the larger of the two quantities was included in Hyder's calculations.

Estimation of the quantity of tyres to landfill also included the proportion of tyres that are sent to landfill as part of shredder floc. Hyder has assumed that these would not have been counted in the tyres to landfill data provided by some jurisdictions. Hence representatives of the metal reprocessing industry were consulted in order to estimate overall shredder floc quantities, and the proportion of that which is tyres. Hyder conducted additional research in order to validate this quantity, and has adopted an assumed proportion that is on the lower end of published ranges (Ciacci, 2010) (Department of the Environment and Heritage, 2002). The precise quantity of tyres in shredder floc has not been revealed in this report as it may be considered commercially sensitive; however it is included in the aggregated total tyres to landfill data presented in Figure 2-17 below.

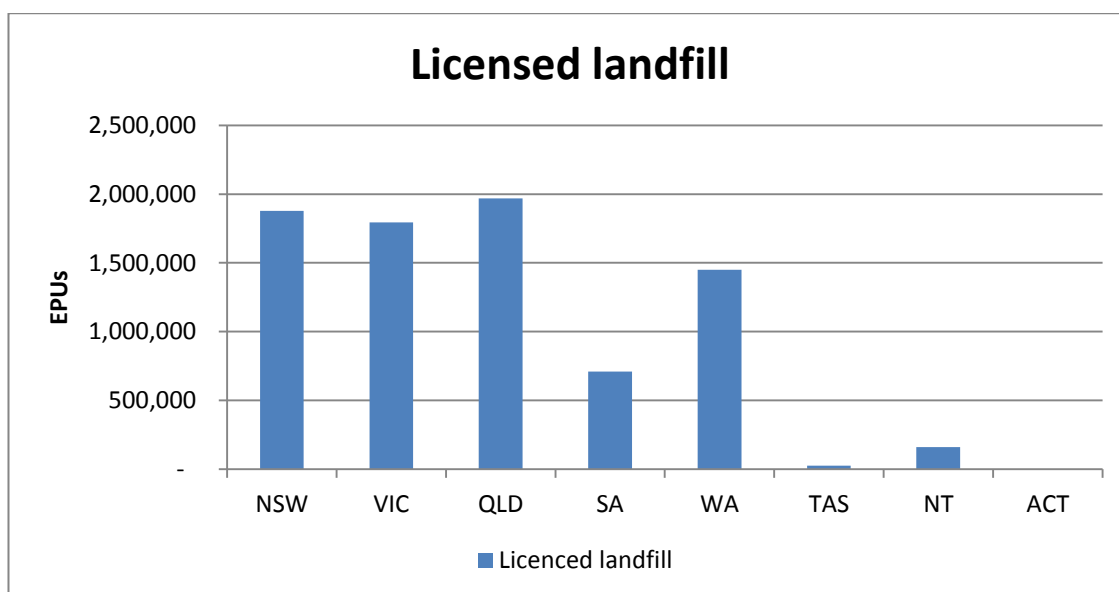


Figure 2-17 Estimated Quantity of Tyres Deposited to Licensed Landfills, by Jurisdiction (EPUs, 2013-14)

Note: The above data includes tyres sent to landfill as part of shredder floc.

It is noted that the quantity landfilled in Western Australia is expected to be much greater than shown above. There is limited available data for regional landfills in WA, due in part to the limited reporting requirements imposed on these landfills. However there is anecdotal evidence to suggest that landfill disposal is a significant management pathway in regional WA.

2.6.3 LEGITIMATE STOCKPILING

For the purposes of this study, a separate category has been formed to account for tyres which are considered to be “legitimately” stockpiled – that is, tyres that are stockpiled on private land, with the permission of the landowner, in compliance with the relevant state or local government regulations and requirements, either with or without any immediate plans to process those tyres.

The industry survey identified some instances of legitimate stockpiling, amounting to an estimated 1,149,000 EPUs. All recorded instances advised of future plans of recycling or energy recovery. A breakdown by state has not been provided as the data was provided by a limited number of players (only 2, each in different states) and it could reveal commercially sensitive information.

Consultation with local and state governments across each jurisdiction indicated that data on stockpiling is not generally available – only two Councils reported tyre stockpiles on private land with the largest consisting of an estimated 1,200 tyres (1,080 passenger tyres and 120 OTR). The majority of metropolitan councils were able to give an indication on legitimate stockpiling of tyres relating to council run waste facilities. Only one of the regional councils was able to provide an estimate on the number of legitimately stockpiled tyres on private property and was a relatively small amount (approximately 300 EPUs).

Some states were able to provide data on the quantity of tyres in legacy stockpiles. In Victoria, it is estimated that there are approximately 6,311,750 EPUs currently sitting in stockpiles across the state. The majority of tyres are noted to be located within a significant stockpile in Stawell, the size of which has been difficult to accurately estimate – estimates range between 1 and 9 million EPUs, with a mid-range estimate of 6 million EPUs used for the total quantity noted above. Hyder was also informed of a significant stockpile in Tasmania which is likely in excess of 1 million EPUs. This stockpile has reportedly formed following the cessation of tyre exports from Tasmania. Information on legacy stockpiles in other states was not made available to Hyder.

2.6.4 MANAGED ON-SITE

Consultations with industry sources and members of the mining industry have indicated that a large proportion of OTR tyres are managed on-site or “in-pit” (refer to Section 4.2.5 for further discussion), as such the current Study has estimated that approximately 79% of OTR tyres were managed on-site, although it is noted that this quantity has not been verified due to the lack of quantitative data on OTR tyre management.

2.6.5 UNKNOWN DATA

It is noted that in order to improve the quality of the data for the current study, a much broader survey of the industry was conducted than previously, with data supplied by more than 46 collectors and reprocessors. The industry survey conducted for the current study was much more comprehensive than the previous study, and enabled the reporting of data on instances of ‘legitimate stockpiling’, as explained above.

However despite additional efforts, Hyder’s analysis has still resulted in a proportion of ‘unknown’ data, although the data gap is considerably less than for the 2009-10 study (62.6% of tyres with unconfirmed destination compared to 13.6% in 2013-14). The data gap for passenger tyres has been notably reduced, with only 0.3% of passenger tyres unaccounted for in the current Study. This compares to 32.4% of truck tyres and 8.8% of OTR tyres which Hyder was not able to determine the destination.

This ‘unknown’ category is assumed to include disposal to unlicensed landfills, stockpiling and illegal dumping, which is discussed further below. This category may also include quantities of exported tyres not shown in the data provided by ABS (refer to Section 4.2.4 for further discussion).

In order to further explore the issue of illegal dumping across Australia, Hyder sought information from local and state governments across each jurisdiction. A total of 67 local governments were contacted with a survey that was designed to assess the extent of illegal tyre dumping in their area to provide more information pertaining to the fate of end of life tyres. Of the 67 local governments contacted, 25 responded to the survey, a response rate of 37%. Of the 25 respondents, five were metropolitan, nine were regional and eleven were remote.

As expected, there was limited data available on illegal dumping, and the information provided was largely qualitative and is summarised overleaf.

Information on disposal fees for tyres was also requested in the survey. Disposal fees for passenger tyres at a metropolitan waste management facility are reportedly in the range of \$4 - \$7 per tyre. Most regional councils reported a similar range, although a few charged \$10 per tyre.

Illegal Dumping

The respondents provided some commentary on the most common locations of illegal dumping incidents. Illegal dumping appears to be most prevalent on public land such as quiet roads, forestry areas, lakes and swamps. The trend in the amount of illegally dumped tyres varied across the metropolitan councils with some noting a decreasing trend while others suggested a 20% increase over the past three years.

Regional councils reported similar observations in regards to illegal dumping of tyres; the majority identified public land such as roads and parks as common settings for illegal dumping, as well as in waterways. Many of the regional councils were of the opinion that trends in illegal dumping had remained relatively stable recently with one increase noted due to the closure of the local landfill.

Generally data from remote councils was more difficult to gather, however it was noted that there are more options to illegally dump tyres in these regions compared to more populous regions, where council managed land may be the only option. Many councils indicated that due to the size of their LGA and areas that are controlled by state/territory agencies, the extent of illegal dumping is often hard to quantify.

Regardless of the remoteness of the council the most prevalent occurrences of illegal dumping took place on public land, often state/national parks and waterways. In many cases these instances of illegal dumping would be reported to the agency responsible for the public land, which was often not the council, making it difficult to determine the true scale of illegal dumping at the local government level.

Discussions with state governments also indicated that the amount of illegal dumping was not well understood as specific data on this issue is generally not tracked. Some data was provided however it was generally noted that the data was not considered accurate or complete. In NSW it was estimated that between 62,500 and 93,750 EPU are dumped illegally every year, compared to Victoria where it was estimated that over 250,000 EPU were dumped in the same period.

2.7 EXPORT OF TYRES AND TDP FROM AUSTRALIA

This section presents data on the export of all tyres and Tyre Derived Product (TDP) under AHECC chapters 40, 87 & 88 as outlined in the *Project Plan*. As detailed in Hyder's methodology (refer Appendix B), data on the amount of tyres and TDP exported from Australia was estimated based on data obtained from the ABS.

Data on the export of tyres in this section is considered in two sections; firstly the export of *all* tyres, including new tyres, is presented in Section 2.7.1, while Section 2.7.2 presents export data of only used tyres and TDP (excluding new tyres). The data has been partitioned in this way as it is considered useful to present exported end-of-life tyres that exclude new tyres.

2.7.1 EXPORT OF ALL TYRES (INCLUDING NEW)

Export of All Tyres by Tyre Type

Figure 2-18 shows the export of all tyres and TDP (in all forms) in 2013-14 compared to historical data. There has been a dramatic increase (by nearly 170%) in export of tyres since the previous study.

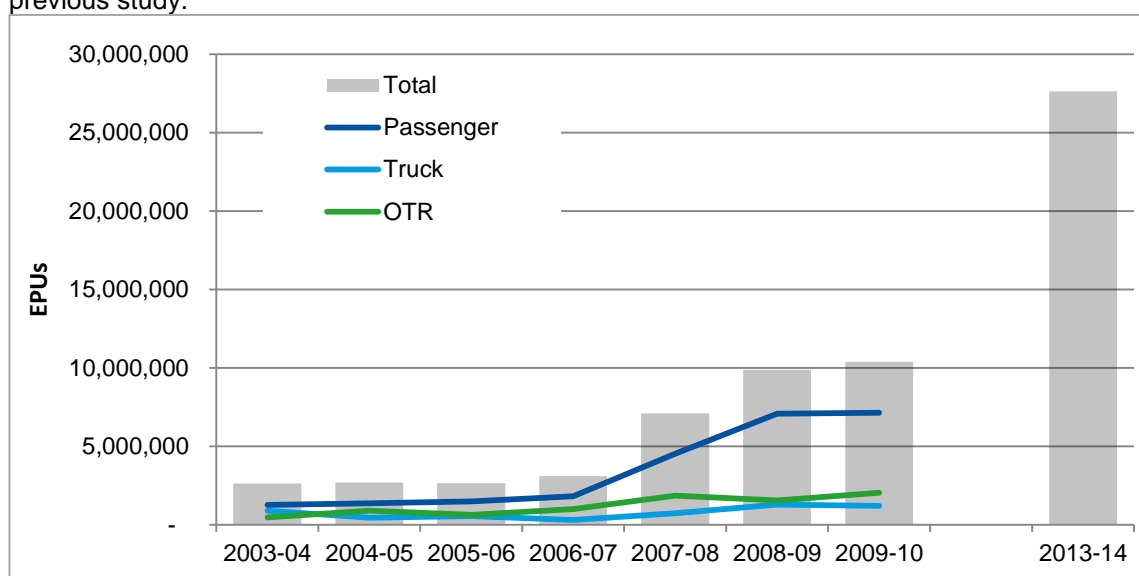


Figure 2-18 Export of all tyres (including new) and TDP by tyre type (EPUs, 2004-2014)

Source: Based on Australian Bureau of Statistics data.

Figure 2-19 overleaf shows export of all tyres in 2013-14 by state of usage (i.e. new, in-use, retreaded, used or TDP), which is summarised in Table 2-15.

The data indicates a dramatic increase in not only the quantity of end-of-life tyres (in-use, used and as TDP), but also the quantity of new tyres exported from Australia, since the previous study.

As discussed in Section 2.2.2, as part of Hyder's analysis of the import/ export data, it was necessary to allocate EPU values to each code in order to convert the data to EPUs. A range of assumptions were necessary in order to allocate EPU values, and these may have influenced the data. In particular, the proportion of used/ loose tyres and used/ baled tyres has been informed by data provided through the industry survey, and therefore is subject to a degree of uncertainty. Refer to Section 4.2.4 for further discussion of issues associated with tyre export data.

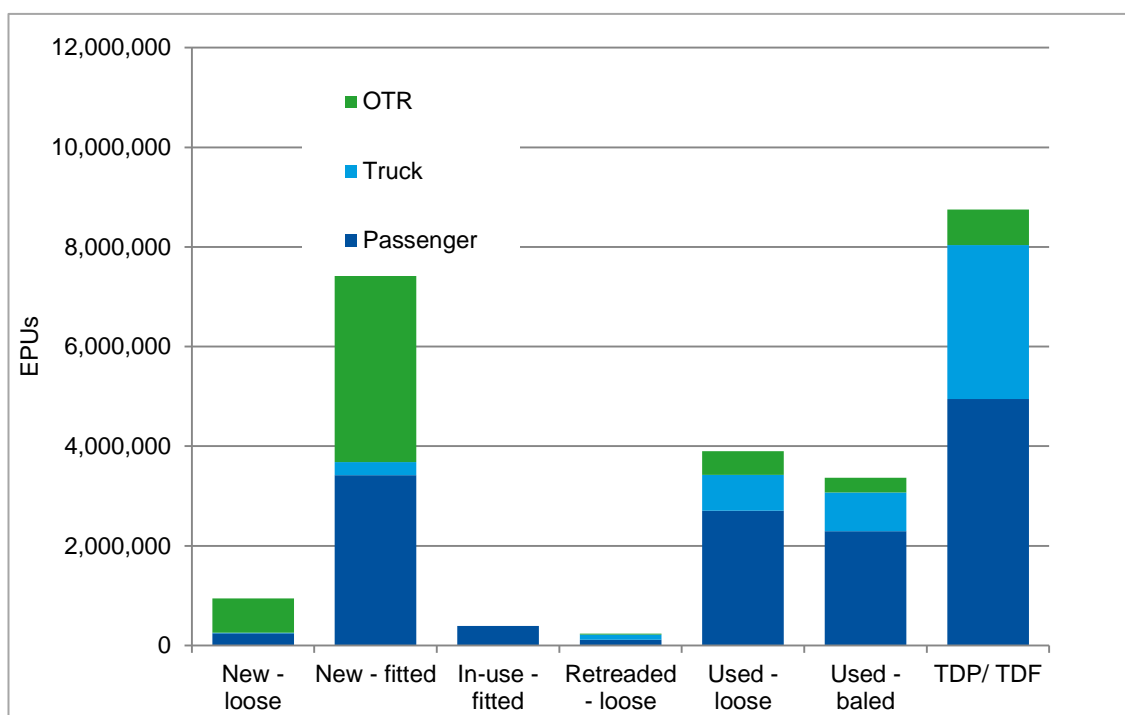


Figure 2-19 Export of all tyres and TDP by tyre type and state (loose, fitted, baled or TDP) (2013–14)
Source: Based on Australian Bureau of Statistics data.

The graph above shows that the dramatic rise in export of new tyres can be partly attributed to a significant quantity of OTR tyres that were exported in the 2013-14 year. These tyres were predominantly exported via vehicle export codes (i.e. new, fitted tyres). It is noted that review of the raw data for the previous 2009-10 study identified that data received from ABS was missing export data for Chapter 84. This largely explains the dramatic rise in export of new fitted tyres.

Table 2-14 Export of all tyres and TDP by tyre type and state (loose, fitted, baled or TDP) (2013–14)

	Passenger	Truck	OTR	Total
New - loose	245,051	12,581	687,985	945,617
New - fitted	3,421,225	263,574	6,389,744	10,074,544
In-use - fitted	393,110	-	-	393,110
Retreaded - loose	112,991	103,160	19,880	236,031
Used - loose	2,706,155	720,826	472,396	3,899,377
Used - baled	2,296,480	775,013	295,803	3,367,296
TDP/ TDF	4,949,141	3,089,819	709,757	8,748,718
Total	14,124,154	4,964,973	8,575,565	27,664,692

Source: Based on Australian Bureau of Statistics data.

Figure 2-20 overleaf compares the export of tyres by state of usage for the 2009-10 and 2013-14 years, which is also summarised in Table 2-15 below. The data again shows the dramatic

increase in the quantity of new tyres exported from Australia, and the export of in-use and used tyres has also risen by over 90%.

Table 2-15 Export of all tyres and TDP by state of usage (EPUs, 2009-10, 2013-2014)

State of usage	2009-10	2013-14	% increase since 2009-10
New	8,542	16,605	94%
In use & used	1,835	11,020	500%
Total	10,377	27,625	166%

Source: Based on Australian Bureau of Statistics data.

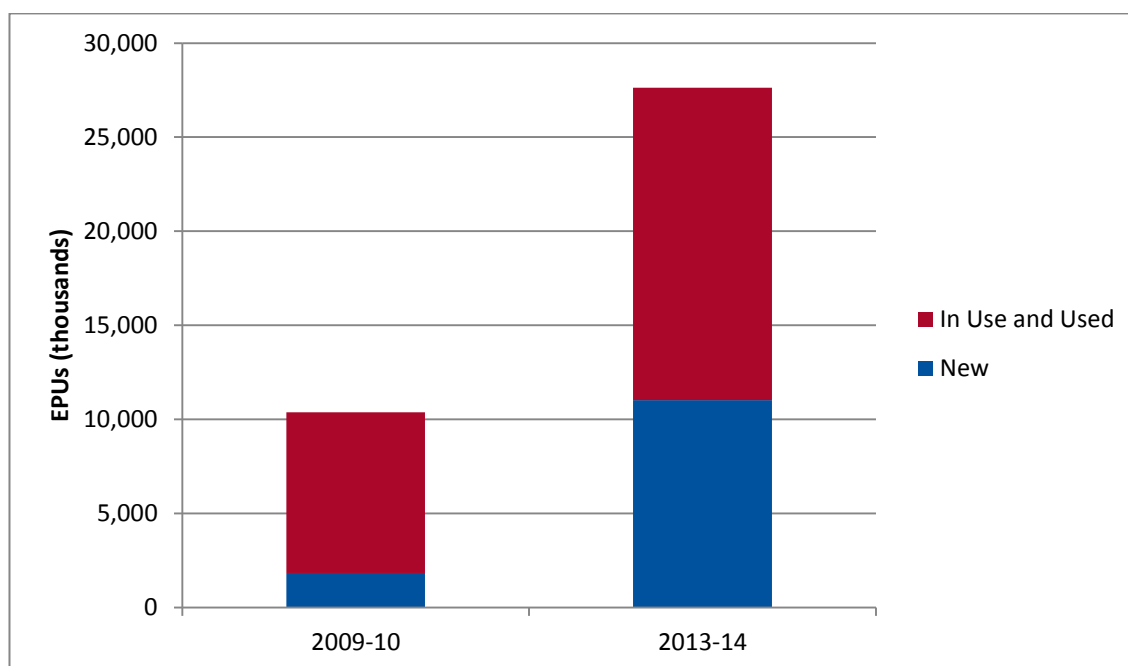


Figure 2-20 Export of all tyres and TDP by state of use (2009-10 and 2013-14)

Source: Based on Australian Bureau of Statistics data.

2.7.2 JURISDICTION OF EXPORT

Figure 2-21 and Table 2-16 show the trend in export of all tyres and TDP by jurisdiction. The data indicates that the significant increase in exports can be largely attributed to the rise in exports from Victoria, Queensland and NSW.

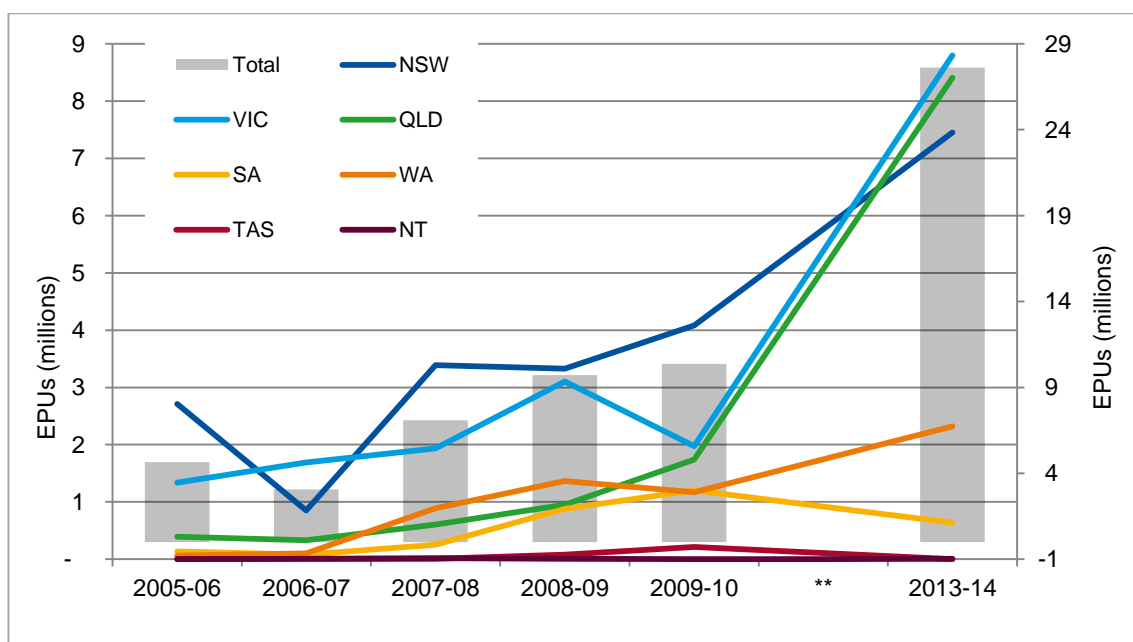


Figure 2-21 Export ports by jurisdiction (EPUs, 2006-2014)

Notes : Based on Australian Bureau of Statistics data.

** Data between 2009-10 and 2013-14 has been extrapolated for the purposes of this graph.

Table 2-16 Export ports by jurisdiction (EPUs, 2006 – 2014)

Jurisdiction	2005-06	2006-07	2007-08	2008-09	2009-10	2013-14
NSW	2,711,165	851,269	3,385,863	3,324,717	4,080,369	7,452,028
VIC	1,338,712	1,686,880	1,937,175	3,101,319	1,976,615	8,800,200
QLD	394,662	333,097	607,477	953,490	1,737,778	8,408,611
SA	135,210	80,201	252,685	879,833	1,203,399	635,970
WA	63,306	100,585	889,553	1,362,460	1,166,809	2,322,956
TAS	1	8,380	4,089	81,548	212,683	1,040
NT	1,749	7,502	15,530	9,026	1,324	4,266
Total	4,644,806	3,067,914	7,092,371	9,712,392	10,378,978	27,625,072

Notes: Data between 2009-10 and 2013-14 was beyond the scope of this study.

Figure 2-29 and Table 2-17 overleaf shows the export of all tyres and TDP by jurisdiction, by lifecycle pathway for the 2013-14 financial year.

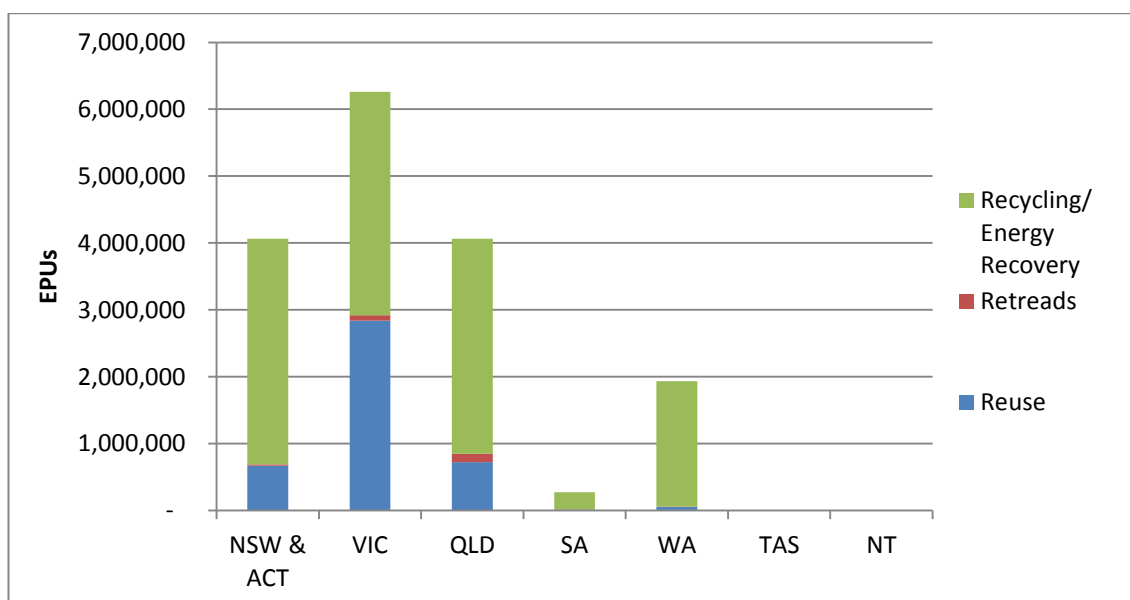


Figure 2-22 Export ports by jurisdiction, by lifecycle state (EPUs, 2013-14)

Table 2-17 Export ports by jurisdiction, by lifecycle state (EPUs, 2013-14)

Jurisdiction	Reuse	Retreads	Recycling/ Energy Recovery	Total
NSW & ACT	668,777	22,414	3,375,126	4,066,317
VIC	2,838,431	83,201	3,340,492	6,262,123
QLD	721,588	124,753	3,218,039	4,064,379
SA	10,813	2,150	262,688	275,651
WA	52,586	3,513	1,880,050	1,936,149
TAS	-	-	-	-
NT	292	-	-	292
Total	4,292,487	236,031	12,076,394	16,604,911

Table 2-18 and Figure 2-23 below show the export of end-of-life tyres (excluding new) by jurisdiction for the 2013-14 financial year.

Table 2-18 Export ports by jurisdiction, excluding new (EPUs, 2013-14)

Jurisdiction	2013-14
NSW	4,066,317
VIC	6,262,123
QLD	4,064,379
SA	275,651
WA	1,936,149
TAS	-
NT	292

Jurisdiction	2013-14
Total	16,604,911

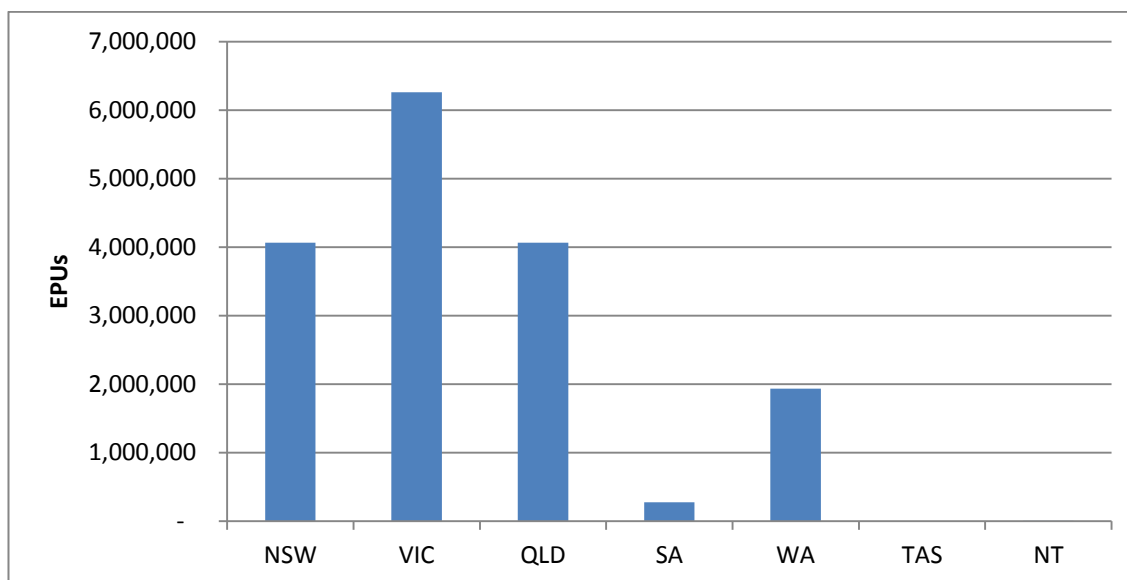


Figure 2-23 Export ports by jurisdiction, excluding new (EPU), 2013-14)

Figure 2-24 below shows the trend in export of all tyres and TDP by jurisdiction on a per capita basis.

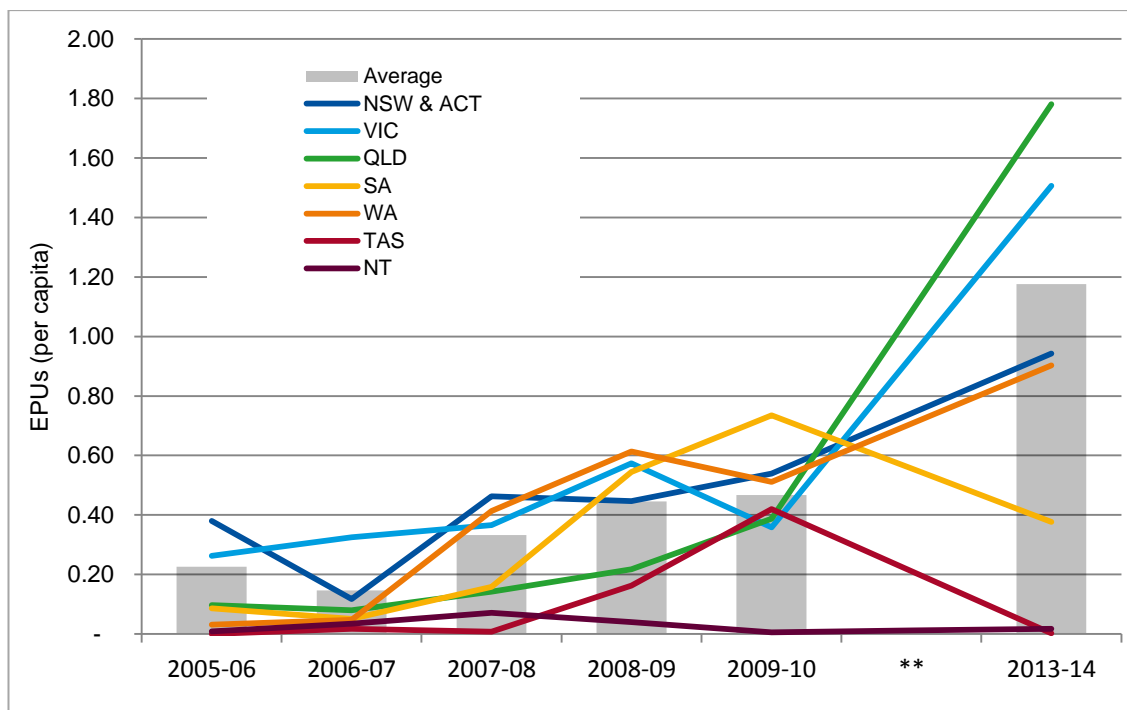


Figure 2-24 Export ports by jurisdiction per capita

Notes: Based on Australian Bureau of Statistics data.

** Data between 2009-10 and 2013-14 has been extrapolated for the purposes of this graph.

2.7.3 EXPORT OF END-OF-LIFE TYRES (EXCLUDING NEW)

When considering the export of end-of-life tyres it is more useful to present export data that excludes new tyres, because these are not considered end-of-life. There are 15 codes that are considered to represent end-of-life tyres, which are summarised in Table 2-19 below. For the purposes of Hyder's analysis of the export of end-of-life tyres this section considers data for these codes only.

Table 2-19 Export codes for end-of-life tyres

AHECC Code	Description
40030000	Reclaimed rubber, in primary forms or in plates, sheets or strip, whether or not mixed with virgin rubber or other added substances, provided that the product has the essential character of reclaimed rubber
40040000	Waste, parings and scrap of rubber (excl. of hard rubber (HS 4017)) and powders and granules obtained therefrom
40061000	Camel-back strips, of unvulcanised rubber, for retreading rubber tyres, whether or not compounded
40121100	Retreaded pneumatic rubber tyres, of a kind used on motor cars (incl. station wagons and racing cars)
40121200	Retreaded pneumatic rubber tyres, of a kind used on buses or lorries
40121300	Retreaded pneumatic rubber tyres, of a kind used on aircraft
40121900	Retreaded pneumatic rubber tyres (excl. those of a kind used on motor cars (incl. station wagons and racing cars), buses, lorries and aircraft)
40122000	Used pneumatic rubber tyres, whether or not subject to recutting or regrooving
40129000	Solid or cushion tyres, interchangeable tyre treads and tyre flaps of rubber
87032322	Secondhand assembled motor cars and vehicles mainly designed for the transport of persons (excl. public-transport type) with spark-ignition reciprocating piston engine, of a cylinder capacity exc 1,500 cc but not exc 3,000 cc
87032422	Secondhand assembled motor cars and vehicles mainly designed for the transport of persons (excl. public-transport type) with spark-ignition reciprocating piston engine, of cylinder capacity exc 3,000 cc
87033322	Secondhand assembled motor cars and vehicles mainly designed for the transport of persons (excl. public-transport type) with diesel engine, of a cylinder capacity exc 2,500 cc
87039022	Secondhand assembled motor cars and vehicles mainly designed for the transport of persons (excl. public-transport type) other than with spark-ignition reciprocating piston engine or diesel engine

Note: For the purposes of this study, tyres that are exported from Australia for reuse or retreading are considered to be end-of-life tyres, as, given they are no longer in-use in Australia, and are no longer available to the Australian market, they can be considered to have reached end-of-life.

Total Export of End-of-life Tyres

Figure 2-25 below shows the trend in export of all end-of-life tyres, which is also summarised in Table 2-20. The data shows a significant increase (95%) in the export of end-of-life tyres since 2009-10, however the increase is not quite as dramatic as that observed for all tyres (i.e. including new). While there is little doubt that exports have significantly increased, it should also

be noted that the apparent jump may be partly due to improved data capture and reporting of exports.

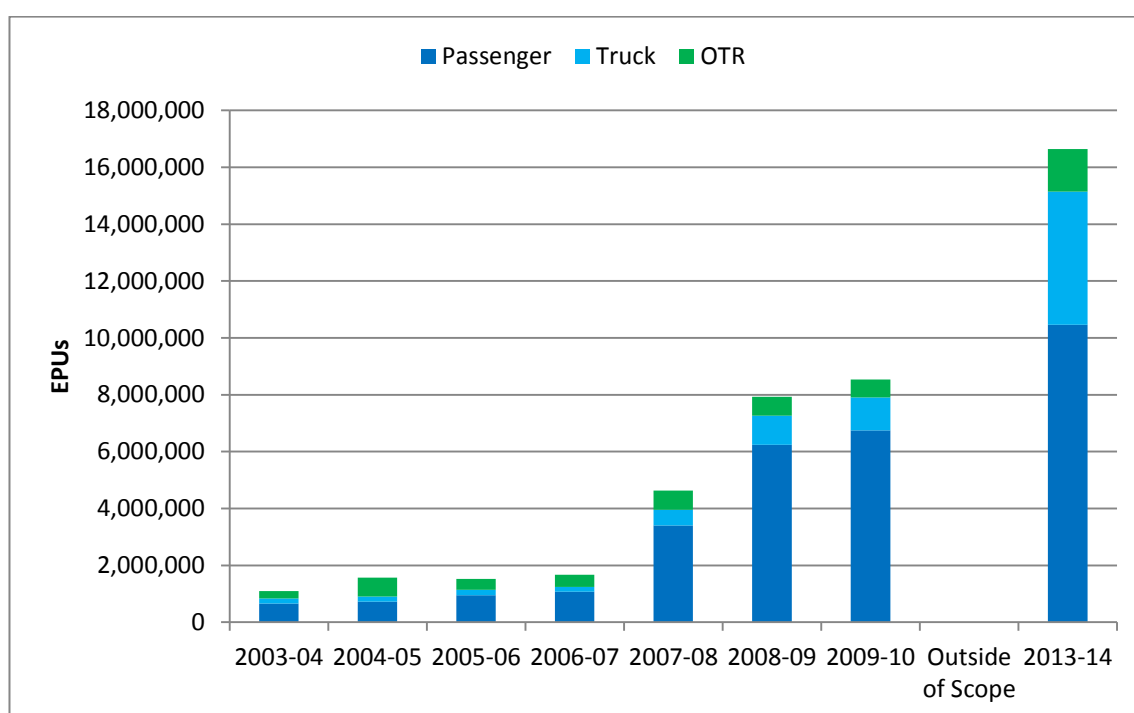


Figure 2-25 Export of end-of-life tyres (excluding new) by tyre type (2004-2014)

Source: Based on Australian Bureau of Statistics data.

Table 2-20 Export of end-of-life tyres (excluding new) by tyre type (2004-2014)

Year	Passenger	Truck	OTR	Total
2003-04	658,412	182,218	259,799	1,100,428
2004-05	723,298	185,995	655,003	1,564,296
2005-06	951,587	195,050	372,248	1,518,885
2006-07	1,070,734	177,864	426,119	1,674,717
2007-08	3,408,141	550,052	675,097	4,633,290
2008-09	6,237,939	1,021,468	672,198	7,931,605
2009-10	6,752,348	1,158,352	621,052	8,531,752
2010-2013	Outside of scope			
2013-14	10,457,235	4,688,818	1,497,836	16,604,911

Source: Based on Australian Bureau of Statistics data.

Export codes and destination countries

As seen in previous years, the main codes used for the export of tyres and TDP in 2013-14 were:

- AHECC 40040000 – Waste, parings and scrap of rubber (excl. of hard rubber (HS 4017)) and powders and granules obtained therefrom
- AHECC 40122000 – Used pneumatic rubber tyres, whether or not subject to recutting or regrooving

These codes accounted for 56% of all tyre exports in 2013-14, or 93% when only end-of-life tyre codes are considered. The dominance of these codes has been increasing over the past seven years, from 38% of all tyre exports in 2006-07 to 79% in 2009-10, however the dominance is even more marked when only end-of-life tyre codes are considered, as shown in Table 2-21 and Figure 2-26 below.

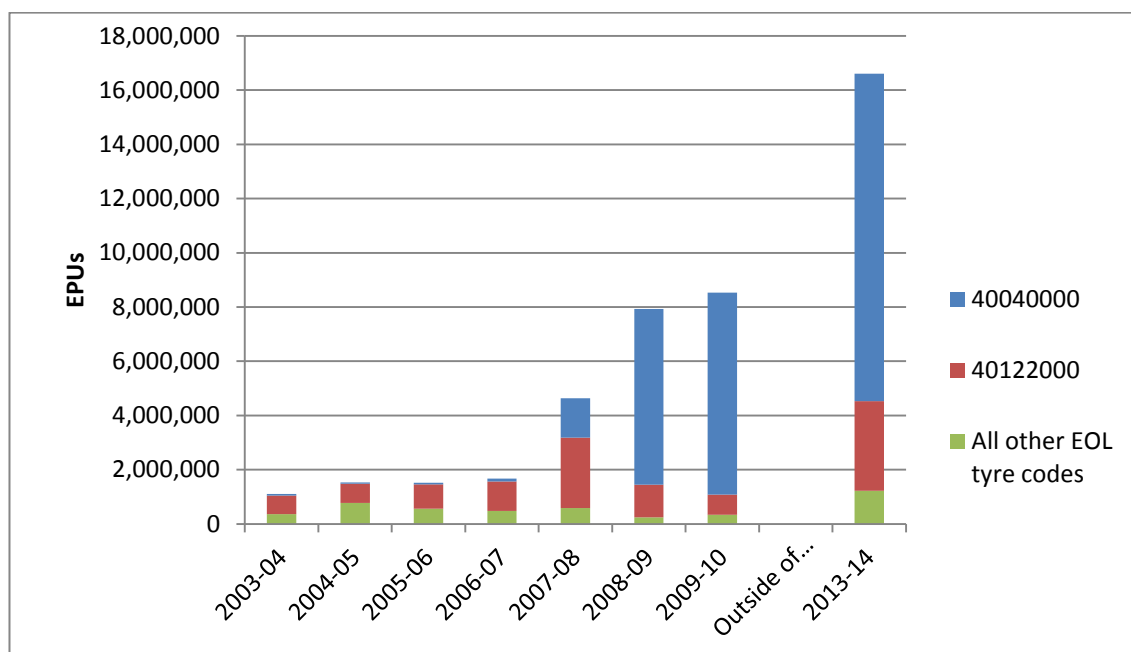


Figure 2-26 Export of end-of-life tyres (excluding new) by major export codes (2004 – 2014)

Source: Based on Australian Bureau of Statistics data.

Table 2-21 Export of end-of-life tyres (excluding new) by major export codes (2004 – 2014)

Export Codes	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2013-14
40040000	49,283	44,969	58,331	112,590	1,449,128	6,487,699	7,452,313	12,070,038
40122000	689,020	705,713	894,787	1,077,296	2,597,811	1,194,105	745,406	3,308,883
Other Codes (excluding new)	362,126	775,497	565,767	484,831	586,351	249,802	334,034	1,225,991
Total	1,100,428	1,526,179	1,518,885	1,674,717	4,633,290	7,931,605	8,531,752	16,604,911

Export of end-of-life tyres by destination country

Figure 2-27 shows the top ten destination countries for the export of end-of-life tyres (excluding new). 89% of end-of-life tyres exported during 2013-14 went to these ten countries. Over half of all end-of-life tyres was exported to the top two countries, which were Malaysia and Vietnam, which accounted for 35% and 25% of all exports respectively.

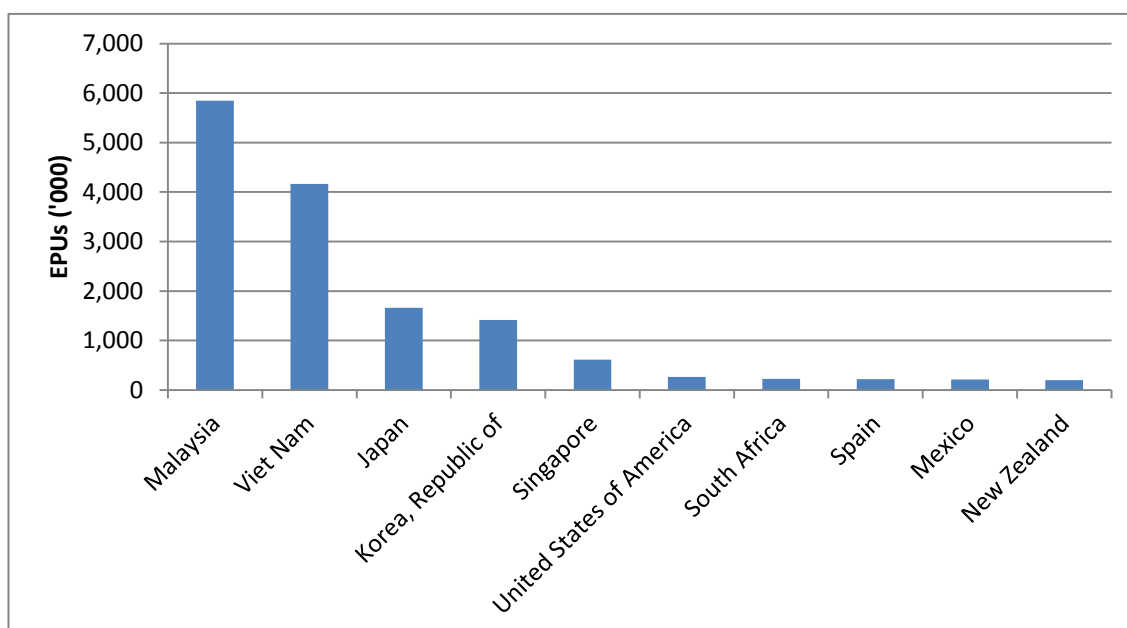


Figure 2-27 Top export destination countries for end-of-life tyres (excluding new) (2013-14)

Source: Based on Australian Bureau of Statistics data.

The major export destination for end-of-life tyres in 2009-10 was Vietnam; however the focus of exporters has shifted in recent years, with Malaysia receiving the largest quantity of Australian end-of-life tyres in 2013-14. This is consistent with the results of the industry survey, with a significant proportion of businesses reporting tyres exported to Malaysia for use in pyrolysis plants.

Table 2-22 Top 10 export destination countries for end-of-life tyres (excluding new) (% , 2013-14)

Country	Percentage of end-of-life tyre exports
Malaysia	35%
Viet Nam	25%
Japan	10%
Republic of Korea	9%
Singapore	4%
United States of America	2%
South Africa	1%
Spain	1%
Mexico	1%
New Zealand	1%

Source: Based on Australian Bureau of Statistics data.

It is noted that the export destination as shown in ABS data may not be the ultimate destination for a number of shipments from Australia, as it is possible for these to be re-consigned once they leave Australia. According to ABS, once a shipment is unloaded then Customs have no ability to track as it is then outside their jurisdiction. Refer to Sections 4.2.3 and 4.2.4 for further discussion of tyre exports.

2.8 SUMMARY

This section provides summary charts and a summary table on the domestic and international destination of end-of-life tyres for the 2013-14 financial year.

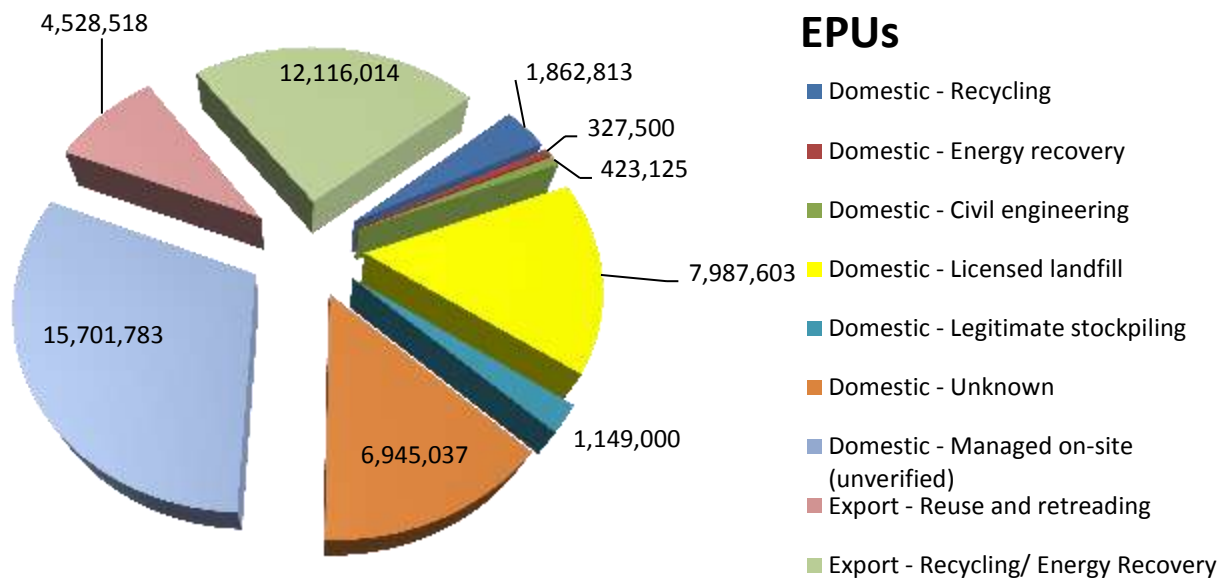


Figure 2-28 Domestic and international destination of end-of-life tyres – total (2013-14)

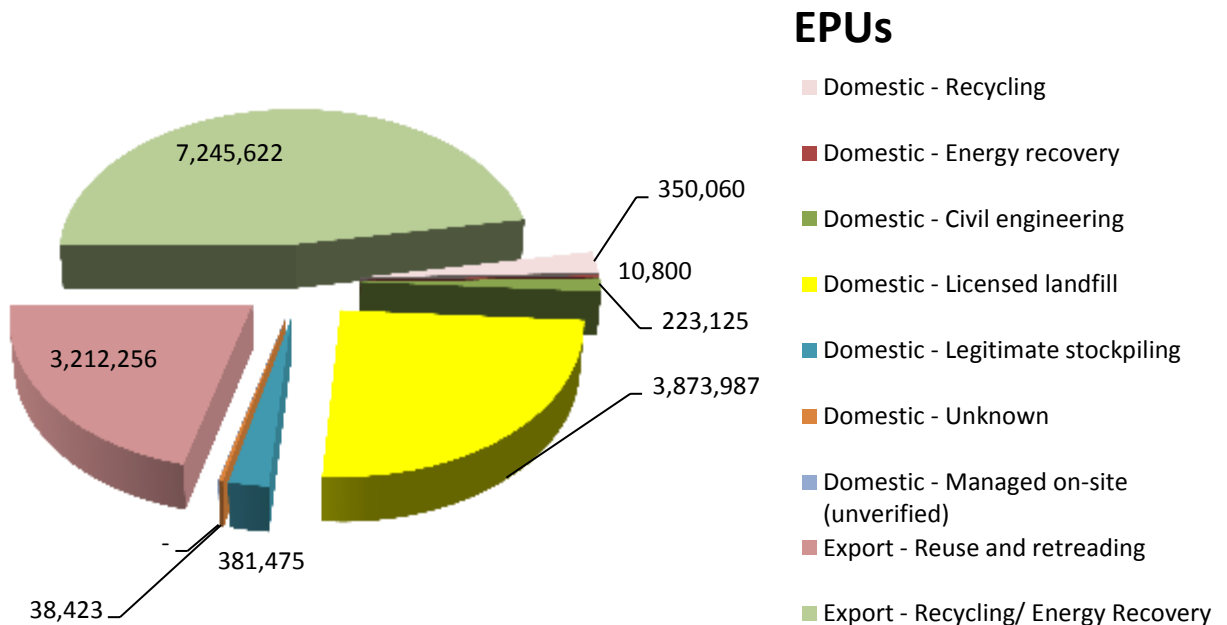


Figure 2-29 Domestic and international destination of end-of-life passenger tyres (2013-14)

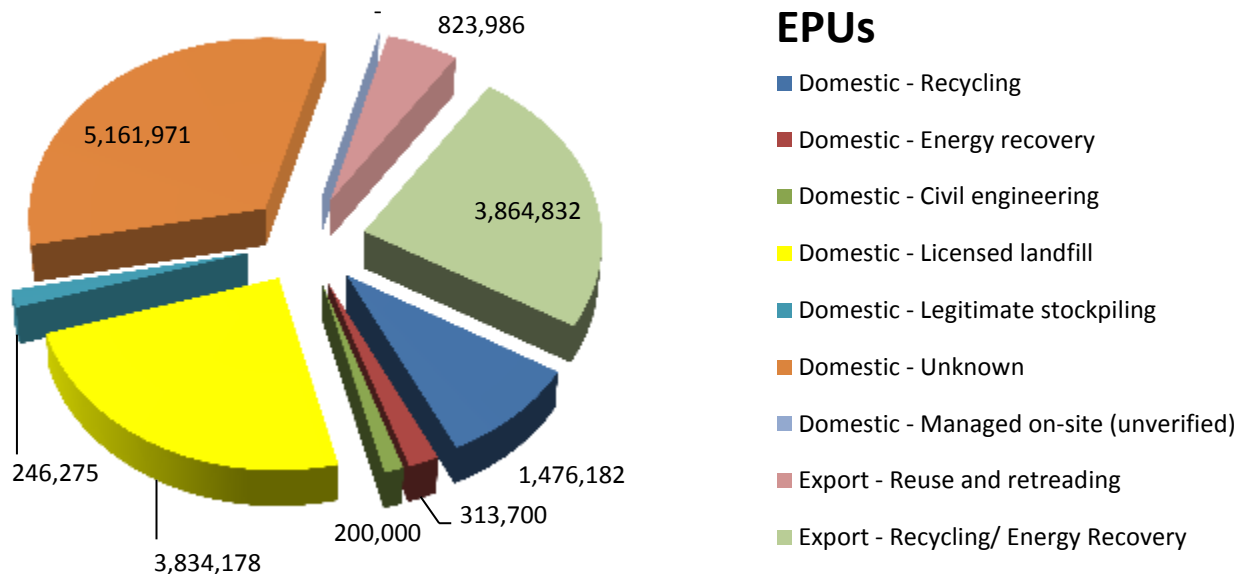


Figure 2-30 Domestic and international destination of end-of-life truck tyres (2013-14)

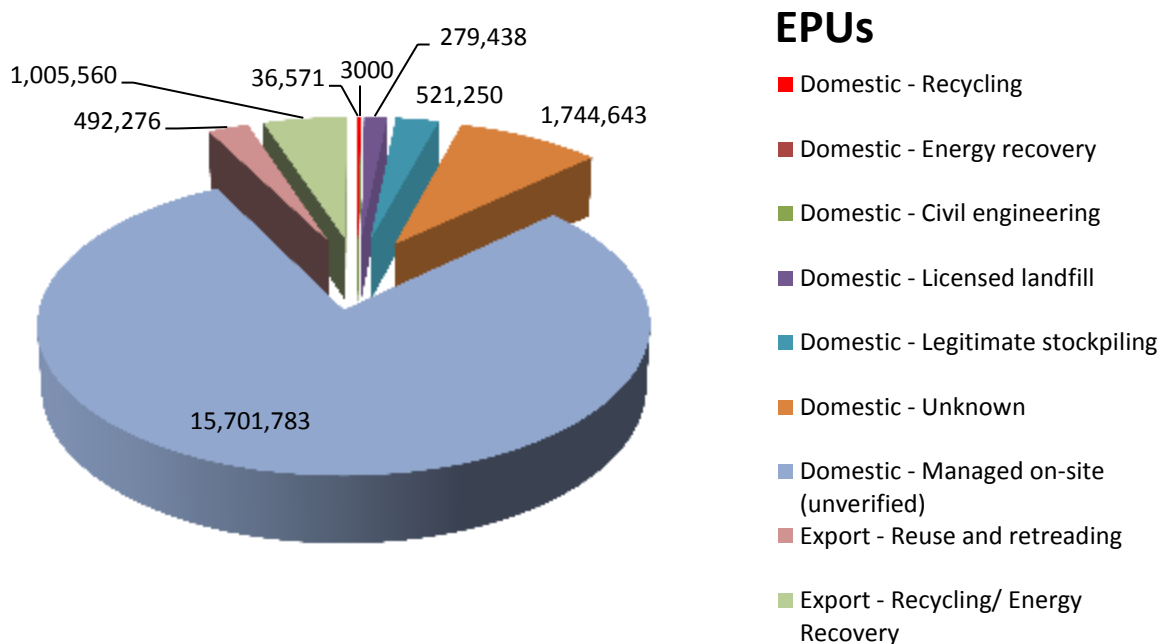


Figure 2-31 Domestic and international destination of end-of-life OTR tyres (2013-14)

Table 2-23 Summary of domestic and international destination of end-of-life tyres (2013-14)

Destination		Passenger		Truck		OTR		Total	
Domestic	Material recycling	350,060	2.3%	1,476,182	9.3%	36,571	0.2%	1,862,813	3.6%
	Energy recovery	10,800	0.1%	313,700	2.0%	3,000	0.02%	327,500	0.6%
	Civil engineering	223,125	1.5%	200,000	1.3%	-	0.0%	423,125	0.8%
	Licensed landfill	3,873,987	25.3%	3,834,178	24.1%	279,438	1.4%	7,987,603	15.6%
	Legitimate stockpiling	381,475	2.5%	246,275	1.5%	521,250	2.6%	1,149,000	2.3%
	Unknown	38,423	0.3%	5,161,971	32.4%	1,744,643	8.8%	6,945,037	13.6%
	Managed on-site (unverified)	-	0.0%	-	0.0%	15,701,783	79.4%	15,701,783	30.8%
	Sub-total	4,877,870	31.8%	11,232,306	70.5%	18,286,683	92.4%	34,396,860	67.4%
International	Reuse and retreading	3,212,256	20.9%	823,986	5.2%	492,276	2.5%	4,528,518	8.9%
	Recycling/ Energy Recovery	7,245,622	47.2%	3,864,832	24.3%	1,005,560	5.1%	12,116,014	23.7%
	Sub-total	10,457,878	68.2%	4,688,818	29.5%	1,497,836	7.6%	16,644,532	32.6%
Total		15,335,748		15,921,124		19,784,519		51,041,392	

Note: All units are in Equivalent passenger unit (EPUs).

3 DATA QUALITY

This Section provides an overview of the quality of the data gathered as part of this study.

3.1 QUALITATIVE ASSESSMENT OF DATA SOURCES

A data confidence rating was incorporated into the industry survey, to enable an assessment of the reliability of each source consulted as part of the study.

Of the 39 businesses surveyed, 23 data sources were rated as having a high degree of reliability, 12 were rated as having a moderate degree of reliability, while only 4 were considered of low reliability.

Furthermore, similar to the previous study, a qualitative assessment of the data gathered for this study has been undertaken to provide an indication of the data quality of each data subset. The data was scored according to the following attributes: method, accuracy, credibility, sample size, comparability (to previous study) and sensitivity to dependent calculations. It is acknowledged that the assessment might be considered subjective; however the scores for domestic destination were informed by the data confidence ratings that were incorporated into the industry survey. Weightings were applied to each score and the weighted scores were then added to provide an overall quality indicator for each data set. Results are summarised in Table 3-24. A summary of the data components, sources/ methodology and identified data issues is provided in Table 3-25.

Table 3-24 Summary of Data Quality Assessment

Weighting	Field										Domestic Desintation												International Destination											
		Consumption			In-Use			End-of-life Arisings			Material Recycling			Civil Engineering			Energy Recovery			Landfill, stockpiling & unlicensed disposal			Reuse			Retreads			Recycling			Energy Recovery		
		Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR	Pas.	Tru.	OTR
30%	Method	3.5	3.5	3.5	4	4	4	3.5	3.5	3.5	5	5	5	5	5	5	5	5	5	4	4	4	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
20%	Accuracy	3.5	3.5	3.5	5	5	5	3.5	3.5	3.5	4	4	3.2	3.9	3.9	3.2	3.9	3.9	3.2	3.5	3.5	3	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
10%	Sample Size	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5
20%	Credibility	4	4	4	5	5	5	4	4	4	3.9	3.9	3.2	3.9	3.9	3.2	3.9	3.9	3.2	3.5	3.5	3	4	4	4	4	4	4	4	4	4	4	4	4
10%	Comparability	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5
10%	Sensitivity to dependent calculations	2	2	2	5	5	5	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2	2	2	2	2	2	2	2	2
100%		3.75	3.75	3.75	4.7	4.7	4.7	3.75	3.75	3.75	4.58	4.58	4.28	4.36	4.36	4.08	4.36	4.36	4.08	3.8	3.8	3.6	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
	Reporting limitations due to commercial sensitivities										Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes															

Score

0.0-2.9



Poor data quality. Potential inconsistency or significant reliance on assumptions.

3.0-3.4



Sub-standard data quality. Some data gaps. Assumptions required

3.5-3.9



Average quality data. Sources are reputable, however potential for data gaps and the need for assumptions.

4.0-4.4



Good reliability. Data from reputable sources. Few data gaps. Low reliance on assumptions.

4.5-5.0



Very high reliability. Data from highly trusted sources. Minimal data gaps. Minimal reliance on assumptions.

Table 3-25 Data collection components, data sources and identified data quality issues

Life cycle phase	Component	Source/method	Assessment of Data Quality	Identified Data Quality Issues
Consumption	Imports	Import data from the Australian Bureau of Statistics (ABS) on loose tyres and vehicles.	Average quality data	<ul style="list-style-type: none"> Assumptions are necessary in order to convert import data to EPU, which results in some uncertainties around reported import quantities.
	Sales	Collation of data on imports.	Average quality data	<ul style="list-style-type: none"> Assumptions are necessary in order to convert import data to EPU, which results in some uncertainties around reported import quantities.
In-use	In-use	Vehicle registration data from the ABS in conjunction with average EPU per vehicle.	High reliability	
Second-hand/ Retreads*	Retreads*	Survey of industry groups, including the Australian Tyre Dealers and Retreaders Association, major national retreaders and identified second-hand tyre dealers.	Average quality data	
	Second-hand*	Targeted survey of identified second-hand tyre dealers.	Average quality data	
End-of-life	Total	Determined using the average lifespan of tyres and new and retreaded tyre sales.	Average quality data	<ul style="list-style-type: none"> Assumptions are necessary in order to convert import data to EPU, which results in some uncertainties around reported import quantities.
	Recycled	Survey of industry groups, including retailers, ATRA and the ATIC, and major tyre recyclers, as well as identified collectors and secondary reproducers doing smaller volumes of material.	Good to High reliability	<ul style="list-style-type: none"> A number of respondents were unable to provide a breakdown of tyres by tyre type, hence some assumptions were necessary.
	Energy production	Survey of industry groups, including the Cement Industry Federation, and major users of tyres for energy production (such as a major steelmaker who currently use TDP for energy required in the steel making process).	Good reliability	
	Landfill	Survey of state and territory departments and agencies, data from industry survey also considered.	Average quality data	<ul style="list-style-type: none"> Incomplete or potentially unreliable state/ territory landfill data, some extrapolation of data required.
	Stockpile and reuse; illegal dumping	Survey of state and territory government departments and agencies, major anti-littering organisations, the Waste Management Association of Australia (WMAA) and select local governments on littering and dumping.	Average quality data	<ul style="list-style-type: none"> Limited data available on stockpiling and illegal dumping, information provided was largely qualitative.

Life cycle phase	Component	Source/method	Assessment of Data Quality	Identified Data Quality Issues
	Export	Data estimate will be generated using survey findings in conjunction with in-use and sales trend data and the expected life span of tyres.	Average quality data	<ul style="list-style-type: none"> Assumptions are necessary in order to convert data to EPU's, which results in some uncertainties around reported export quantities. The proportion of used/ loose tyres and used/ baled tyres has been informed by data provided through the industry survey, and therefore is subject to a degree of uncertainty. The export data shows a dramatic increase in the quantity of new tyres exported from Australia. Data provided by ABS potentially underestimates the quantity of exported tyres.

The results show an average to high degree of confidence in most data. As expected, landfill, stockpiling and unlicensed disposal was considered only “average” data quality. Data for consumption and international destinations, which is reliant on import and export data was also considered of “average” data quality, which is discussed further in Section 3.2 and Section 4.2.4.

3.2 QUALITY OF IMPORT/ EXPORT DATA

In order to reaffirm the validity of the data presented in this report, an analysis of the source dataset (International Merchandise Trade, Australia) from the Australian Bureau of Statistics (ABS) has been undertaken through a review of the ABS publication *International Merchandise Trade, Australia, Concepts, Sources and Methods* (Cat. No. 5489.0) (Australian Bureau of Statistics, 2001).

Firstly, it should be noted that the ABS trade data utilised in this assessment is widely used to provide input into Federal budgetary requirements, including Australia’s Balance of Payments and National Accounts. The ABS has noted that in order to meet national and international data standards, trade statistics need to maintain a six digit level of international Harmonised System (HS) commodity classification. The ABS undertakes a sufficient level of editing which aims to confirm the quality and integrity of such paramount trade statistics. Nonetheless, a demand exists for trade data that can provide greater detail than this six digit level. Potential errors as a result of the ABS quality assurance editing include the following:

- A reported value being overstated or understated
- A possible error in the reported country of origin or final destination

The ABS has stated that the main limitations in obtaining accurate data are the arrangements that are in place to protect businesses, meaning that information may not be fully revealed and the large volumes of data involved may result in lowered quality assurance.

With regard to the accuracy and reliability of this dataset, there are a number of points that the ABS notes. The ABS always considers the data that is published to be at a high level of accuracy. However, limitations exist given that the accuracy of international merchandise trade statistics are based on the information reported to Customs. While there are no sampling errors as such (as statistics are not collected via survey), there is a need to check ABS trade data with that of other partner countries and thereby ensure the validity of the trade estimations made by the ABS.

In amending the original source data the ABS use quality assurance measures to ensure that data errors are acknowledged and corrected or omitted. It should be noted that Customs have their own process of detecting and correcting errors in export and import data. Both Customs and ABS work together to identify and deal with major data issues.

The ABS note that the amendments made are often “significant in both absolute and percentage terms”, to “ensure the correct scope and adequate data quality” is maintained for international merchandise trade statistics, although the examples presented indicate that amendments are commonly made to the value of merchandise imports/ exports, not necessarily the quantity imported/ exported. Comparison of initial and final estimations of ABS export and import data has shown very little variation, thereby confirming the high reliability of the ABS data. The ABS notes that verifying whether the data properly reflects Australia’s true exports and imports is more difficult.

The ABS conducts “Partner Country” comparisons to compare the export and import statistics of Partner Countries with reciprocal import and export statistics, and thereby check the accuracy of the statistics at an aggregate level. Partner agencies include the following:

- United States of America (USA)
- Japan
- European Union (EU)
- New Zealand

The discrepancies that have been identified via this methodology have been minimal at an aggregate level and as a result the ABS notes that there is a reasonable level of confidence in the accuracy of Australia's international merchandise trade statistics. Evidently the destination of tyres that were identified in this study go beyond the scope of the four agencies that are utilised by the ABS for data checking. This infers that there may be discrepancies which have not been accounted for via ABS checking mechanisms and results in this report should be considered in light of this.

The ABS also notes that while the goods included and excluded from Australia's international merchandise trade statistics are aligned with current UN standards, Customs are responsible for the entries of the source data; and therefore the ABS coverage is limited by the "operational boundaries that Customs adheres to".

The ABS consider the quality of Australia's international merchandise trade statistics to be very high, given that their data assurance approach is internationally recognised and that their broad level accuracy and reliability checking mechanisms show that significant errors are corrected. Nonetheless, there is the potential for inaccuracies that are unaccounted for in the source data collected by Customs, and there is the possibility that data has been excluded for commercial purposes. Furthermore, ABS note the validity of their results at more detailed levels "may be less accurate", and results in this report should be considered in light of this.

However, anecdotal evidence from a range of stakeholders suggests export data from the ABS may be underestimating actual export quantities and that export markets may account for a portion of the currently 'unknown' tyre data. Refer to Section 4.2.4 for further discussion.

4 OVERVIEW OF END-OF-LIFE TYRES MARKET IN AUSTRALIA

This chapter provides an overview of current market settings related to tyres and tyre derived products in Australia. It is noted that an in-depth market analysis was beyond the scope of the current study, therefore this section provides a high-level assessment of current markets, market capacity and the key price mechanisms influencing the industry. Opportunities for market development are explored in Section 4.5.

4.1 REGULATION OF TRANSPORT, STORAGE AND DISPOSAL OF TYRES IN AUSTRALIA

Regulation of the transport, storage and disposal of tyres to landfill influence the recovery markets, destinations and disposal routes of tyres across Australia. Table 4-26 summarises the current regulations, policies and controls that state and territory governments have in place on the storage, disposal and transportation of tyres.

Table 4-26 Summary of regulatory controls on tyres, by jurisdiction

Jurisdiction	Activity	Regulatory controls
Victoria	Disposal to Landfill	<p>Tyres are considered a solid inert waste from an industrial source. Whole tyres are prohibited from disposal at landfill sites, and must be shredded into pieces not exceeding 250 millimetres in size in any dimension (which can be disposed of at a licensed facility).</p> <p>Relevant documents:</p> <p><i>EPA Victoria, Industrial Waste Resources Guidelines, Waste Categorisation Environment Protection Act 1970 – Waste Management Policy (Siting, Design and Management of Landfills), Victorian Government Gazette No S 264 14 December 2004</i></p>

Jurisdiction	Activity	Regulatory controls
	Transportation, storage and Reprocessing	<p>The Victorian EPA has developed an Interim Waste Management Policy for the storage of waste tyres, which is due to expire on the 29th of April 2015. During the implementation of this policy, the Department of Environment and Primary Industries (DEPI) together with EPA Victoria developed a Regulatory Impact Statement (EPA Victoria, 2014). The document was produced with the intention of providing a comprehensive assessment of the possible options for the safe and appropriate storage and management of waste tyres in Victoria.</p> <p>The Interim Waste Management Policy currently requires that premises that store more than 5000 EPU or 40 tonnes of tyres at any time are to abide by a number of conditions including:</p> <p>Storage of such amounts only for the purposes of transfer, reuse, recycling, reprocessing or energy recovery.</p> <p>Stored in a manner that minimises risks to the environment, human health and therefore minimising the risk of fire which will be considered as compliant if in accordance with the following guidelines:</p> <p>Outdoor storage: Victorian Fire Services Guideline – Open Air Storage of New or Used Tyres (2014).</p> <p>Indoor storage: Victorian Fire Services Guideline – Indoor Storage of New or Used Tyres (2014).</p> <p>There are no controls on the transport of tyres within Victoria.</p> <p>Relevant documents:</p> <p><i>Environment Protection Act 1970 – Waste Management Policy (Storage of Waste Tyres), Victorian Government Gazette No S 139 3- April 2014</i></p>
New South Wales	Disposal to Landfill	<p>The <i>Protection of the Environment Operations Act 1997</i> requires that waste tyres must be transported to a place that can legally accept it. Whole tyres are not permitted to be landfilled in the Sydney and surrounding metropolitan areas. In regional and rural areas, the disposal of tyres to landfill is at the discretion of local government.</p> <p>Relevant documents:</p> <p><i>Protection of the Environment Operations Act 1997 (Version 01.01.2015)</i></p>
	Transportation, Storage and Reprocessing	<p>The <i>Protection of the Environment Operations (Waste) Regulation 2014</i>, governs the licensing requirements regarding the transporting, storage and processing of waste tyres. Current requirements are summarised as follows:</p> <p>Transporters of waste tyres greater than 200 kilograms or more than 20 waste tyres (whichever weighs less) will be required to monitor their movement within NSW. The previous requirement to obtain an Environment Protection Licence (EPL) for the interstate transportation of waste tyres was removed in 2014.</p> <p>An EPL must be obtained if more than 5 tonnes of waste tyres or 500 waste tyres are being stored on site at any one time.</p> <p>An EPL must be obtained if processing more than 5000 tonnes of waste tyres per year.</p> <p>The <i>NSW Fire Brigades Guidelines for Bulk Storage of Rubber Tyres 2014</i> outlines the minimum requirements for the stockpiling of tyres in an open yard or within buildings.</p> <p>Relevant documents:</p> <p><i>Protection of the Environment Operations (Waste) Regulation 2014</i></p> <p><i>Fire & Rescue NSW Guideline for Bulk Storage of Rubber Tyres 2014 (Version 03)</i></p>

Jurisdiction	Activity	Regulatory controls
South Australia	Disposal to Landfill	<p>Whole tyres are prohibited from disposal at landfill sites in South Australia. If tyres are deemed unsuitable for recycling, they may be disposed to a licenced depot, provided they are shredded into pieces not exceeding 250 millimetres in size in any dimension. Disposal of waste tyres are subject to the same licensing requirements for the storage and processing (outlined below).</p> <p>Relevant documents:</p> <p><i>Environment Protection (Waste to Resources) Policy 2014</i></p>
	Transportation, Storage and Reprocessing	<p>The <i>Environment Protection Act 1993</i>, governs the licensing requirements regarding the transportation, storage and processing of waste tyres. The requirements are summarised as follows:</p> <p>A licence must be obtained if used tyres being transported for fee or reward. Once licensed, transporters must complete a waste tracking form which identifies where the tyres are collected and where they are going to. All parties involved throughout the process must complete the form, including the producer of the waste (i.e. the retailer), the licensed transporter and the licensed disposal operator. The depot to which the tyre waste is transported to, must also be licensed by the EPA, unless they meet the listed exemptions.</p> <p>The reception, storage, treatment and disposal of waste tyres (greater than 250 millimetres in size) is listed as a Prescribed Activity of Environmental Significance and therefore requires a licence, unless the amount in question is below 5 tonnes and being used solely for the purpose of recycling, reuse, or if it is conditionally approved by the Authority.</p> <p>Used tyres should be stored in a manner that minimises risks to the environment, human health and therefore minimising the risk of fire which will be considered as compliant if in accordance with the following guidelines:</p> <p>General Guidelines for the Outdoor Storage of Used Tyres issued by the South Australian Fire Service Fire Safety Department</p> <p>Building Code of Australia, Part E of Book 1</p> <p>Relevant documents:</p> <p><i>Environment Protection Act 1993 (Version 30.11.2013)</i></p> <p><i>EPA 183/10: Waste guidelines – Waste tyres, updated September 2010</i></p>
Western Australia	Disposal to Landfill	<p>The <i>Environment Protection Regulations 1987</i> sets a boundary around the Perth Metropolitan and Country Area, where tyre disposal to landfill is not allowed, known as the Tyre Landfill Exclusion Zone. Disposal within this exclusion zone, requires written approval from the Chief Executive Officer of the Department of Environment Regulation. Disposal outside of the exclusion zone must be disposed of to a licensed landfill. Other disposal options (such as incineration) are allowed for, although they require significant documentation and testing.</p> <p>Relevant documents:</p> <p><i>Environment Protection Regulations 1987</i></p>

Jurisdiction	Activity	Regulatory controls
	Transportation, Storage and Reprocessing	<p>The <i>Environment Protection (Controlled Waste) Regulations 2004</i> governs the licensing requirements regarding the transportation of waste tyres.</p> <p>Under the regulations, tracking of used tyres is required if they are from commercial premises. Any such transportation must be carried out by a licensed controlled waste carrier. Records of such transportation must be retained for at least 3 years. The licensed carrier is responsible for the management of the waste tyres and is allowed to include the cost associated with managing the tyres in their contract price.</p> <p>The <i>Environment Protection Regulations 1987</i> governs the licensing requirements regarding the storage, handling and disposal of waste tyres. Under the regulations:</p> <p>A licence is required if more than 500 tyres are stored at a tyre fitting business</p> <p>A licence is required if more than 100 tyres are stored in any other place.</p> <p>Relevant documents:</p> <p><i>Environment Protection (Controlled Waste) Regulations 2004</i></p> <p><i>Environment Protection Regulations 1987</i></p>
Queensland	Disposal to Landfill	<p>The <i>Environmental Regulation 2008</i> governs the requirements regarding the disposal of tyres, which is listed as a Regulated Waste. The Environmentally Relevant Activity (ERA) 60 – Waste disposal; states that regulated waste are allowed to be disposed of at any licensed landfill.</p> <p>Relevant documents:</p> <p><i>Environmental Protection Act 1994 – Environment Protection Regulation 2008</i></p>
	Transportation, Storage and Reprocessing	<p>The transportation, storage and processing of tyres is also governed by the <i>Environmental Regulation 2008</i>. Recent amendments to this were made as part of the Greentape Reduction project (Department of Environment and Heritage Protection (EHP), 2013), which was aimed at streamlining and integrating various environmental regulations within the broader legislative piece - the <i>Environmental Protection Act 1994</i>. The transportation, storage and recycling of tyres are regulated via a series of listed Environmentally Regulated Activities (ERA). The relevant ERAs are 57 – Regulated Waste Transport and ERA 59 – Tyre Recycling.</p> <p>ERA 57 – Regulated Waste Transport, the transportation of all tyres on a commercial basis or over 250 kg on a non-commercial basis triggers a standard application requirement.</p> <p>ERA 59 – Tyre Recycling, tyre recycling operating on a commercial basis for receiving and recycling or receiving and reprocessing 1000 or more EPU, or parts of tyres in a year trigger a standard application requirement.</p> <p>The previous ERA 56 – Regulated Waste Storage, was removed. This previously enforced a licensing requirement for facilities receiving and storing 5 tonnes or more, or 500 or more EPU. As it is, only recycling, processing and transportation are under statutory regulation. It should be noted however that waste tyre storage facilities remain subject to other regulatory requirements in Queensland under fire, health and planning legislation.</p> <p>Relevant documents:</p> <p><i>Environmental Protection Act 1994 – Environment Protection Regulation 2008</i></p>

Jurisdiction	Activity	Regulatory controls
Tasmania	Disposal to Landfill	<p>The <i>Environmental Management and Pollution Control (Waste Management) Regulations 2010</i> governs the requirements for the disposal of tyres. As a listed Controlled Waste, tyres may only be accepted at Secure Landfills, unless at the discretion of the Director of the EPA, where they may be accepted at putrescible landfills. Whole tyres are prohibited from going to landfill and must be shredded.</p> <p>Under the <i>Landfill Sustainability Guide 2004</i>, tyres may be stockpiled and managed separately as long as the stockpile does not exceed 500 tyres and is stored in individual piles of 150 tyres or less. Their disposal requires specific approval from the EPA. It should be noted however, that this is not legally enforced and is a recommended guideline for landfill operators in Tasmania.</p> <p>Relevant documents:</p> <p><i>Environmental Management and Pollution Control Act 1994 – Environmental Management and Pollution Control (Waste Management) Regulations 2010</i></p> <p><i>Landfill Sustainability Guide 2004</i></p>
	Transportation, Storage and Reprocessing	<p>The storage and processing of tyres is also governed by the <i>Environmental Management and Pollution Control (Waste Management) Regulations 2010</i>; and as a Controlled Waste, their removal, storing, reusing, reprocessing is prohibited unless approval is obtained from the Director of the EPA.</p> <p>The transportation of tyres is regulated by the <i>Environmental Management and Pollution Control (Controlled Waste Tracking) Regulations 2010</i>. This Regulation requires the registration of controlled waste handlers and therefore all parties involved with the production, transportation and receiving of tyres.</p> <p>Relevant documents:</p> <p><i>Environmental Management and Pollution Control Act 1994 – Environmental Management and Pollution Control (Waste Management) Regulations 2010</i></p> <p><i>Environmental Management and Pollution Control Act 1994 – Environmental Management and Pollution Control (Controlled Waste Tracking) Regulations 2010</i></p>
Northern Territory	Disposal to Landfill	<p>The <i>Waste Management and Pollution Control Act 1994</i> requires environment protection approvals and licences for activities listed in Schedule 2 of the Waste Management and Pollution Control Act, and tyres are a listed waste. This Act governs that the disposal of tyres for a commercial or fee basis requires a licence.</p> <p>As a listed waste, all tyres are required to be shredded prior to placement in landfill. In practise this requirement has not been practical or possible in the many remote landfill locations. As a result Darwin and Alice Springs are the only two centres where tyres are shredded prior to sending to landfill. In other places tyres are segregated from other waste prior to placement in landfill.</p> <p>The Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory outlines the best practice for the storage of tyres, including:</p> <p>Waste tyres are not to be stored in the open for more than five days unless they meet certain water exclusion standards</p> <p>The dimensions of each tyre stockpile should not exceed 5 metres as the base wide, 45 metres as the base length and 2 meters as the height.</p> <p>The minimum distance between the tyre stockpile should not be less than 10 metres in any direction</p> <p>Relevant documents:</p> <p><i>Waste Management and Pollution Control (WMPC) Act 1994</i></p>

Jurisdiction	Activity	Regulatory controls
	Transportation, Storage and Reprocessing	The <i>Waste Management and Pollution Control Act 1998</i> is also the governing legislation for the collection, transportation, storing and processing of tyres and requires a licence if done so on a commercial or fee basis. Transporters of waste tyres however are not required to track their movement within NT. Relevant documents: <i>Waste Management and Pollution Control Act 1998</i>
ACT	Disposal to Landfill	There are no legislative constraints to the placement of tyres in landfill in the ACT. However it is understood that an operational ban was implemented so that tyres will not be placed in landfill in ACT. All tyres that are collected at waste transfer stations or landfill sites are sent interstate (to NSW) for recycling or disposal.
	Transportation, Storage and Reprocessing	The <i>Environment Protection Act 1997</i> defines the transportation of 2 tonnes or more of used, rejected or unwanted tyres as a Class A activity and therefore requires the person to hold an environmental authorisation. Relevant documents: <i>Environment Protection Act 1997</i>

Nationally, tyres are listed as a 'controlled waste' in List 1 of Schedule A of the *National Environmental Protection (Movement of Controlled Waste between States and Territories) Measure 2004* (Controlled Waste NEPM). The NEPM has established a national system to track the transport movements of controlled waste between States and Territories and developed nationally recognised licences for interstate transporters. While, the interstate transport of tyres is regulated via this piece of legislation, the intrastate regulatory framework surrounding the disposal, storage, transportation and processing of tyres varies across the states and territories as outlined in **Table 4-26**. Notable changes to the governance of tyre management have occurred within the past two years in the states of Victoria, New South Wales and Queensland.

Compared to neighbouring states, Victoria has a "relatively light approach" in relation to the management of tyres; as was noted in the Waste Tyres Regulatory Impact Statement (Environment Protection Agency (EPA) Victoria, September 2014). Consequently, tyre stockpiles in Victoria have seen increases as the NSW regulatory framework has tightened. The *Interim Waste Management Policy for the Storage of Waste Tyres* was developed to manage the increasing risks associated with the storage of waste tyres in the short term. However it is due to expire on the 29th of April 2015, and therefore will require the Victorian EPA to examine longer term measures. It should be noted that there is no licensing requirement under the current Interim Policy. Rather, those that are storing more than the trigger level are required to abide by best practice fire service guidelines.

Similarly, New South Wales has recently introduced new requirements relating directly to the storage, transportation and processing of waste tyres. This was in response to the NSW EPA identifying a number of compliance issues relating to the unlawful transport, storage and disposal of waste tyres. The changes have seen the removal of the need for an Environment Protection Licence (EPL) for interstate movement (although the NEPM requirements still exist), and a tightening of all other trigger requirements for an EPL in regard to tyre storage, transporting and processing within NSW.

In 2013, the Queensland environmental legislative framework underwent significant changes via the Greentape Reduction project (Department of Environment and Heritage Protection (EHP), 2013). The subsequent piece of legislation, the *Environmental Protection (Greentape Reduction) and Other Legislation Amendment Act 2012*, removed the threshold for tyre storage as an environmentally relevant activity (ERA) under ERA 56 – Regulated waste storage. This

means that tyre storage no longer requires an environmental authority in relation to that activity. However, people undertaking tyre storage must comply with Fire Services Requirements, which are enforced under their own legislation rather than environmental protection legislation..

Overall, while all States and Territories appear to have some governance and guidance for tyre transporters, storage facilities and processors; the lack of a coherent approach highlights the complexity of understanding the various triggers and requirements within each jurisdiction. The different approaches taken in each jurisdiction confirms the absence of a consistent nationwide mandate on tyre regulation. The current approaches by the various States and Territories would be greatly strengthened by a nationwide framework that would allow individuals to easily identify their obligations and compliance requirements across the various jurisdictions.

4.2 CURRENT TYRE RECOVERY MARKETS

The sections below provide an overview of the main pathways for recovery of Australian tyres and their relative size. The assessment of markets also includes information relating to export markets, as this has proven to be a crucial component of the end-of-life tyres market in Australia.

4.2.1 RETREADING/ REUSE

According to industry sources, the retread market has continued to contract since the previous study. It is understood that, while retreading of truck tyres in Australia remains relatively strong, retreading of other tyres has generally declined and there are now only a limited number of businesses involved in retreading in Australia, potentially in the order of just 3-5 businesses. The primary reason for this continues to be the decrease in the price of new tyres available in Australia, which has decreased the viability of the retreads market. One industry source observed that use of performance tyres has been increasing; and it is understood that many of these tyres, for example on 'mag wheels', are unable to be retreaded.

There is anecdotal evidence to suggest that, at least in the past, there has been a thriving market for second-hand tyres, or casings as they are known in the industry. Limited quantitative data was available on the number of tyres being diverted to the seconds and retreads market. There were anecdotal reports that 5 years ago up to 25-30% of tyres were being diverted to the second-hand market, however Hyder has been advised that this market has since declined, with more recent estimates averaging between 7-10% used tyres ending up in the casings market. A number of industry sources agreed that the casings market is saturated and is declining.

A number of sources indicated that there is a strong international seconds market, particularly in Africa. Hyder and Tyres Reclaimed investigated this claim, however it was generally found that industry sources were either unable or unwilling to identify the destination of casings exports. The National Road Safety Council (NRSC) in Namibia published a report in 2008 investigating the effects of imported second-hand tyres on road safety, and found that poor quality tyres were being received from exporting countries, which included Australia. The report indicated that some exporters were not exercising proper caution and were exporting poor quality, un-roadworthy tyres. Since Customs in the receiving country were not required to open shipments and check the quality of the used tyres, poor quality tyres were being sold to Namibian consumers at low prices. Further, it was found that consumers were aware of the poor quality and associated dangers of used tyres, but were willing to take the risk because they could not afford new tyres.

Although this report is some years old, it is likely that this practice is still occurring and there is certainly anecdotal evidence that it has been increasing. If there are issues around the quality of used tyres ending up in Africa, this raises concerns about the quality of Australian exports. In

order to ensure that only tyres of adequate quality are being exported to international second-hand markets, it may be worth considering developing a quality standard for used tyre exports.

4.2.2 DOMESTIC RECYCLING AND ENERGY RECOVERY

There are a number of established markets for tyre derived products in Australia, although as found in previous studies, these markets are relatively small, and consequently the rate of local recycling of end-of-life tyres has reduced considerably since the previous study.

A brief overview of the range of established local tyre recycling and recovery markets for end-of-life tyres are provided overleaf.

Table 4-27 below provides a breakdown of the Australian tyre recycling and recovery markets. This data excludes quantities of tyres shredded, baled or processed locally for the purposes of export, which is discussed in Section 4.2.3.

Table 4-27 Summary of domestic tyre recycling and recovery markets

Form	Product/ Destination	Example Applications	Passenger	Truck	OTR	TOTAL	Proportion of domestic market
Granulated, crumbed or powdered	Rubber crumb	<ul style="list-style-type: none"> Road construction Adhesives Explosives 	176,150	1,156,688	21,600	1,354,438	36%
	Granules	<ul style="list-style-type: none"> Soft surface matting Moulded products 	165,350	347,688	14,400	527,438	13%
	Landfill	<ul style="list-style-type: none"> Disposal 	8,560	3,057	571	12,188	0.3%
	Total (Granulated, crumbed or powdered)		350,060	1,476,182	36,571	1,862,813	50%
Whole tyres/ shredded tyres	TDF	<ul style="list-style-type: none"> Energy recovery (e.g. pyrolysis) 	10,800	313,700	3,000	327,500	8.7%
Whole tyres/ granules/ shredded tyres	Civil engineering	<ul style="list-style-type: none"> Civil construction 	223,125	200,000	-	423,125	11%
Whole Tyres	Stockpiling for Future Recycling	<ul style="list-style-type: none"> Pyrolysis Crumbing 	381,475	246,275	521,250	1,149,000	31%
TOTAL			965,460	2,236,157	560,821	3,762,438	100%

Tyre Derived Products (TDP)

The process of shredding and grinding end-of-life tyres produces granules and crumb rubber/powder in a varying range of sizes. These are collectively referred to throughout this report as Tyre Derived Products (TDP), and account for the primary market for end-of-life tyres in Australia (approximately 50% of the existing domestic market).

TDP includes shredded, chipped, crumbed, granulated or powdered material, steel and textiles. TDPs can be categorised according to size and material type. The definition and terminology for TDP classifications varies across the industry (and has thus varied across past reports on end-of-life tyres). The following table summarises the classifications of TDP as adopted by TSA (Tyre Stewardship Australia, 2014).

Table 4-28 Tyre Derived Products – sizes and applications (from TSA (2014))

Product description	Size	Potential End Use Markets	
Whole Tyres	N/A	<ul style="list-style-type: none"> Tyre Derived Fuel (TDF) Civil Engineering 	
Cut/Shredded Tyres	200 mm +	<ul style="list-style-type: none"> Tyre Derived Fuel (TDF) Civil Engineering 	
Tyre Chip - nominal 6" chip	60mm - 200mm	<ul style="list-style-type: none"> Tyre Derived Fuel (TDF) Civil Engineering 	
Tyre Chip - nominal 2" chip	20mm - 60mm	<ul style="list-style-type: none"> Tyre Derived Fuel (TDF) Civil Engineering 	
Coarse Granulate	10mm - 20mm	<ul style="list-style-type: none"> Playground and equestrian surfacing 	
Fine granulate	1mm - 10 mm	<ul style="list-style-type: none"> Soft surfacing and matting Moulded products 	<ul style="list-style-type: none"> Mulches Replacement for coal (TDF)
Crumb/ Powder	Less than 1 mm	<ul style="list-style-type: none"> Road surfacing – asphalt and spray seal Adhesives General rubber mixing 	<ul style="list-style-type: none"> Elastomers Explosives
Steel	N/A	<ul style="list-style-type: none"> Established metal recycling market Concrete reinforcing 	
Carbon black	N/A	<ul style="list-style-type: none"> Pigment Reinforcement in rubber and plastic products 	
Silicon carbide	N/A	<ul style="list-style-type: none"> Abrasives, cutting tools 	
Textile	N/A	<ul style="list-style-type: none"> Carpet backing 	
Fuel (oils and gases)	N/A	<ul style="list-style-type: none"> Energy generation 	

Source: Adapted from information presented in (Tyre Stewardship Australia, 2014)

Crumb rubber

Production of rubber crumb constitutes the most significant Australian market for TDP, representing approximately 36% of the established local market. Crumb rubber can be used in a number of applications, based on information provided by industry stakeholders, the following are considered to be the main uses of crumb rubber in Australia:

- Crumb rubber in sprayed bituminous surfacing (spray seal)
- Adhesives

Crumb rubber can be used to replace the traditional Polymer Modified Binder in spray seal pavements for its plasticity and waterproofing properties. The properties of rubber have been reported in the *Economics of Tyre Recycling* report by ARRB Group (formerly Australian Road Research Board) (2004) to improve the binding capacity of the sealant, particularly in sprayed bituminous surfacing (spray seal). A spray seal is a surface treatment consisting of a sprayed film of bituminous binder covered with aggregates and then rolled.

ARRB Group (ARRB, 1999) reports that the success of this product has been well established in Australia, and is attributed to the higher application rate of this product and subsequent resistance to cracking. In 2011, the Australian Asphalt Pavement Association (2011) also reported that crumb rubber modified binders have also been shown to have a longer service life and improved performance compared to traditional modified binders.

Rubber powders are also used in the manufacture of contact adhesives, such as those used in tiling applications. While the use of 'rubber based adhesives' is commonly specified in construction applications, the Australian Master Tilers Association notes that rubber is actually used as a 'filler' in many cement-based adhesives and the rubber particles play no part in the binding process.

Regardless of the function of the rubber particles, the adhesives market is one of the major purchasers of crumb rubber products, and has been for many years. Accordingly, the adhesives market – while very important – is also very mature, and Hyder understands that all of the available capacity is taken up by existing suppliers.

New and emerging markets for rubber crumb are discussed in Section 4.5.2.

Rubber Granules

Production of rubber granules accounts for a lesser portion than crumb rubber, representing approximately 13% of the local TDP market. Recycled rubber granulate can be used in a range of moulded products, flooring and matting, which can be used in sporting grounds and playgrounds. Hyder understands that a small quantity may also be used for civil engineering applications.

It is noted that this market is limited in size and industry sources have indicated that there may be limited opportunity to expand the market further.

Civil Engineering

A range of TDP sizes, including whole tyres, tyre chip and cut/shredded tyres can be used as low cost fill in a number of civil engineering applications, including retaining walls, blast walls and sea walls. Hyder understands that this market is relatively small accounting for around 11% of the local recycling market. There are only a limited number of players in this market in Australia. There appears to be potential for expansion of this market, which is further discussed in Section 4.5.1.

It is noted that shredded tyres have also been known to be used in the construction of landfills, particularly as an alternative drainage material in place of gravel aggregates, however Hyder understands that this would then be reported as landfilled material.

Tyre Derived Fuel (TDF)

Tyre Derived Fuel (TDF) is produced when end-of-life tyres are converted into a product for use as fuel. Typically whole tyres, cut/shredded tyres and tyre chip can be used as the fuel feedstock. TDF can be used a replacement for fossil fuels in cement kilns, power stations, smelters or paper mills.

Due to the high proportion of rubber and carbon black content, they have a high calorific content of between 32 and 34 MJ/kg. One tonne of tyres is reportedly equivalent to 0.7 tonnes of petroleum in terms of energy value (Ramos, 2011).

Industry consultation indicated that the local market for TDF has contracted in Australia since the previous study, and now accounts for less than 1% of the local market.

The potential for development of these existing markets is discussed in Section 4.5.1. Section 4.5.2 provides a summary of new or emerging markets for TDF in Australia.

4.2.3 INTERNATIONAL ENERGY RECOVERY

In 2013-14, there was a thriving market in the export of TDF, which has been clearly demonstrated by the current study which indicates an increase of nearly 170% in tyre exports since the previous study for the 2009-10 financial year (refer to Section 2.7).

As shown in Section 2.7.3 markets in south-east Asia (particularly Malaysia, Vietnam and Singapore) are the most common initial destinations for rubber products, but it is clear that there is significant movement of product across the world, including markets in North America, Africa, Europe and South America. In addition, a number of industry sources voiced suspicions that there is a much larger quantity of tyres being exported than ABS export data indicates.

It is noted that all graphs and data tables within this report are based on ABS data, although data sourced directly from Australian reprocessors and collectors indicated that approximately 18,600,000 EPU were exported, which is approximately 11 % greater than ABS data. It is also possible that this quantity underestimates the international market as there are a number of reasons to suspect that some of the collectors consulted may have under-reported tyre quantities. Firstly, there are indications that many of these businesses operate a largely cash business, as such there may be a tendency to under-report to avoid greater scrutiny by authorities (such as the Australian Taxation Office). It is also possible that the businesses may not be complying with the relevant environmental regulations on storage of tyres or state licensing regulations thus under-reporting may occur to avoid investigation by environmental regulators.

While there is some degree of uncertainty around the quantity of exports, it is nonetheless clear that exports are on the rise. Industry sources advised that export of TDF for use in international energy markets is effectively the cheapest form of tyre disposal for Australia. There are low margins involved, in fact a review of market prices conducted by Hyder has indicated that the export of TDF may be predominantly driven by avoidance of higher processing or disposal costs, particularly in states with high waste levies such as Victoria and NSW.

It appears that even reprocessors involved in crumbing activities are reliant to some degree on this export market, as the domestic market is too weak and currently incapable of absorbing the volume of TDF being generated.

These international energy markets have been notoriously volatile and recently (in 2015) even more so (refer to Section 5 for further discussion of more recent trends). The price of oil and coal have a strong influence on international TDF markets and on whether or not they can move their tyres through an agent for overseas recycling.

The price of oil and coal were relatively strong during the 2013-14 financial year, thus export markets were also strong. This situation has since changed dramatically in 2015, which is further discussed in Section 5.

4.2.4 OVERVIEW OF ISSUES ASSOCIATED WITH TYRE EXPORT DATA

Anecdotal evidence from a range of industry sources suggests export markets may also account for a significant portion of the 'unknown' tyre data, and furthermore there are potential ambiguities in Hyder's interpretation of the data. The following sections provide an overview of issues associated with tyre export data.

Undeclared Exports

One reason cited for the potential under-reporting of export data is that there are situations where the exporters are not required to declare shipments to the Australian Customs Service (Customs). Australian Customs and Border Protection Service require that all goods intended for export from Australia with a value of \$2000 or more must be declared to Customs on an export declaration number (EDN) (Australian Customs and Border Protection Service, 2015). Goods with a value less than \$2000 are considered exempt³ from this requirement. Exporters are required to report their products to their Broker but, if the value is less than \$2000, then this product is not recorded with Customs.

Hyder understands that approximately 20 tonnes of end-of-life tyres can fit into a standard shipping container (a standard 20-foot shipping container has a volume of 38.5m³ and baled tyres have a density of around 500 kg/m³). Therefore, a tyre exporter may only be obligated to declare their load to Customs if they believe the end-of-life tyres were worth more than \$100/t. Hyder understands that the current purchase price within international markets has been consistently less than this for some years, therefore it is very likely that exporters would argue that the contents of their containers are worth less than the \$2000 that would trigger additional paperwork requirements.

It appears likely that many shipping containers containing end-of-life tyres may leave Australia totally unrecorded in Customs and ABS records. The Australian Customs and Border Protection Service does offer assistance with Australian Harmonized Export Commodity Classification (AHECC) classification, for goods worth more than \$2000, and exporters can fill out the Application for AHECC B318 form. But the extent to which tyre exporters actively seek out this advice is uncertain, given the disparity between the likely value of their goods and the threshold at which they are required to make a declaration.

There are also anecdotal reports that exports of waste tyres are occurring in returning shipping containers. The tyres are reportedly baled and marked as 'empty' shipping containers destined for Asia.

It appears highly likely that undeclared exports contribute to at least some of the large amount of "unknown" data in this study.

³ There are exclusions and restrictions to the use of the exemptions. Further details may be found in the Export Control Manual, Volume 12 (Australian Customs and Border Protection Service, 2015).

AHECC Classifications

There is some uncertainty around the quantities of imported and exported end-of-life tyres. Some of the uncertainty relates to the necessary assumptions made in order to allocate EPU values to each code so that the data can be converted to EPUs (refer to Section 2.2.2 for further discussion). However there is also a possibility that material may be imported or exported against incorrect codes, due to the ambiguity in statistical items in the Harmonized Tariff Item Statistical Code (HTISC) and the Australian Harmonized Commodity Classification (AHECC).

Ambiguity in the wording of codes may have significant implications for the Customs data provided by ABS. For example, Table 4-30 below shows how the import code 4012900027 “Solid rubber tyres” is listed under code heading 4012.

Table 4-29 Import code descriptions under Chapter 40, Heading 4012

Chapter	Heading	HS Code	Import Statistical Item	Description
40	4012			RETREADED OR USED PNEUMATIC TYRES OF RUBBER; SOLID OR CUSHION TYRES, TYRE TREADS AND TYRE FLAPS, OF RUBBER:
		40121		- Retreaded tyres:
		401211	4012110083	-- Of a kind used on motor cars (including station wagons and racing cars)
		401212	4012120085	-- Of a kind used on buses or lorries
		401213	4012130086	-- Of a kind used on aircraft
		401219	4012190089	-- (excl. those of a kind used on motor cars (incl. station wagons and racing cars), buses, lorries and aircraft)
		401290		- Other
			4012900027	Solid rubber tyres

Codes contained under Heading 4012 represent retreaded and used tyres, which is clear from the chapter description, however when this code is viewed as a standalone code, the description is merely “Solid rubber tyres”. Given the significant quantity of tyres that were imported against this code (2,074,870 items), there is a strong suspicion that this code, intended for used tyres, is being used for the import of new tyres.

Customs is not able to check that every material exported is correctly labelled against the HTISC/ AHECC codes, due to the sheer scale of materials imported and exported from Australia. The onus to correctly label materials exported is largely attributed to the exporter or broker. However, this is one instance where it is considered highly likely to cause misuse of import codes and therefore data from ABS may be easily misinterpreted.

Summary

As identified above, there is significant degree of uncertainty in relation to tyre export data, which raises some concerns as to the quality of the export data detailed in this report. Hyder has exercised due care in using this data but the data should be considered in the context of these limitations.

The relative extent to which this confusion is intentionally and unintentionally caused is difficult to determine. There may be commercial incentives to avoid clear and accurate labelling of data.

It is also possible that many Australian tyre exporters are not completely familiar with the intricacies of existing Australian Customs systems and processes.

4.2.5 UNKNOWN TYRE DESTINATIONS

Despite the greater coverage of the industry survey conducted by Hyder and Tyres Reclaimed compared to previous surveys, the study has resulted in a significant quantity of end-of-life tyres of 'unknown' destination. This category accounted for 6,945,037 EPU's, or 13.6% of Australian end-of-life tyres.

As previously stated, the data gap is considerably less than for the 2009-10 study (which found 62.6% of tyres with unconfirmed destination). The data gap for passenger tyres has been notably reduced, with only 0.3% of passenger tyres unaccounted for in the current Study. This compares to 32.4% of truck tyres and 8.8% of OTR tyres for which Hyder was not able to determine the destination. The current Study has estimated that approximately 79.4% of OTR tyres were managed on-site, which is further discussed below.

OTR Tyre Destinations

In order to investigate the destination of the large portion of OTR tyres, representatives of the mining industry were consulted as part of the study. It is difficult to source quantitative data on mining tyres as the rate of tyre generation at mine sites is closely tied to production rates; therefore mining companies are generally unwilling to share this data. Some data on the quantity of tyres scrapped was received from two mining companies, however Hyder was unable to include the data in the current study as the data received was from outside the study period, and also the data provided only end-of-life generation rates, the destination of the material was not confirmed (although, as stated below, Hyder has been advised anecdotally that up to 99% of OTR tyres are managed on-site).

Western Australia is a significant market for OTR tyres and Hyder has reviewed a report prepared for the WA DER mapping waste flows in the Pilbara and Broome regions in the 2011-12 financial year (Talis Consultants, 2013). The report estimates generation of tyres within the region, broken down into mining and non-mining tyres, however does not indicate any local recycling quantities. Quantities of tyres from the Port Hedland Sub Catchment and Remote East Pilbara Sub Catchment appear to be transferred to Karratha and Perth for recycling, however it was not possible to discern the exact quantities as the material recycled is categorised as "Mixed rubber".

Although no quantitative data for the destination of OTR tyres used at mine sites was made available, anecdotal evidence indicated that upward of 90% (potentially up to 99%) of tyres at Australian mine sites are managed on-site. It is understood that this practice is generally approved by state governments; Hyder discovered a number of Waste Management Plans WMPs for Australian mine sites that indicated that OTR tyres would be buried on-site or "in pit" as the practice is known in the industry.

Hyder was advised by a representative of a large mining company that the decision to manage end-of-life tyres on site had been made in light of the company's Corporate Social Responsibility policy. This was reportedly due to the fact that the only viable alternative that had been identified was to export the tyres, where it would be extremely difficult to verify that the tyres were managed responsibly.

A report prepared by Sustainable Strategic Solutions (2006) on behalf of the WA Department of Environment and Conservation (now DER) indicated that most mine sites in WA dispose of OTR tyres on-site and provided a recommendation that mine sites be required to have "tyre management plans", to ensure that future recovery of mining tyres is possible through surveying and GIS mapping.

The main barrier to increased recycling of OTR tyres appears to be the “tyranny of distance”. Industry sources indicate that the average cost to transport and collect from remote mine sites can be in the order of \$350 - \$450 per tonne, which means that transferring the material for recycling is not economically viable. Mine sites are therefore opting for the far cheaper option of managing tyres on-site. Transport costs are further discussed in Section 4.4.2.

Hyder is aware of one company that is taking the lead on the issue of OTR tyre recycling, and has been developing an OTR recycling facility which may be operational by mid-2016. However, while the practice of disposing tyres on-site or “in pit” is permitted, there appears to be little driver for mining companies to do otherwise. Hyder notes an opportunity for State Governments to consider a review of the waste management requirements of major mine sites, to ensure that recycling options be taken up, where available and viable.

The destination of the missing truck tyres is more difficult to ascertain, although one possibility is that some of these tyres are also ending up at mine sites. One mining company consulted as part of the Study indicated that truck tyres account for a proportion of their scrapped tyres. Another possibility is that the export data underestimates actual export quantities, as discussed above in Section 4.2.4.

4.3 MARKET CAPACITY

As part of the industry survey, current reprocessors were asked to estimate their current processing capacity. Most established tyre recyclers involved in crumbing activities reported operating at between 35% and 60% of potential capacity⁴. Based on the information provided, the estimated total capacity for crumbing in Australia is approximately 4.5 million EPUs.

There is significantly more shredding capacity in the industry, however it is not possible to accurately estimate this as only a small proportion of businesses involved in shredding were able to estimate the capacity at which their business is currently running.

4.3.1 SUMMARY OF CURRENT AUSTRALIAN MARKET

Figure 4-32 overleaf presents a graphical overview of the end-of-life tyres market in Australia and a breakdown of the estimated size of each market.

⁴ One particular business surveyed was involved in R&D activities and given the operation is only at pilot stage, they reported operating at 100% capacity but this is not reflective of a full commercial operation and has been excluded from the analysis.

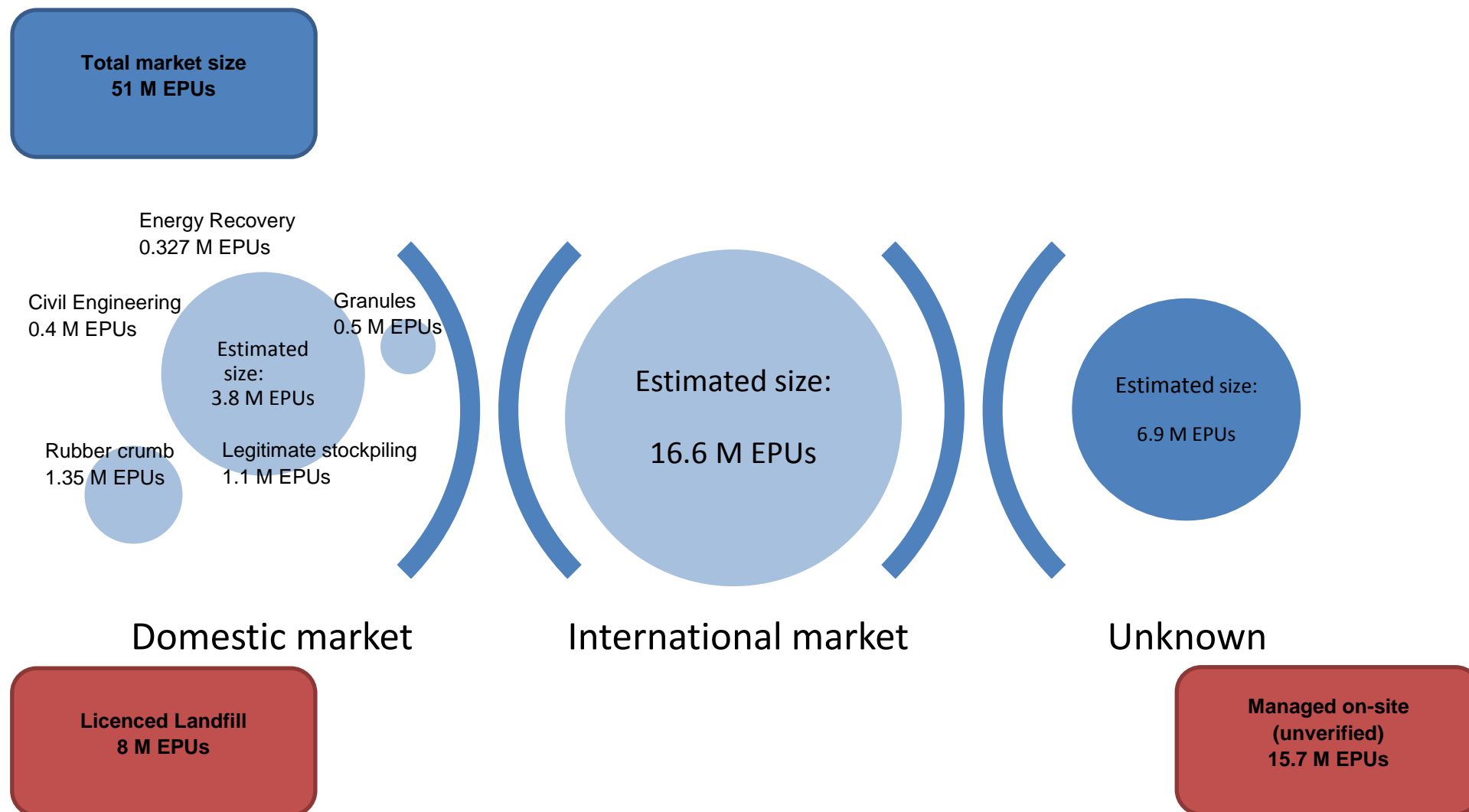


Figure 4-32 Overview of Australian end-of-life tyres market

Note: Data is expressed in M EPU (Millions of EPU) for ease of comparison.

4.4 KEY PRICE MECHANISMS

This section provides an overview of the key price mechanisms within the end-of-life tyres market in Australia and their influence over the market.

4.4.1 CAPITAL AND PROCESSING COSTS

A tyre is made from as many as 10 different compounds and is designed specifically to remain intact under high pressure. As a result, tyres are difficult to disassemble in either a high tech (for example breaking a tyre back down to its initial components) or a relatively low tech (such as shredding or crumbing) manner. The high cost of processing tyres is due to both the price of initial infrastructure and also ongoing maintenance, such as regular replacement of shredder blades.

Estimates provided to Hyder suggest that a large capacity shredder, capable of shredding tyres to a size suitable for energy recovery may cost in excess of \$0.5 million in capital for the equipment alone. Operating costs for such machinery are estimated to be in the order of one third of capital expenditure (CAPEX) per annum, with power consumption comprising a large portion of this (around one quarter of total operating costs). Maintenance costs run at between 15–30% of CAPEX.

Infrastructure costs increase significantly with the need to produce finer grade products (that is, the smaller the crumb size the higher the cost). Hyder understands that installation of such equipment can be in excess of \$1 million. Operating costs for this type of machinery are also extremely high, with maintenance costs and power supply being significant given the nature of the feedstock.

It is noted that the power requirements may present a significant constraint in terms of suitable sites for installation, especially for the larger unit described above. Utility upgrades required to operate such a unit could potentially far exceed the capital cost of the equipment itself.

An alternative to shredding is the baling of whole tyres. Hyder understands second-hand balers are readily available in the marketplace (many shipping from the US), with capital costs well under \$50,000. Relatively simple operating procedures, low processing costs and historically strong international demand for baled whole tyres also contribute to the low barriers to entry in this style of market. Figure 4-33 overleaf presents a graphical summary of the capital and processing costs associated with tyre reprocessing.

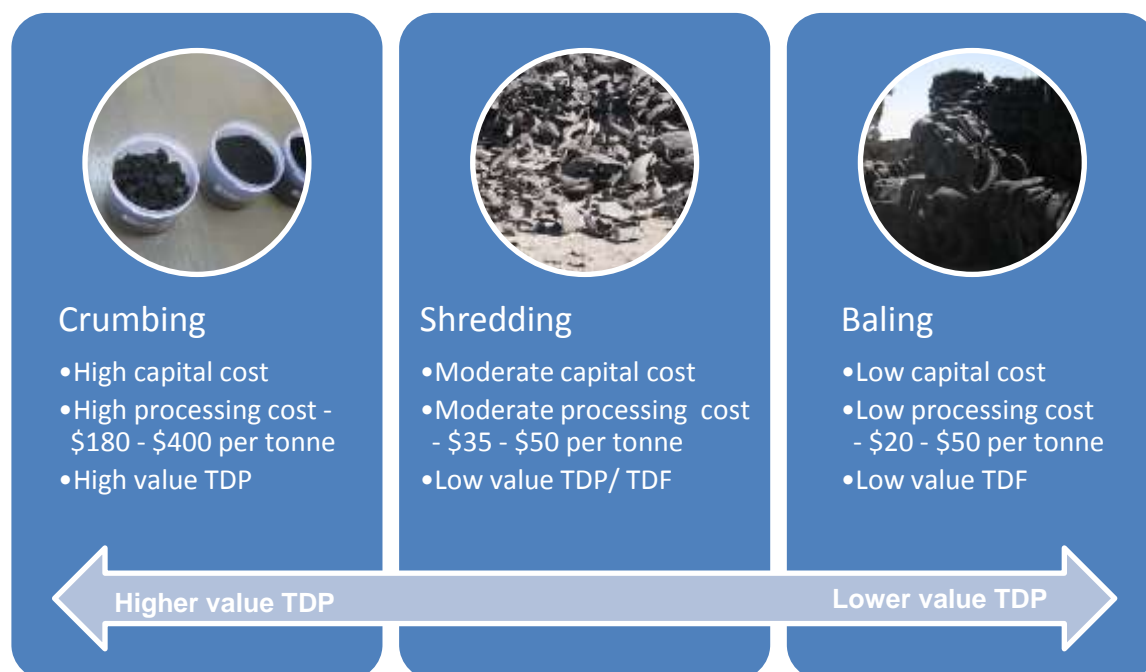


Figure 4-33 Summary of tyre reprocessing costs (capital and processing costs)

4.4.2 TRANSPORT COSTS

Transport costs are a significant factor in the tyre recycling market, and might be considered one of the most significant barriers to increased recovery of end-of-life tyres in Australia. Hyder was advised that often the cost to transport tyres from remote and regional areas to metropolitan areas, where the majority of tyre reprocessors are located, are generally prohibitive.

As with most markets for waste materials, the impact of transportation costs is often significant, with low value materials such as recycled concrete having an economically viable transport distance of as little as 30km (Sustainability Victoria, 2013). The marginal nature of tyre recycling (particularly for export) suggests that a similar constraint would apply, meaning it may not be feasible to collect and transport stockpiled tyres from regional and rural stockpiles even to local regional centres for centralised processing.

Industry sources suggested that transport costs are between 50-80c per EPU within a ~200 km radius, which would erode a significant portion of the collection fees currently charged in some areas (refer to Section 4.4.3 for discussion on collection fees).

Export costs

Research conducted by Hyder and Tyres Reclaimed indicates that export costs during the study period were within the following ranges:

- Queensland/ NSW/ Victoria: approximately \$450-\$1,800 per container depending on the destination
- Western Australia: approximately \$550 - \$2000 per container depending on the destination
- Tasmania to Melbourne: approximately \$3000 per container

These costs are particularly significant for tyres located in regional areas, as Hyder was advised that transport costs to transfer a container to the port for export can be as much as the cost to export the container. Estimated costs for a container located close to a port are within the range

of \$400-\$500, however regional centres such as Shepparton in Victoria might attract up to \$1600 per container to transport it to port.

Hyder's research has indicated that the commercial opportunity associated with tyre export is not based on the value of the product as a fuel source; considering the capital, processing and transport costs against prices that have been quoted for TDF, there is a net cost to exporters to access international fuel markets.

However, tyre collectors are able to charge a collection fee for collection/disposal/recycling of tyres, which is further discussed in the next section. It appears that these collection fees have, at least in the past, offered greater profit margins to tyre exporters, particularly for baling operations which require lesser capital investment.

Hyder is aware that export costs have recently increased dramatically (in some cases up by \$1000 per container in 2015) following the recent drop in the value of the Australian dollar. See Section 5 for further discussion of the impact this is currently having on the tyre recovery sector.

4.4.3 COLLECTION FEES

A key barrier to the increase of local tyre reprocessing therefore appears to relate to the pricing mechanism for collection/disposal/recycling of tyres. Collection fees are generally charged by reprocessors in order to offset the high costs associated with tyre reprocessing, however strong competition amongst collectors has progressively driven down the collection fees in some areas. Information provided by a range of industry sources indicate a wide range of fees charged across the country, which are summarised in Table 4-30 below.

Table 4-30 Summary of tyre collection fees, by state/ jurisdiction

State/ Jurisdiction		Average Collection fee (per EPU)
Victoria		\$1.65
NSW		\$2.18
Queensland		\$1.60
SA		\$1.75
WA	Metro	\$1.65
	Regional/ Remote	\$4.25
NT		\$5.00
Tasmania		\$2.50

Note: Not all survey respondents were willing to share tyre collection fees charged. The information in this table is based on responses from 20 businesses across Australia.

As shown in the table above, collection fees appear to be lowest in Victoria, Queensland and metropolitan WA, while collectors are able to fetch much higher fees in remote areas of NT and WA. Collection fees are noted to generally be higher and fluctuate more in regional areas, where they vary more dependent on travel time.

Pricing of collection fees is dependent on competition and collectors are often compelled to drop prices in order to compete with those charged by competitors. There were several reports of collectors charging as little as \$1 per EPU for collection, which has served to drive down

collection prices, particularly in NSW, Queensland and WA which appear to have the lowest fees compared to other states. Given that these states have three of the largest ports in Australia, and also the largest proportion of exports, it is evident that the entrance of balers/exporters of tyres to the market has had a significant influence on market pricing.

A number of major reproprocessors indicated that collection fees in some regions have fallen well below levels that are required to offset processing and transport costs, with indications that \$1 per EPU represents less than half that reportedly needed to sustain a viable recycling business.

There is strong evidence that retailers are failing to pass on the full levy or “environmental charges” that they charge their customers. Hyder’s research suggests that fees charged by retailers in many instances are well above the market rate for tyre collections and, instead of passing this revenue on for legitimate recycling, many retailers may be looking for the cheapest disposal options and pocketing the excess.

One source indicated that one particular tyre retailer has moved toward greater transparency by revealing the true “recycling charge” on its invoices – Hyder understands that the charge is often hidden by other retailers, and several stakeholders noted that this transparency on pricing would be highly welcomed. It was further suggested that this might be a topic for further research by TSA, as independent economic modelling of the true cost of tyre reprocessing, conducted by an independent entity would provide reproprocessors with evidence to justify increasing the fees, which appears to be desperately needed to fund legitimate local recycling.

4.4.4 SUMMARY OF KEY PRICE MECHANISMS

In summary, Hyder’s assessment indicates that the high processing costs faced by the tyre recycling industry, increased competition and undercutting of collection fees by some tyre collectors have combined to create challenging market conditions.

In Hyder’s view the collection fees at the start of the economic value chain (i.e. disposal levies applied to customers) have been the most significant contributor to the market challenges. The sizeable collection fees which can be gained by merely collecting tyres have increased competition, and the intensity of rivalry is fierce with a large number of competitors each trying to gain market share. There were numerous reports of price undercutting, which has driven down collection fees, which is impacting reproprocessors which have relied on this revenue to offset high processing costs. There is a need to resolve this potential market failure, whereby reproprocessors income (predominantly collection fees) is eroded to such levels that processing becomes unviable, as collection fees in some regions are already reportedly below that required to sustain local reprocessing businesses.

4.5 CHALLENGES AND OPPORTUNITIES FOR MARKET DEVELOPMENT

This section explores opportunities for market development which have been identified throughout the course of the study. This is not an exhaustive list, but captures the key opportunities that were identified throughout the consultation by Hyder and Tyres Reclaimed.

4.5.1 EXISTING MARKETS

Tyre Derived Products

According to industry sources, there may be limited scope for expansion of the local markets for rubber granules. However the Gold Coast Commonwealth Games in 2018 may provide short-term opportunities for growth in this market through increased uptake of track surfacing and matting applications.

One issue cited by a number of industry sources is that local crumb increasingly has to compete with cheaper overseas imports, from countries such as Malaysia and China. One manufacturer of rubber flooring reported importing crumb from Malaysia for their products. Hyder was advised that there are imported rubber crumb products available at approximately \$20 less than the local cost price.

According to industry sources, subsidies provided in other countries make it possible for imported tyre crumb to be sold at a cheaper price than can be offered by local tyre reprocessors. A lack of production controls in these jurisdictions means that, in many instances, the products provided are of poor quality and fail to meet the required specifications for use. Furthermore, industry sources reported a suspicion that overseas competitors may be using alternative feedstock (e.g. rubber seals), which would also result in a lower quality product. Not only does this situation make it extremely difficult for local companies to compete on price, it has also led to negative perceptions with regard to the quality of tyre crumb and its appropriateness in some applications, which damages the entire market.

Whilst one way to counteract this might be to offer similar subsidies to local reprocessors, Hyder recognises that this type of intervention is unlikely to come from government funding and does not currently align strongly with the scope of TSA. Therefore, more localised and nuanced approaches may be considered such as:

- Development of quality standards for end products
- Ongoing support for product testing and case study development
- Highlight and showcase key projects of significance

There is also significant opportunity to leverage government procurement practices in developing stronger end markets for TDP. For example, the Victorian Government recently introduced requirements for all fleet vehicle providers to be members of TSA prompting immediate action from a number of organisations. Given all states and territories support the scheme as the key mechanism for delivering improved outcomes for end of life tyres, it is likely that government procurement contracts can act as both a mechanism for promoting TSA and for mandating the use of local TDPs where relevant.

Industry sources have suggested that there is potential for growth in the crumb rubber market through use in explosives. This is further discussed in Section 4.5.2.

Civil Engineering

This study has shown that the local market for end-of-life tyres used in civil engineering applications is relatively small; there is certainly potential for growth in this market.

Tyres (whole and shredded) may be used for a range of civil engineering applications which are summarised below in **Table 4-31**.

Table 4-31 Summary of civil engineering applications

Whole	Shredded
Retaining walls	Road embankments
Wall building blocks	Subgrade fill in soft soils
Crane pad base	Landfill (drainage layer, gas capture pipe backfill)
Race track crash barriers	Void filler (behind retaining wall)
Erosion control/rainwater runoff barriers	Drainage media
	Vibration damping layer

The primary advantage of shredded tyres in engineering applications are that they have a low density and high permeability, therefore can act as a lightweight fill material. The use of whole tyres relies upon the ability of the tyre to act as a container which can be filled with crushed rock or gravel to form a structural unit.

Depending on the application the number of tyres required can vary significantly. For example 1m³ of compacted shredded tyres requires around 55 EPU (US Department of Transport, 1997). The number of tyres needed to construct a retaining wall is dependent on the civil requirements. Hyder's review of a case study found that construction of a wall 3m high required around 20 EPU per m² of wall (Ecoflex, 2008).

A major barrier to widespread use of tyres in civil applications in Australia, according to industry sources, is that tenders in the construction industry tend to specify products and not outcomes. For example, a WA business has developed a concrete/tyre retaining wall manufactured that reportedly meets the relevant Australian Standards for use in a number of applications. However, Hyder was advised that tender documents are commonly written as a 'design & construct' using specified products instead of being 'outcomes based'. This approach precludes the use of alternative products, including those which might incorporate significant quantities of TDP.

A further barrier may be the regulatory environment. Most States have restrictions on the number of tyres that may be stockpiled. If State Governments were to develop specifications for waste derived products this would provide greater certainty about when a tyre derived product exits the regulatory framework. NSW is leading the regulatory change with the recovered tyres exemption 2014 (NSW EPA, 2014). The exemption applies to tyres used in civil engineering structures and road making activities (using industry recognised standards such as the Building Code of Australia) and exempts users from obligations under the Protection of the Environment Operations Act and the Waste Regulation. This provides greater certainty to the construction industry that they will not have ongoing liability when using tyres in construction. However, there are still burdens placed on industry with restricted uses (not below groundwater) and record keeping requirements (6 years) that do not apply to the virgin materials that tyres compete against. Western Australia is also in the process of developing end-of-waste guidelines but tyres have not been identified as a priority for the immediate future.

Domestic Energy Recovery

The combustion of tyres in cement kilns has declined over the past few years and evidence suggests there are currently no tyres going to Australian cement kilns for energy recovery. There was a moderate amount of end-of-life tyres being used for fuel in cement kilns during the previous 2009-10 study, however, Boral's cement kiln at Waurin Ponds, which previously accepted tyres, closed in 2012.

The Cement Australia kiln in Gladstone reportedly burned around eight tonnes of passenger tyres per day (Gladstone Observer, 2006) in 2005-2006 which would equate to around 2,900 tonnes per year. Hyder understands that the feeder equipment required is still in place therefore there is still a capability to accept tyres. However, previously the tyres were shredded on-site and processing of tyres ceased when that shredder broke down. It appears that the business case to recommence processing of tyres by investing in a new shredder failed, and continues to fail, due to the high cost of transport. With a significant proportion of tyres in NSW and Victoria it is reportedly 50% cheaper to send a shipping container to Asia, due to low "backloading" rates, than to Gladstone.

The potential for other methods of energy recovery is further discussed in Section 4.5.2.

4.5.2 NEW OR EMERGING MARKETS

This Section provides a brief overview of new or emerging markets for tyre derived products which have been identified as potential growth areas in the Australian market.

Road surfacing (Crumb Rubber Asphalt)

The use of crumb rubber in sprayed bituminous surfacing is relatively well established in Australia, predominantly as a sprayed bituminous surface where the crumb rubber is added at the point of preparation of the mix, and is blended on a just-in-time basis at the point of spraying. Production of crumb rubber asphalt is, by contrast, yet to be fully realised in Australia.

The application of crumb rubber asphalt has several advantages mainly because it saves non-renewable raw materials, large volumes are needed in each project, and there will always be a market in road construction around the country. The primary disadvantage is that the cost of size reduction makes it less viable when compared to the current low prices of virgin petroleum products. It is further understood that crumb rubber asphalt requires additional bitumen be added to the mix, which increases production costs compared to using virgin products.

Crumb rubber asphalt can be produced through wet or dry mixing. The wet mix is produced through digesting rubber and bitumen at a high temperature and then adding aggregate in a mixing plant. A dry mix process involves the addition of dry rubber particles to aggregate and bitumen in a pugmill at an asphalt mixing plant. ARRB Transport Research investigated performance of the two mixes, and found that dry process crumb rubber performed better in both rutting and fatigue. However, wet mixes still performed better than most alternatively modified binders tested.

The study referenced by Austroads (Austroads, 1999) made the following recommendation in relation to use of crumb rubber asphalt.

The 14 mm asphalt mix shall contain 8.0% of bitumen and 2.5% of crumb rubber expressed as a percentage of the total mass of the mix. The crumb rubber shall have a maximum particle size of 440 µm and a maximum bulk density of 300 kg/m³. Dry mix asphalt shall be stored for a minimum of half an hour, to allow digestion of the rubber to proceed, before being placed.

Industry sources have suggested that use of crumb rubber asphalt in road construction, at current construction rates, could consume almost all of the rubber crumb currently being produced by the tyre recycling industry. There is certainly a significant opportunity for increased uptake of TDP locally in crumb rubber asphalt applications. Hyder understands that TDP in this application may be cheaper than the traditional polymers that it replaces, although it does require additional capital investment upfront to allow incorporation of TDP in asphalt production. Recent investment by Downer EDI in new bitumen warm mix infrastructure at their Bayswater site shows the desire of market leading companies to support the development of this market. The plant will allow integration of crumb rubber in warm mix applications as well as increased capacity to integrate recycled asphalt pavement (RAP).

However the major barrier, according to industry stakeholders, continues to be a lack of momentum amongst Australian roads authorities. Even where specifications for the addition of crumb rubber in asphalt exists, provision is not always allowed within tender documents. Similarly, given road development is cost competitive, respondents are often reluctant to offer any product that might have a greater upfront cost, regardless of any long term payback. A representative of the road construction industry indicated that, while modifications to asphalt production may be needed, if requirements for crumb rubber were included in road design specifications, industry would adjust accordingly, with the desire to win work being the main driver.

Although the advantages of crumb rubber asphalt are already well proven and there are “at scale” examples of its application in Australia, it has been suggested through the consultation that further R&D is required to continue to improve confidence in the product within the market. This may be as much a product of perception as the need to “prove” the efficacy of the application, however as this remains the prevailing opinion by key stakeholders it must therefore be considered as key to market development. Investment by either government and/or TSA in this area should therefore be done with the existing suite of knowledge and evidence already in mind. This may mean that more targeted research into specific localised applications is appropriate.

There may also be scope for the introduction of targets for use of crumb rubber asphalt in road surfacing. For example, the state of California (USA) introduced a government mandate which required it to increase the use of rubberised asphalt pavements to at least 35% of the total weight of asphalt paving materials used on its highway construction and repair projects by 2013 (Official California Legislative Information, 2005). This could be applied in a number of settings, however in most instances the key point of intervention for this market are the state road authorities and either mandated or more likely voluntary targets should be considered at this level. Such an approach would certainly help to drive uptake of TDP through Australian road construction.

Crumb rubber explosives

Another potentially significant local market, which was suggested by a number of sources, is the use of crumb rubber in explosives. Crumb rubber can be used in two ways in the explosives market, firstly as a stemming agent that contains and directs the explosion to maximise the impact and secondly within the explosive itself as a replacement for diesel as a mix with ammonium nitrate.

In the first instance crumb rubber competes with aggregate as a stemming agent which is readily available on mine sites and inexpensive to procure. There are some performance limitations of aggregates when compared with crumb rubber. On the other hand, when detonated, crumb rubber stemming sends fragments of rubber material across the mine site.

Crumb rubber can be used as a diesel replacement within the explosive. Diesel is an expensive medium to use and is less stable both from a transport perspective and as a mixing agent with

ammonium nitrate. In terms of performance, diesel requires significantly more input to achieve a similar blast result as rubber mixed explosives. Hyder was also advised that crumb rubber alters the blast characteristics which can be advantageous in colder climates such as Canada.

Hyder understands Commercialisation Australia is currently funding (business.gov.au, 2015) the development of a waterproof blasting explosive made from recycled crumb rubber⁵.

Crumb rubber as a substitute for coal

Tyre Derived Fuel (TDF) can be used as a substitute for many fossil fuels used in existing processes such as cement kilns, power stations, smelters or paper mills. TDF can be either whole tyres or shredded. While TDF can be used as an alternative fuel, it is most commonly used as a supplemental fuel.

On average, the energy content of TDF ranges between 27 and 39 MJ/kg. This compares favourably to bituminous coal (26-30 MJ/kg) (Giere, 2004). Another advantage of TDF is that it typically contains less than 2 wt% moisture which is less than bituminous coal (3-10%)

As TDF is an opportunity fuel, that is it must be cheaper than the fuel they are displacing, it has a number of limiting factors. Firstly, the processing cost must be considered, and this increases with the decreasing size of the final product. The cost of grinding whole tyres for combustion in a power station for example can be as much as 5 times more expensive than the equivalent size reduction for coal; de-wiring alone increases the cost of energy recovery by 25-50% (Amari, 1999). Cement kilns are therefore the most viable combustion option as they do not require a large reduction in size and the steel wire does not need to be removed.

Secondly a continuous tyre supply is needed to justify the start-up costs and increased maintenance costs at the combustion plants. Lastly, energy recovery is lower than recycling or reuse on the waste hierarchy therefore from a philosophical perspective it is less preferable.

OneSteel has patented a process which allows substitution of coal for tyre derived fuel (fine grade crumb rubber) in their steel mill. There is potential for this to be taken up by other steel mills around Australia, however Hyder was advised that there may not currently be enough reprocessing capacity in Australia to produce the amount of rubber crumb which would be required by the process (although the source did not specify the quantities involved).

Energy from Waste Technologies

Pyrolysis

Pyrolysis is the process of applying heat in the absence of oxygen. When exposed to high temperatures under pyrolysis conditions, the tyre degrades into its constituent products including carbon char, oil, syngas, steel and inorganic ash.

The uses of the constituents is summarised below in **Table 4-32**.

⁵ Further information can be found at this link: <http://www.business.gov.au/advice-and-support/EIP/Accelerating-Commercialisation/Pages/AC-PortfolioParticipant.aspx?PageContentID=80>

Table 4-32 End-of-life tyre constituents and their uses

Constituent	Use
Carbon char	Water purification Air purification Batteries and fuel cells Pollution adsorbent Energy (30.5 MJ/kg)
Oil	Energy (44 MJ/kg)
Syngas	Energy (30-40MJ N/m ⁻³)
Steel	Scrap metal recycling

Source: (Fortuna, 1997)

The pyrolysis process is optimised with the use of smaller feed size particles which provide more reaction surface, resulting in a high heating rate and rapid decomposition (Nkosi, 2014). However, as stated previously the processing cost increases with the decreasing size of the TDF. Using whole tyres reportedly results in higher yield of char as there is not enough surface area to facilitate the reaction (Nkosi, 2014).

The main barrier for the development of tyre pyrolysis processes on a commercial scale is that the products are competing against virgin materials which are currently cheaper to produce. An example of this is the recent drop in crude oil and coal prices which has made alternate sources of energy less competitive. Also, the scrap metal may be difficult to process due to contamination with carbon and the high volume mass which increases transport costs.

A review of published reports indicated that there was only one dedicated tyre pyrolysis plant in Europe operating in 2004 on a semi-commercial basis (Mukesh, 2004) with none in the USA. However it is unclear whether the UK plant is still in operation as there is no evidence of the company online. A 2011 report indicated that there was a plant in Spain capable of processing 16,500 tonnes of used tyres per year (Ramos, 2011) but similarly there is no information currently online indicating if the plant is operational. A report detailing challenges to tyre recycling in Spain indicated that the pyrolysis plant in operation did not have any clear advantages over other processes (Uruburu, 2013). There are a number of pyrolysis plants in Asia, particularly Malaysia, which process tyres exported from Australia however this market has recently contracted quite considerably (see Section 5 for further discussion).

During consultation for this project Hyder and Tyres Reclaimed noted that there were a number of businesses (at least 5) either considering or actively developing plans for pyrolysis plants. Particularly in Victoria, the publicity around the significant stockpile of tyres at Stawell appears to have spurred a number of businesses to be exploring pyrolysis options.

Pyrolysis technologies are mostly small-scale and modular, and could be well suited to a distributed regional hub model, which would reduce transport costs and take advantage of existing collection and aggregation systems.

However, there is a significant degree of technical risk associated with such processes, and emerging technologies such as pyrolysis have been prone to technical failures in the past. These concerns make it difficult for proponents to secure feedstock and funding. In the UK, a project proposed by Pyreco intends to process 200 tonnes of tyres per day using a pyrolysis system developed by thermal processing experts Metso. Despite the experience and global gravitas of the technology provider in the thermal processing industry, the project has struggled to attract the 80 million GBP investment required (Waste Management World, 2013). The success or failure of early projects may be critical to the growth of this market.

Hyder also understands the Renex facility in Melbourne, which was in commissioning at the time of writing, intends to accept a small volume of tyres in addition to shredder floc. The plant will employ a pyrolysis-based system to treat contaminated soils, but will take a small proportion of calorific waste streams to assist in maintaining process temperatures.

Gasification

The use of gasification technology has been commonplace for many years, but it has only recently been applied to the management of solid waste. It is a thermal process in which heat is applied to waste in a limited oxygen environment to promote partial combustion. The process decomposes the waste whilst controlling the temperature, pressure and ratios of carbon, hydrogen and oxygen.

The result is a synthesis gas or syngas with an approximate yield of 63% by weight, and a solid phase representing about 37% about total weight (Ramos, 2011). The syngas has low calorific value (5 - 6 MJ/Nm³) and it is composed mainly of hydrogen and carbon monoxide. Most existing plants burn the syngas immediately to recover energy via a steam turbine system. Syngas can also be used to fuel gas engines, gas turbines and fuel cells, potentially offering greater conversion efficiencies, but this is yet to be commercially proven.

While biomass gasification is relatively well developed and currently having increasing success in Europe, application of the technology to end-of-life tyres is still in its infancy. The only operational gasification plant solely processing waste tyres was developed by the Krupp Polysius Technology with a facility in Switzerland processing approximately 24,000 tonnes and another in Germany processing 40,000 tonnes (Juniper Consultancy Services, 2004). There are no commercial gasification facilities of any kind in Australia. There are gasification reference plants taking mixed MSW as feedstock in Norway, Germany, UK (Energos), and facilities taking RDF as feedstock in Germany and Japan.

There are a number of ongoing barriers impacting the uptake of energy from waste technology to recover energy from end of life tyres. Whilst evidence suggests that commercial scale facilities do exist in other jurisdictions, it is clear that the conditions for success are marginal and that the gate fee remains the predominant driver for investment. Considering the indicative collection fees presented in 4.4.3 (which would be largely indicative of competitive gate fees) the financial viability of such facilities may not be guaranteed in the current Australian market.

Obtaining funding for unproven technologies will also be an ongoing barrier in the adoption of this technology for used tyre processing. It may be more likely in the short term that tyres will be included as a minor feedstock to a MSW gasification plant of which there are currently two plants planned and approved in Western Australia. Hyder understands that up to 15% of the feedstock for this facility could be tyres (Personal Communication, New Energy Corporation). Hyder understands that this is due to the high energy content and volatility of tyre rubber; tyres tend to combust (or gasify) very quickly, which can have a detrimental impact on the stability of the combustion process.

There is scope for government and TSA to play an active role in facilitating this technology in Australia. Whilst direct funding for infrastructure could be seen as the simplest and most direct form of intervention, the lack of current funding in the market suggest this may not be an option. In addition, funding may only serve to “prop up” models that do not have the business case to exist unaided. Therefore, government effort may be better placed in clearing the pathway for such technology to be put on the ground, such as setting clear policy and regulatory guidance for project proponents, assisting with community engagement and consultation, feasibility studies, development of sound business case and environmental impact statements and similar support.

5 FUTURE OUTLOOK

The majority of information presented in this report relates to the 2013-14 financial year, as that was the study period stipulated under the scope of this project. However, it must be acknowledged that market conditions in that year were vastly different to the conditions at present (in 2015). Although beyond the scope of the current study, it would be remiss of Hyder not to provide some commentary around the recent trends observed in the Australian end-of-life tyres market, and the challenges that the sector are currently facing.

Australian tyre recyclers, collectors and exporters are facing a significant market anomaly, with a number of events combining to result in a severely constrained international export market. These include:

- A substantial drop in commodity prices for coal and oil, being the major resources with which TDF competes;
- The drop in the value of the Australian dollar, increasing the cost of export routes;
- A major initiative conducted by the Malaysian Government in October 2014, aimed at investigating and reducing emissions from pyrolysis plants. Hyder was advised by an industry source that inspections of pyrolysis plants in Malaysia led to the closure of 54 out of 72 facilities. Given that Malaysia is one of the largest export destinations for Australian TDF, this was a major contributor to the contraction of international TDF markets.

Hyder understands that these changing conditions has led to a global decline in the demand for TDF and that this has led to a situation where recyclers are now making a loss in exporting their product, where previously a small margin could be made. According to information reported by Inside Waste (WME Media, 2014), exporters are now making a loss of 30 or 40 cents per tyre, compared to a profit of around 5 to 10 cents per tyre that was possible previously.

There are now widespread reports that collectors, recyclers and exporters are unable to find buyers for their product and that stockpiling is occurring at a rapid rate.

A Market Alert issued by the Australian Tyre Recyclers Association issued in February 2015 (ATRA, 2015) indicated that the current market conditions are unprecedented and that there is a serious risk of market failure.

According to industry sources, the current market conditions have served to worsen the disparity between the collection fees collectors are able to charge, and the funds required to offset costs associated with recycling. There is a pressing need to remedy this situation; Hyder is aware of at least 2 businesses that have gone out of business in recent months.

Hyder was advised that the Malaysian pyrolysis plants which have been closed down are having to upgrade their facilities to meet strict environmental requirements. It is therefore hoped that the situation may be remedied in time to avoid a severe market failure. This event highlights the need for immediate action to support increased local uptake of Australian TDP and TDF, to reduce the industry's reliance on overseas markets and subsequent vulnerability to global market conditions.

6 CONCLUSIONS & RECOMMENDATIONS

This report presents the sources and fate of end-of-life tyres in Australia for the 2013-14 financial year. In this study the destinations for end-of -life tyres have been categorised as follows:

- Domestic: recycling, energy recovery, civil engineering, licensed landfill, legitimate stockpiling, managed on-site and unknown.
- International: reuse and retreading, recycling and energy recovery.

It is noted that data categorised as “unknown” represents the balance of tyres for which the destination cannot be identified.

The findings of the current study indicate that approximately 51 million equivalent passenger units (EPU) of tyres entered the waste stream in 2013-14 which is around 408,000 tonnes (compared to 48.5 million EPU tyres entering the waste stream in 2009-10). Of these, approximately 5% were recovered locally (either through recycling, energy recovery or civil engineering) compared to 16% in 2009-10; 32% were exported compared to 18% in 2009-10; approximately 16% went to licenced landfills; and 2% were stockpiled for future recovery. Approximately 14% of end-of-life tyres were categorised as having “unknown” destination, and anecdotal evidence suggests that approximately 31% of Australian tyres are landfilled at mining sites (however it is noted that it was not possible to verify this quantity due to the lack of availability of quantitative data for OTR tyres).

The current study has highlighted the following major factors influencing the fate of Australian end-of-life tyres:

- local landfill prices and regulatory controls;
- constrained local markets and demand for TDP/ TDF;
- global commodity prices and demand;
- highly volatile international energy markets;
- increased competition for collection fees, restricting the income available to offset tyre recyclers’ high processing costs; and
- high transportation costs often required to access recovery options.

The domestic market for TDP and TDF in Australia has contracted by over 65% since the previous (2009-10) study. The sector has become increasingly reliant on the international energy market, with exports increasing from 18% in 2009-10 to more than 32% in 2013-14. This has been highlighted by the more recent market conditions observed in 2015, where a drop in commodity prices and the Australian dollar, coupled with the closure of a number of Malaysian pyrolysis plants has led to a global decline in the demand for TDF. Industry sources report that this has led to a situation where recyclers are now making a loss in exporting their product, where previously a small margin could be made. Recently, there have been widespread reports that businesses are struggling to find buyers for their product, leading to increased stockpiling and a number of companies going out of business, as the sector faces market conditions far worse than have been experienced before.

The Study has found that OTR tyres continue to be predominantly landfilled or managed “in-pit” at mining sites. The most common reason cited is the “tyranny of distance” with most mining sites located a significant distance from established tyre recyclers or ports and, lacking a viable alternative, these tyres are being landfilled or managed on-site.

The current market conditions highlight the case for the development of stronger local markets for TDP and TDF in order to reduce the industry’s reliance on overseas markets and

subsequent vulnerability to global market conditions. Support for development of end markets will be a key focus of TSA and a number of state government agencies over the coming years.

Hyder has identified a range of opportunities which decision makers may consider to support development of Australian tyre recycling markets, including:

Opportunity	Potential Initiatives
Support increased local recycling	<ul style="list-style-type: none"> ▪ Development of quality standards for end products ▪ Ongoing support for product testing and case study development ▪ Highlight and showcase key projects of significance to leverage government procurement practices in developing stronger end markets (refer to Section 4.5.1).
Provide a more consistent national approach to tyre regulation	<ul style="list-style-type: none"> ▪ Support development of a consistent national approach to tyre regulations. ▪ Develop a nationwide framework that would allow individuals to easily identify their obligations and compliance requirements across the various jurisdictions.
Support increased uptake of TDP locally through increased production of crumb rubber asphalt	<ul style="list-style-type: none"> ▪ Develop targets for use of crumb rubber asphalt in road surfacing (refer to Section 4.5.2). ▪ Support further R&D to continue to improve confidence in the product within the market.
Support improved price transparency for tyre disposal or “recycling charges”	<ul style="list-style-type: none"> ▪ Encourage greater transparency amongst tyre retailers of levies or “environmental charges” to consumers. ▪ TSA funding for independent financial modelling of collection and recycling fees, to determine appropriate pricing required to offset legitimate recycling.
Support increased OTR recycling	<ul style="list-style-type: none"> ▪ State Governments review the waste management requirements of major mine sites, so as to ensure that available recycling options be taken up, where available and viable.
Work to ensure that only tyres of adequate quality are being exported to international second-hand markets	<ul style="list-style-type: none"> ▪ Develop a quality standard for used tyre exports, to ensure that Australian tyre exports are not of poor quality and potentially impacting road safety in other countries, particularly Asia and Africa (refer Section 4.2.1).

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APPENDIX A

EPU VALUES BY TYRE TYPE

Tyre classification	Type of tyre	EPU ratio
New		
Passenger	Motorcycle	0.5
	Passenger Car	1
Truck	Light Truck/SUV	2
	Truck small (17.5" & 19.5")	3
	Truck large (20" & 22.5")	5
OTR	Small Specialty/Ag (skid steer, forklift 8"-15", front tractor & backhoe 15" to 18")	3
	Medium Specialty/Ag (20" – 30")	5 to 8
	Large Specialty Ag (32" and above)	20-30
	Small Earthmover (24" – 25")	50
	Medium Earthmover (29" – 35")	100
	Large Earthmover (above 35")	200
Recycled/Used		
Passenger	Motorcycle	0.5
	Passenger	1
Truck	Light Truck	2
	Truck	5
	Super Single	10
OTR	Solid small (up to 0.3m high)	3
	Solid medium (>0.3m up to 0.45m)	5
	Solid large (>0.45 m up to 0.6m)	7
	Solid extra large (> 0.6m)	9
	Tractor small (up to 1m high)	15
	Tractor large (>1m up to 2m)	25
	Fork lift small (up to 0.3m high)	2
	Fork lift medium (>0.3m up to	4
	Fork lift large (>0.45m up to	6
	Grader	15
	Earth mover small (up to 1m	20
	Earth mover medium (>1m up 1.5m)	50
	Earth mover large (>1.5 up to 2m)	100
	Earthmover extra large (>2m up to 3m)	200
	Earthmover giant (>3 up to 4m)	400
	Bobcat	2

Source: *Tyre Stewardship Australia Guidelines* (Tyre Stewardship Australia, 2014)

APPENDIX B

PROJECT PLAN (METHOD REPORT)



PROJECT PLAN

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NATIONAL ENVIRONMENT PROTECTION COUNCIL

STOCKS & FATE OF END OF LIFE TYRES - 2014 STUDY

Project Plan

Final

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This report has been prepared for National Environment Protection Council in accordance with the terms and conditions of appointment for Stocks & Fate of End of Life Tyres - 2014 Study dated 17 November 2014. Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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1 INTRODUCTION

Since late 2009, representatives from the tyre industry and government have been working toward establishing a voluntary, industry-led product stewardship scheme for end-of-life tyres. The *Product Stewardship Act 2011*, which came into effect in August 2011, set in place the framework for accreditation of product stewardship schemes in Australia, and the Tyre Product Stewardship Scheme was officially launched in January 2014.

Central to measuring the success of the scheme is the establishment of baseline data – that is, data for 2013-14 financial year on end of life tyre destinations. The most recent national study was the *Study into domestic and international fate of end-of-life tyres* (Hyder, 2012) which reported data for the 2009–10 financial year. In view of this, Hyder Consulting (Hyder), in partnership with key knowledge broker Tyres Reclaimed, has been engaged by the National Environment Protection Council (NEPC) to undertake an update to the 2009-10 study to seek to improve available data, inform activities around the implementation of the product stewardship scheme and provide baseline data that can be used to measure performance of the scheme.

There have been a number of past studies that have aimed at documenting the “current state” of the end of life tyres market. The most recent of these studies undertaken for Sustainability Victoria, highlights a significant data gap in relation to the ‘secondary tyres market’; that is, the market for tyres that does not include large reprocessors (for example material that is directly imported, transported or stockpiled). Estimates suggest that as much as 50% of all end of life tyres enter the secondary market and as such the fate of this material is largely unknown. With this in mind, the NEPC seeks to undertake detailed data analysis and stakeholder consultation to more fully understand the destination of end of life tyres from across the primary and secondary tyres market.

The *Study into the Stocks and Fate of End-of-life Tyres in Australia 2013-14* (the Study) seeks to inform these processes by:

- Reviewing and updating the method and tools to update tyres data and trends;
- Consistent with the developed method, obtain data on, and analyse the trends in the sources and fate of end-of-life tyres; and
- Assess current and future markets for Australian tyre derived products.

This report outlines the method that Hyder Consulting and Tyres Reclaimed will use to collect and calculate up-to-date data on the lifecycle of tyres for this study. This report also outlines the qualitative assessment that will be undertaken during the collection and calculation of data for the Study, and the method that will be used to undertake the trend analysis and market assessment for the Study.

This method has been based on the methodology adopted for the previous study and has been updated and refined based on learnings from that study and discussions with the project management team. This method will be further refined during the course of the Study, and the subsequent market assessment. A finalised method will be presented in full as a component of the final Study report.

2 METHOD FOR DATA COLLECTION AND ANALYSIS

2.1 TYRE CLASSIFICATION, DEFINITIONS AND REPORTING

2.1.1 TYRE TYPES AND SIZES

Data on tyres will be expressed in equivalent passenger units (EPUs). EPUs are a standardised measure for the quantity of tyres. Where data collected is provided by weight, data will be converted into EPUs for reporting.

For this study, consistent with the previous study, an EPU will be taken to be 9.5 kg for a new tyre, and 8.0 kg for a used tyre. Accordingly, the EPU for a tyre in-use, and for a tyre put into re-use, will be taken to be the mid-point between the EPU for a new tyre and the EPU for a used tyre, being 8.75 kg.

Retread tyres will be assumed to enter their intermediate destination at an EPU of 8.0kg. It is assumed that this EPU will then be reduced by a further 0.5kg during the buffing of tyres prior to retreading. This 0.5kg of buffings will be attributed to an end-of-life destination. It will then be assumed that 2.0kg will be added back onto the tyre as retread casing. These assumptions will be tested during the course of the survey of tyre retreaders.

Table 2-1 shows the EPU weights that will be used for tyres at different stages in the lifecycle of a tyre.

Table 2-1 EPU of tyres by lifecycle point

Stage of use		EPU
Consumption	New	9.5 kg
	Second-hand	8.75 kg
	Retreads	9.5 kg
In-use		8.75 kg
Intermediate destination		8.0 kg
End-of-life destination		8.0 kg

In order to maintain consistency with the previous study, the EPUs stated above will be retained for the purposes of this study.

Tyres will be classified as being passenger, truck or off-the-road (OTR) tyres. Passenger tyres include those used on passenger vehicles, motorcycles and caravans, as well as trailers for domestic use. Truck tyres are those used on buses, light and heavy commercial vehicles, prime movers, trailers and semi-trailers, and fire fighting vehicles. OTR tyres are those used on machinery or equipment used in areas such as agricultural, mining and construction and demolition.

Table 2-2 overleaf shows the classification of tyres for vehicle types taken from the Tyres Product Stewardship Scheme Guidelines (August 2012) prepared by Tyre Stewardship Australia.

The number of tyres per vehicle type and the indicative EPU per vehicle is shown in Table 2-2. The values and terminologies shown in Table 2-2 will be verified and refined during the course of data collection for this study. This will include an evaluation of average weight of tyres for different vehicle types during the survey of the tyre industry, in particular truck tyres and passenger vehicle tyres (as noted above).

The calculation of EPU per vehicle will be made on the assumption that all vehicles, either assembled or unassembled, have a full complement of tyres fitted, including spare tyres. The calculation of EPU through the lifecycle of tyres will include both the outer tyre and the inner tube for pneumatic tyres.

N.B. Consistent with the previous study, this study does not cover tyre types smaller than those classified as passenger tyres. Examples of tyres excluded from the study are tyres from bicycles and other cycles; mowers and wheelbarrow; carriages for disabled persons; baby carriages; etc.

Table 2-2 EPU values by tyre types

Tyre classification	Type of tyre	EPU ratio
Passenger	Motorcycle	0.5
	Passenger	1
Truck	Light Truck	2
	Truck	5
	Super Single	10
Off-the-road	Solid small (up to 0.3m high)	3
	Solid medium (>0.3m up to 0.45m)	5
	Solid large (>0.45 m up to 0.6m)	7
	Solid extra large (> 0.6m)	9
	Tractor small (up to 1m high)	15
	Tractor large (>1m up to 2m)	25
	Fork lift small (up to 0.3m high)	2
	Fork lift medium (>0.3m up to 0.45m)	4
	Fork lift large (>0.45m up to 0.6m)	6
	Grader	15
	Earth mover small (up to 1m high)	20
	Earth mover medium (>1m up to 1.5m)	50
	Earth mover large (>1.5 up to 2m)	100
	Earthmover extra large (>2m up to 3.0m)	200
	Earthmover giant (>3 up to 4m)	400
	Bobcat	2

2.1.2 GEOGRAPHIC DISTRIBUTION OF TYRES

Consistent with the previous study, data on the consumption and use of tyres, and the domestic source and fate of end-of-life tyres will be reported by jurisdiction (state or territory) and by remoteness classification (metropolitan, regional or remote).

Remoteness classifications will be made using the Remoteness Structure from the *Australian Standard Geographical Classification (ASGC)* (Cat. No. 1216) published by the Australian Bureau of Statistics (ABS). Consistent with the previous study, the Remoteness Structure will be used for local government areas, and will be refined to a three-tiered remoteness classification as shown in Table 2-4.

Table 2-3 Remoteness classification

ABS Remoteness Structure	Remoteness classification for tyres
Major cities	Metropolitan
Inner regional	Regional
Outer regional	Remote
Remote	
Very Remote	

The remoteness classification for each local government area in Australia has been mapped previously and is presented in Appendix B.

Details on the method for attributing data according to jurisdictions and by remoteness at each stage in the life cycle of a tyre are provided in the following sections. Details on the method for collating data on the export destination of tyres are given in section 2.3.6.

2.1.3 CONFIDENTIALITY OF DATA

Companies and organisations that provide data or assistance during the course of this study will be acknowledged in the Study report. However, company specific data will not be reported at any stage during this study unless express permission is given.

Consideration will also be given to the share of the market held by any particular company at any particular stage in the lifecycle of tyres, or in any geographic area, during the reporting of data. Where a particular company has a share of the market such that the reporting of data at that stage or for that area would reveal commercially sensitive information, data will be consolidated so as to protect commercial confidentiality.

2.2 DATA REQUIREMENTS AND SOURCES

In accordance with Hyder's proposal, dated 29 September 2014, data will be collected across all stages of the life cycle of tyres to provide an up-to-date picture on the sources and fate of end-of-life tyres in Australia for the 2013-14 financial year. This will form the basis for estimating the following:

- the number of tyres entering the Australian market for that year (net imports of loose and fitted tyres; number of tyres in use and import of end-of-life whole tyres, shredded and crumbed);
- the number of tyres reaching end-of-life in 2013-14;
- the number of end-of-life tyres going back into the market as 'seconds' or for retreading;
- the number of tyres recycled (amount baled, shredded and crumbed) and end markets for tyre derived products (including market identification);
- the number of tyres to energy production;
- the number of tyres disposed of to landfill;
- the number of tyres stockpiled – legitimately and illegally (where known); and
- the number of tyres exported and purposes of export (whole tyres by EPU and tyre derived products by weight, exporting jurisdiction and export destination)

As previously stated, all data will be expressed in EPUs. In addition, data fields will be further broken down by geographical distribution where possible.

The proposed sources for these data collection requirements are summarised in Table 2-4 overleaf, with the method for collection of data on each requirement detailed in the following sections. A detailed contact database will be formed, which will be utilised by both Hyder and Tyres Reclaimed for the data collection process. Organisations from each level of industry across each jurisdiction will be contacted in an attempt to garner as much information as possible. It should be noted that in some cases, direct names of organisations may be difficult to obtain, although Hyder will make every attempt to overcome this challenge. The contact list will be provided to NEPC separately, and a summary of stakeholders contacted will be provided as an appendix to the report. The appendix will quantify the number of completed surveys and stakeholders contacted, no contact details will be published in the report.

Where state government data sets are being used to support the analysis some data extrapolation may be required given that 2013/14 data will not be broadly available until well into 2015.

Table 2-4 Data collection requirements and proposed data sources and method

Life cycle phase	Component	Data requirement	Expected precision	Source/method
Consumption	Imports	Number of tyres entering Australian market	High	Import data from the Australian Bureau of Statistics (ABS) on loose tyres and vehicles.
	Sales		High	Collation of data on imports and retreads.
In-use	In-use	Number of tyres 'in-use' in relevant financial year	Medium	Vehicle registration data from the ABS in conjunction with average EPU per vehicle.
Second-hand/ Retreads*	Retreads*	Number of tyres going back into the market as 'seconds' or for retreading	Medium	Survey of industry groups, including the Australian Tyre Dealers and Retreaders Association (ATRA), major national retreaders and identified second-hand tyre dealers.
	Second-hand*		Medium	Targeted survey of identified second-hand tyre dealers.
End-of-life	Total	Number of tyres reaching end-of-life	High	Determined using the average lifespan of tyres and new and retreaded tyre sales.
	Recycled	Number of tyres recycled	High	Survey of industry groups, including the ATRA and the Australian Tyre Industry Association(ATIC), and major tyre recyclers, as well as identified collectors and secondary reprocessors doing smaller volumes of material.
	Energy production	Number of tyres to energy production	High	Survey of industry groups, including the Cement Industry of Australia, and major users of tyres for energy production (such as OneSteel who currently use significant volumes of tyres in the steel making process).
	Landfill	Number of tyres disposed to landfill	Medium	Survey of state and territory departments and agencies.
	Stockpile and reuse; illegal dumping	Number of tyres stockpiled – legitimately and illegally	Medium	Survey of state and territory government departments and agencies, major anti-littering organisations, the Waste Management Association of Australia (WMAA) and select local governments on littering and dumping. Data estimate will be generated using survey findings in conjunction with in-use and sales trend data and the expected life span of tyres.
	Export	Number of tyres exported and purposes of export	Medium	Export data from the Department of Foreign Affairs and Trade on loose tyres and vehicles, combined with Survey of industry groups, including the Australian Tyre Industry Association.

2.3 COLLECTION AND ANALYSIS OF DATA

Data will be collected and calculated for the 2013-14 financial year on the consumption and use of tyres, and domestic and export fate of end-of-life tyres.

2.3.1 CONSUMPTION OF TYRES DATA

For the purposes of this study, consumption refers to the sale of whole tyres for the purpose for which they were designed.

Also for the purposes of this study, it will be assumed that all tyres made available for purchase during the period of study were also sold during the period of study. That is, tyres will be considered to be either in-use or at end-of-life. The holding of tyres before, or in between these two stages in the lifecycle of a tyre will be considered only for the purpose of data collection on the number of tyres in-use or at end-of-life.

Domestic manufacture

It is understood that there is no domestic manufacture of tyres in Australia. As previously reported, South Pacific Tyres closed its manufacturing facility in Melbourne at the end of 2008, and Bridgestone closed its manufacturing facility in Adelaide in early 2010. Given that data is being collected for tyres for the 2013-14 financial year, it will be assumed that no domestically manufactured tyres entered the market during the period of study.

Net importation

Data on the net importation of loose and fitted tyres entering Australia will be sourced from the Australian Bureau of Statistics (ABS). The net import of tyres will be calculated by balancing the import of loose and fitted tyres with the export of loose and fitted tyres in corresponding import and export product categories.

Data on the import of loose and fitted tyres will be obtained for the relevant categories in Schedule 3 of the Combined Australian Customs Tariff Nomenclature and Statistical Classification (Working Tariff). Import data will be requested for the 2013-14 financial year. Hyder is already in the possession of relevant import data for the previous studies.

The broad, four-digit categories that cover the relevant codes are shown in Table 2-5. The highest level of detail within these categories is the ten-digit statistical codes. These codes have been previously assessed to determine their relevance to this study, and will be reviewed as part of the current Study to confirm that they remain relevant. The relevant ten-digit statistical codes will also be assessed to determine:

- which classification of tyre the code relates to
- the EPU for a typical tyre
- the number of tyres to be attributed to each unit within the code

The full list of the import and export data codes (for which data will be requested) will be based on the list of codes considered in the previous study, this will be updated throughout the study, based on the outcomes of the industry survey.

Statistical codes that are not considered relevant to this study include those that relate to vehicle parts, rather than whole vehicles.

Table 2-5 Relevant four-digit import and export data codes

Code	Description
4011	New pneumatic tyres, of rubber
4012	Retreaded or used pneumatic tyres of rubber; solid or cushion tyres, tyre treads and tyre flaps, of rubber
8426	Ships' derricks; cranes, including cable cranes; mobile lifting frames, straddle carriers and works trucks fitted with a crane
8427	Fork-lift trucks; other works trucks fitted with lifting or handling equipment
8429	Self-propelled bulldozers, angledozers, graders, levellers, scrapers, mechanical shovels, excavators, shovel loaders, tamping machines and road rollers
8430	Other moving, grading, levelling, scraping, excavating, tamping, compacting, extracting or boring machinery, for earth, minerals or ores; pile-drivers and pile-extractors; snow-ploughs and snow-blowers
8432	Agricultural, horticultural or forestry machinery for soil preparation or cultivation; lawn or sports-ground rollers
8433	Harvesting or threshing machinery, including straw or fodder balers; grass or hay mowers; machines for cleaning, sorting or grading eggs, fruit or other agricultural produce, other than machinery of 8437
8701	Tractors (other than tractors of 8709)
8702	Motor vehicles for the transport of ten or more persons, including the driver:
8703	Motor cars and other motor vehicles principally designed for the transport of persons (other than those of 8702), including station wagons and racing cars
8704	Motor vehicles for the transport of goods
8705	Special purpose motor vehicles, other than those principally designed for the transport of persons or goods (for example, breakdown lorries, crane lorries, fire fighting vehicles, concrete-mixer lorries, road sweeper lorries, spraying lorries, mobile work
8708	Parts and accessories of the motor vehicles of 8701 to 8705
8709	Works trucks, self-propelled, not fitted with lifting or handling equipment, of the type used in factories, warehouses, dock areas or airports for short distance transport of goods; tractors of the type used on railway station platforms; parts of the foregoing vehicles
8710	Tanks and other armoured fighting vehicles, motorised, whether or not fitted with weapons, and parts of such vehicles
8711	Motorcycles (including mopeds) and cycles fitted with an auxiliary motor, with or without side-cars; side-cars
8716	Trailers and semi-trailers; other vehicles, not mechanically propelled; parts thereof
8801	Balloons and dirigibles; gliders, hang gliders and other non-powered aircraft
8802	Other aircraft (for example, helicopters, aeroplanes); spacecraft (including satellites) and suborbital and spacecraft launch vehicles
8803	Parts of goods of 8801 or 8802

Data on the export of loose and fitted tyres will also be requested from ABS for the relevant codes used in the Australian Harmonized Export Commodity Classification (AHECC). Schedule 3 of the Working Tariff and AHECC use the same statistical codes.

However, the highest level of detail in the AHECC is an eight-digit statistical code. As such, data on the import on tyres will be aggregated to an eight-digit statistical code to allow for the calculation of the net import of whole and fitted tyres. Where not all of the ten-digit statistical codes within a particular eight-digit statistical code are relevant to this study, data will be adjusted accordingly.

A more detailed account on the method for the collection of data on the export of tyres and tyres derived product is provided in section 2.3.6.

Second-hand sales

Data on the domestic sales of second-hand tyres will be collected during the survey of tyre industry groups and tyre retailers, retreaders and recyclers. Details on the survey method are provided in section 2.3.3.

Data on the net importation of second-hand tyres will be calculated using the method outlined above.

Retread sales

Data on the domestic sales of retreaded tyres will also be obtained during a survey of industry groups, major national retailers and retreaders. Details on the survey method are provided in sections 2.3.3 and 2.3.5.

Total sales

The total number of new and retreaded tyre sales in Australia will be calculated by adding:

- the number of domestically manufactured tyres (if any)
- the net number of tyres imported
- the number of tyres retreaded

The number of new and retreaded tyre sales will include imported second-hand tyres in the calculation of the net importation of tyres. As such, and for the purposes of this study, the number of new and retreaded tyre sales is the number of tyres entering the Australian market for the first time.

The calculation of the total sales of tyres in Australia will be made by adding the number of new and retreaded tyre sales to the number second-hand tyres sold.

The distribution of the sales of passenger and truck tyres between each state and territory will be assumed to be the same as that for the distribution of tyres in-use, being aligned to the distribution of vehicle registrations (see section 2.3.2).

The distribution of the sales of OTR tyres will also be done on the basis of the distribution of the OTR tyres in-use (see section 2.3.2).

2.3.2 TYRES IN-USE

Passenger and truck tyres

The total number of tyres in-use for passenger and truck tyres will be determined by the extrapolation of data on the number of passenger vehicles and trucks registered for use in each

state and territory. This extrapolation will be undertaken using the classification of tyres and indicative EPU for vehicle types shown in Table 2.

Passenger vehicle and truck registration data will be built using the ABS publication Motor vehicle census (Cat. No. 9309) to 31 January 2014. Data from the Motor vehicle census will be cross checked and updated with vehicle registration data from individual states and territories where it is available.

Data from the 31 January 2014 census, and individual states and territories will then be used, in combination with ABS's Australian Demographic Statistics (Cat. No. 3101), to generate figures for the number of passenger vehicles and trucks in-use for the entirety of the study period.

As stated in section 2.3.1, the distribution of passenger and truck tyres in-use between states and territories will be done on the basis of vehicle registrations in each state and territory. Unregistered vehicles, such as tractors used on farms, are assumed to be negligible in quantity. The distribution of passenger and truck tyres in-use by remoteness will also be done on the basis of population distribution by remoteness within each state, using the ABS publication Regional Population Growth (Cat. No. 3218).

It will be assumed that the average distance travelled by passenger vehicles and trucks does not differ between states and territories.

Off-the-road tyres

Data on the number of OTR tyres in-use will be calculated using the average lifespan of OTR tyres and historic sales figures for OTR tyres.

The average lifespan of OTR tyres has been estimated in the previous study, this will be reviewed and updated, if necessary, during the course of the survey of industry.

The distribution of OTR tyres between states and territories, and by remoteness, will be done on the basis of population distribution, using the ABS's Australian Demographic Statistics (Cat. No. 3101), except for tyres identified as being used in a particular industry (see Table 2-2). The distribution of OTR tyres used in a particular industry between states and territories will be done on the basis of the distribution of that particular industry between jurisdictions taken from the ABS publication Australian Industry (Cat. No. 8155).

All OTR tyres used in mining will be assumed to be in-use in remote locations.

OTR tyres used in agriculture will be assumed to be in-use in regional or remote locations. The remoteness distribution for OTR tyres used in agriculture on the basis of the population distribution between regional and remote areas within a jurisdiction.

OTR tyres used in wholesale and retail trade will be assumed to be distributed to the same extent as population across all remoteness classifications.

2.3.3 INTERMEDIATE DESTINATION

The intermediate destination for tyres refers to points of collection of used tyres prior to them being either resold as second-hand tyres, retreaded, or sent to an end-of-life destination. Data from intermediate destinations will assist in the calculation of the number of tyres entering specific disposal pathways.

Retailers, retreaders, recyclers and collectors

Tyre retailers, retreaders, recyclers, collectors, and industry groups will be surveyed on the fate of tyres that they collect. A copy of survey forms to be used is provided in Appendix A.

Data will be collected on the amount of used tyres being resold as second-hand tyres, retreaded, or sent to an end-of-life destination.

Stockpiles

For the purposes of this study stockpiling will be considered to be the collection of tyres on private land for undefined purposes. This does not include the routine storage of tyres by retailers, retreaders or recyclers during the course of conducting their business.

The total amount of stockpiled tyres will be estimated by considering the quantity of end-of-life tyres that cannot be accounted for. Data on the amount of tyres being stockpiled will also be informed by a survey of state and territory government departments and agencies, select local governments, the Boomerang Alliance, the Waste Management Association of Australia (WMAA) and major anti-littering organisation on the extent of stockpiling. This will be done in conjunction with the industry survey to assess the amount of illegal dumping. The balance of tyres that are unaccounted for will then be assumed as being stockpiled or illegally dumped.

A copy of the survey form for stockpiling and illegal dumping is provided in Appendix A.

2.3.4 END-OF-LIFE TYRES

Passenger and truck tyres

The total number of end-of-life tyres will be calculated for passenger vehicle and truck tyres using the average lifespan of tyres and tyre consumption quantities. In the previous study, the average lifespan of passenger and truck tyres was determined to be the ratio between the number of tyres in-use and the number of new and retreaded tyre sales. The number of end-of-life tyres was then estimated to be the number of new and retreaded tyre sales at the point in time which is equal to the average lifespan of tyres prior to the end of the study period (31 July 2014).

Hyder will review the average lifespan of passenger and truck tyres calculated during the previous study, and update this using data collected in the current study. The figures for new and retreaded tyre sales for 2013-14 will be generated during the course of this study (as explained in section 2.3.1). The figures for new and retreaded tyre sales for the years prior to 2013-14 will be taken from the previous Hyder (2012) study, with the missing data for the years between 2009-10 and 2013-14 will be interpolated from the data previously calculated.

Off-the-road tyres

The number of end-of-life OTR tyres will also be determined to be the number of new and retreaded tyre sales at the point in time which is equal to the average lifespan of tyres prior to the end of the study period (31 July 2014).

The number of end-of-life OTR tyres will be calculated using estimates provided during the survey of industry on the average lifespan of OTR tyres, and an estimate of the annual change in the sales of new OTR tyres.

All tyres

Estimated lifespan for all tyre types will be confirmed during the survey of industry. This will include an examination of what particular tyres are used for, and how this affects their lifespan.

As explained in section 2.3.1, the number of new and retreaded tyre sales includes some second-hand tyres entering the Australian market for the first time. As such, and for the purposes of this study, the lifespan of tyres refers to the time a tyre is in-use in the Australia market.

Furthermore, the number of end-of-life tyres will be used to calculate the total of the number of end-of-life tyres reaching final destination in Australia, and the number of tyres and tyre derived product being exported from Australia. As such, and for the purposes of this study, the number of end-of-life tyres will include used tyres that are exported for reuse and retreading.

The source of end-of-life tyres will be assumed to be distributed geographically and by remoteness in the same proportions as tyres in use.

2.3.5 DOMESTIC DESTINATION OF END-OF-LIFE TYRES

Data will be collected on the fate of tyres reaching an end-of-life destination in Australia. Data will also be collected on the state of tyres reaching an end-of-life destination, being either whole tyres or tyre derived product (shredded, crumbed or powdered). Data on the state of end-of-life tyres will be used to confirm findings on the fate of end-of-life tyres, given that particular states of end-of-life are associated with particular uses. These associations will be confirmed during the course of the Study.

During the collection of data on the destination of end of life tyres, information will also be collected that will inform the subsequent market assessment (refer to Section 3).

Recycling

Data will be collected for tyres reprocessed into a tyre derived product, and for whole tyres used for a purpose other than for which they were designed, for instance, civil works.

Data will be collected through a structured survey of the tyre industry associations and major tyre recyclers. This survey will ascertain information about the source and form of tyres received for recycling, and the destination and form of tyres being recycled and reprocessed, including for export. A copy of the survey form to be used is provided in Appendix A.

Hyder and Tyres Reclaimed will contact relevant industry associations and recyclers as part of the survey. A key difference in the methodology of the current project, compared to the previous, will be the way the industry survey will be conducted. The previous study led to a significant portion of 'unknown' or missing data in the end-of-life dataset. Given this significant data gap, there is a clear need for a more in-depth survey of industry, focusing on the smaller industry players which control much of the secondary tyres market.

Data collection for the current study will therefore be conducted in stages: initially, Tyres Reclaimed will interview across their existing network of tyre collectors, processors and retailers to collect data, but to also collect details of other players in the secondary tyres market. These other players will trigger a second stage of interviews and so on, in order to reach multiple layers of the market.

By incorporating this key adjustment to the method of data collection, it is hoped that the portion of tyres with an "unknown" destination will be less than the previous study.

An estimate will be made of the proportion of the Australian market covered by the survey for both the recycling of whole tyres and the reprocessing of tyres. Data collected will then be adjusted (i.e. extrapolated based on the estimated proportion of the industry covered by the survey) to account for that component of the market not covered by the survey. It is envisioned that most of the market will be comprehensively covered through the process outlined in this document; therefore the lowering the potential need to rely on extrapolated data.

Energy recovery

Data on the use of tyres as an energy source in cement kilns will be collected through a survey of the Cement Industry of Australia and cement kilns identified as using tyres for an energy

source. Data on the pathway of end-of-life tyres used for energy recovery will also be collected during the collection of data on the retreading and recycling of tyres.

The results of the previous study indicated that domestic use of end-of-life tyres as an energy source had been limited to cement kilns. There is evidence that energy recovery of end-of-life tyres through pyrolysis has since commenced on a small scale in Australia. This will be explored during the course of the survey of the tyre industry regarding the fate of end-of-life tyres.

Furthermore, steelmaker OneSteel will be contacted to better understand the potential and current capacity within which tyres are being recycled as part of their energy recovery process, and therefore the role of recycled tyres within the steel manufacturing industry. It is understood that OneSteel are currently utilising tyres for energy recovery at their steelworks in Rooty Hill, NSW, and Laverton, Victoria.

A limited survey will be conducted as it is understood that there are only a small number that use tyres for energy recovery. As such, it is also anticipated that the entirety of the domestic use of end-of-life tyres for energy will be accounted for during this study.

Landfilling

Data will be collected on the disposal of tyres to landfill as whole tyres, shredded tyres, and as shredder flock from the disposal of whole vehicles.

Relevant state and territory departments and agencies will be contacted to determine the number of tyres disposed of to landfill. Metal reproducers will be consulted to assess the quantity (if any) of tyres ending up as shredder flock.

Waste audit data will also be consulted to assess the proportion of tyre material being disposed of to landfill.

The Minerals Council of Australia will be contacted regarding the landfilling of OTR tyres.

Illegal dumping

Hyder will attempt to distinguish between illegally dumped tyres and legitimate stockpiles for reporting purposes. In doing so, definitions of legal, illegal and dumped stockpiles will be formed and be included in Hyder's report.

As noted in section 2.3.3, data on the amount of tyres being stockpiled will be assessed by a survey of state and territory government departments and agencies, select local governments, and major anti-littering organisation on the extent of stockpiling. An assessment will then be made of the balance of tyres that are unaccounted for that are being stockpiled or illegally dumped.

2.3.6 EXPORT DESTINATION FOR TYRES AND TYRE DERIVED PRODUCTS

As noted in section 2.3.1, data on the amount of tyres and tyre derived products exported from Australia will be collected for the relevant AHECC categories. The four-digit categories for the import and export of tyres and tyre derived products are shown in Table 2-5. The relevant eight-digit statistical codes for the export of tyres and tyres derived product, which were used in the previous study, will be used as the starting point and will be reviewed and updated as part of the current study, in particular through the industry survey (refer below for further discussion).

Data collected will be broken down by the port of export and the destination country, and the stated purpose of the exported product. Data will also be collected on the state of the product being exported, being either whole tyres (fitted, loose or baled) or tyre derived product

(shredded, crumbed or powdered). Again, the state in which tyres are exported will be important in confirming the fate of end-of-life tyres exported from Australia, and this will be assessed during the course of the Study.

During the collection of data on the destination of exported tyres and tyre derived products, information will also be collected to inform the market assessment and identification of market intervention opportunities (refer to section 3).

Re-use and retreading

The number of tyres exported for reuse and retreading will be assumed to be the total number of tyres exported as whole tyres either fitted to a vehicle or loose. Baled whole tyres will not be considered to be tyres exported for re-use or retreading.

Recycling and energy recovery

The number of tyres exported for recycling or energy recovery will be determined to be the total number of tyres exported as whole baled tyres or as a tyre derived product.

An estimate of the breakdown between tyres exported for recycling and energy recovery will be made taking into account the state of the tyre or tyre derived product, and the export destination.

Under-reporting of export of whole tyres

The previous study explored the widely-held suspicion that the number of whole tyres being exported from Australia was being under-reported, and there is evidence to suggest that this is a continuing issue. A number of measures will be taken to investigate the existence and extent of this problem.

Initially, it will be important to understand the range of export codes that tyres and tyre derived product are being exported under. The previous study indicated that alternative codes were being used to disguise the export of whole tyres, and Hyder has been advised anecdotally that this is still occurring.

Regarding the codes in use for export of tyres, there is no better source than those actually involved in exporting tyres. As such, all recyclers, collectors and exporters of tyres and tyre derived product, consulted as part of the industry survey, will be asked to provide export codes used by their business, and this information will be used to inform the data request that Hyder submits to ABS.

Data from ABS on the amount of tyres and tyre derived products exported will also be compared with survey results from the tyre industry on the amount of tyres and tyre derived product being exported from Australia to identify any obvious inconsistencies.

The state of end-of-life tyres being exported to major destination countries, which is anticipated to include Vietnam, will also be examined to determine if there are any inconsistencies with the domestic industry's understanding of the state of end-of-life tyres exported from Australia.

Depending on the information collected through the industry survey, additional export data may be requested for particular codes which are identified (throughout the course of the project) as potentially being used to disguise the export of whole tyres. Hyder will consult with NEPC and the project management team prior to requesting any additional export data.

State and territory environmental protection agencies, or the like, will be contacted regarding their knowledge of end-of-life tyre collection and disposal sites. Data will be requested as to the activity of tyre balers, their estimates of the quantities of whole baled tyres being exported and approximate numbers of balers and recyclers in their respective states. If possible, this

information will be used to track the movement of baled tyres through customs to identify misrepresentation of export codes.

2.3.7 SURVEY PROCESS

Detailed records will be taken of all data sources, contacts and contact attempts. Copies of spreadsheets used to analyse data will be provided with the final report (aggregated data only will be supplied, in order to protect commercially sensitive data).

A contact list of stakeholders has been compiled combining Hyder industry contacts with those provided by the Department and industry associations. This will be updated as the project progresses, and can be provided separately, if the project management team wishes.

First contact with survey respondents will generally be made by phone. Where survey respondents wish to answer questions by phone then survey forms will be used for data entry purposes by Tyres Reclaimed/ Hyder and will not be viewed by the respondent unless requested.

Where survey respondents wish to answer questions in writing, these survey forms will be emailed to survey respondents. However, survey respondents will be given an opportunity to provide information in whatever form suits the respondents. In the case where respondents provide information in a form other than a completed survey form, the survey forms will be used for data entry purposes by Tyres Reclaimed/ Hyder.

Stakeholders contacted will be provided information on how any data provided will be presented in reports. Issues of commercial sensitivity data will be managed on a case-by-case basis, typically through aggregation of sensitive data.

2.4 QUALITATIVE ASSESSMENT OF DATA

As data is collated from the various sources, Hyder and Tyres Reclaimed will conduct a qualitative assessment of the reliability of the data sets.

2.4.1 DATA ENTRY

All data collected will be requested in, or entered into Microsoft Excel. This will include the use of formal templates for the surveys of industry (presented in Appendix A). All subsequent calculations of data will also be made using Microsoft Excel.

Data entry will be reviewed and checked by different project team members. A preliminary data validation process will be undertaken during the entry and cross checking of data to assess whether the results are within the expected range of findings.

2.4.2 DATA CONFIDENCE RATING

An indication of data confidence will be included where appropriate, using a 'traffic light' system of 'High Confidence', 'Medium Confidence' and 'Low Confidence' ratings. This system will be used to identify and manage any areas of weakness in the data collected, or the method of data collection and calculation. This is especially important in understanding the validity and quality of the data collected regarding the secondary tyres market.

The data confidence rating will be incorporated into the surveys and project databases, to inform an overall confidence rating for data sets at each stage in the lifecycle of tyres, for different tyre types and for different geographic distributions. Furthermore, the nature of the data

collected; quantitative, qualitative or anecdotal, will be distinguished and considered as part of the broader assessment.

As part of the data confidence assessment, each data set will be rated using the 'traffic light' system for their performance against the following key characteristics:

- Accuracy
- Credibility
- Comparability to previous data sets
- Reporting limitations due to commercial sensitivities

The results of the overall data confidence assessment will be reviewed and summarised in Hyder's *Data Collection Outcomes* report.

3 METHOD FOR MARKET ASSESSMENT AND IDENTIFICATION OF MARKET INTERVENTION OPPORTUNITIES

This section provides an overview of the method that Hyder Consulting will use to undertake the market assessment for the Study.

3.1 MARKET ASSESSMENT

Hyder will conduct an assessment of current and future markets for Australian tyre derived products. The market assessment will explore the following:

- An estimation of the current size of each established end market for Australian tyre derived product;
- An estimation of the current capacity of each established end market for Australian tyre derived product. This will be estimated using findings from the survey of recyclers and other stakeholders;
- Identification of new or emerging markets for tyre derived products;
- An analysis of current and future market trends; and
- An estimation of the potential future capacity of each established, new or emerging end market for Australian tyre derived product.

The market assessment will be based on findings from the survey of recyclers and other stakeholders and Hyder's desktop research. During the data collection phase, recyclers and other stakeholders will be asked about the current size and capacity of the Australian industry, and their estimates for the growth potential of market for Australian tyre derived product. Recyclers and other stakeholders will also be surveyed for their views on the likely trends in the market for end-of-life tyres and tyre derived products.

Recent trends in the fate of end-of-life tyres from domestic sources will be assessed (using Microsoft Excel) on the basis of the findings of the current and previous studies. Any differences in the method between the two studies will either be accommodated for in the development of the trends and/or noted in the final report.

3.2 KEY PRICE MECHANISMS

In order to assist in the identification and selection of potential market intervention activities aimed at supporting and enhancing end-of-life tyre markets, Hyder will build a conceptual model to identify and assess the current processing, transport and ongoing operating costs of various treatment pathways for end of life tyres.

Hyder's assessment will build on information sourced from previous projects. To ensure data currency (as well as jurisdictional differences) throughout the course of the data collection survey, key market price data will be sought, including:

- Processing costs (shredding, baling, chipping etc);
- Transport costs (freight, etc)
- Disposal costs; and
- Export costs

Our analysis will look to make relative comparisons on the factors that influence costs based on the best available information from the market. A potential issue with regard to the recognition of possible intervention points is the volume-value paradigm, which is common in many waste commodity markets. This will be explored in the current project and commentary will be provided in the final report.

Consideration will also be given to the point at which any market intervention adds the most benefit based on this paradigm, and an assessment of this will be included in the final report.

4 REPORTING

The findings from the data collection and analysis, market assessment and will be summarised and presented in the final report. This will include a full list of findings from the market assessment on the fate of end-of-life tyres. Relevant data will be presented within this report, if necessary in a summary, table or graphical form.

To the extent that it is possible, commentary will also be included on the identification of market intervention opportunities, including recommendations on the order of priority for the opp.

APPENDIX A

DRAFT SURVEY TEMPLATES

TYRE COLLECTORS & RECYCLERS SURVEY FORM

COMPANY DETAILS

Company Name:	
Company Type:	
City:	
State:	
Contact Name:	
Contact Phone Number:	
Email:	
Survey Date:	

Green cells are for data input.

Orange cells are for optional data input.

Red cells require selection from drop down menu.

Tyre type definitions:

Passenger: car, 4WD and motorbike tyres

Truck: truck, bus, etc.

Off-the-road: mining, construction, agricultural, etc.

**** All data collected should be for the 2013-14 financial year**

TYRES RECEIVED (from Australian sources)

COMMENTS

	Passenger	Truck	Off-the-road	Total
Total received?	SELECT			
Who do you receive the tyres from?	SELECT	SELECT	SELECT	SELECT
What form do you receive the tyres in?	SELECT	SELECT	SELECT	SELECT
EPU rating				
Data accuracy? ± %				
How has this quantity been measured e.g. weighbridge, vehicle counts, turnover ?				
If you receive whole tyres, please estimate the percentage of tyres which might end up for reuse (including retreading and sold as second hand tyres).				
At what stage is data collected?	SELECT			

SOURCE OF TYRES (by jurisdiction) - where do your tyres come from?

COMMENTS

By jurisdiction of origin (not by jurisdiction where recycled)	EPU/ t / %	Passenger	Truck	Off-the-road	Total
ACT	SELECT				
NSW	SELECT				
NT	SELECT				
QLD	SELECT				
SA	SELECT				
TAS	SELECT				
VIC	SELECT				
WA	SELECT				

SOURCE OF TYRES (by remoteness) - where do your tyres come from?

COMMENTS

Estimated proportion of tyres received from:	EPU/ t / %	Passenger	Truck	Off-the-road	Total
Metropolitan areas (major cities)	SELECT				
Regional (smaller cities, large towns and surrounds)	SELECT				
Remote (townships, rural areas)	SELECT				

USED/ END-OF-LIFE TYRE DESTINATIONS (sold into **Australia**) - Where do your tyres go in Australia (and in what form)?

COMMENTS

Form	Purpose	EPU/ t / %	Passenger	Truck	Off-the-road	Total
SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT				

USED/ END-OF-LIFE TYRE DESTINATIONS (Exported)

Form	State of export	Purpose	Country	EPU/ t / %	Passenger	Truck	Off-the-road	Total
SELECT	SELECT	SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT	SELECT	SELECT				

EXPORT CODES USED (IF APPLICABLE)

Please advise which export codes your business uses for export tyres

TYRE LIFESPAN

Based on your knowledge of end-of-life tyres, please can you estimate the average lifespan of a tyre

Passenger	Truck	Off-the-road	Total

QUALITATIVE FEEDBACK

MARKET TRENDS

Passenger	Truck	Off-the-road	Total
-----------	-------	--------------	-------

COMMENTS

What is your estimated market share of the total Australian tyre recycling market? (%)

Please provide your estimate of trends for the tyre recycling market.

2009-2014	± %				
Current	± %				
Anticipated next 1-2 years	± %				

CAPACITY

At what capacity is your business operating? (%)

MARKET FEEDBACK

COMMENTS

Please provide comment on the state of the market for tyre recycle, including availability of material, prices, markets, competitors, etc.

Passenger	
Truck	
Off-the-road	

MARKET PRICES - Please provide an indication of the following costs (a range is acceptable)

	Form		Passenger	Truck	Off-the-road	Total
Collection fees	SELECT	\$/ EPU				
Processing costs	SELECT	\$/ t				
Processing costs	SELECT	\$/ t				
Transport cost		\$/ t				
Disposal		\$/ t				
Export cost		\$/ t				

INDUSTRY CONTACTS

COMMENTS

Do you know of other collectors/ reproprocessors handling tyres? Please name these companies.

CONFIDENTIALITY

Can we provide your information to NEPC/ DoE?	
Can we publish your company figures in the report?	

CONTACT ATTEMPTS	Date	Time	Contact name	Comments
1				
2				
3				
4				
5				

TYRE ILLEGAL DUMPING SURVEY FORM

SECTION 1 - ORGANISATION DETAILS

Organisation name:		
Organisation type:		
City & State:		
Contact Name:		
Contact Phone Number:		
Contact position/title:		
Survey Date:		

Tyre types	Definition
Passenger	Car, 4WD and motorbike tyres
Truck	Includes all truck and bus tyres
Off-the-road	Includes mining, construction and agricultural vehicles designed for off-road use

SECTION 2 - TYRE DISPOSAL OPTIONS

Note: What avenues are available for residents or businesses to dispose or recycle tyres in your area?

Disposal avenues commonly used	
Passenger	
Truck	
Off-the-road	

SECTION 3 - ILLEGAL DUMPING INCIDENTS

Tyre type (please specify units)	Units	Passenger	Truck	Off-the-road
Estimated number of tyres illegally dumped per year	Private land			
	Public land			
Variation in number of tyres illegally dumped per year. i.e. is this typical or are there large variations year to year?	± %			
Most common location of illegal dumping (e.g. bushland, highways, rural roads, natural reserves, rural properties) Please separate into private and public land	Private land			
	Public land			
Other locations of illegal dumping Please separate into private and public land	Private land			
	Public land			
Are you aware of any stockpiles (other than illegal dumping) on private land? If so, please estimate number of tyres.	Private land			
Trend in illegal dumping over past 1-3 years	± %			

SECTION 4 - COMMENTS

Note: Comments on illegal dumping

Other Comments	
Passenger	
Truck	
Off-the-road	

Contact record	Date	Time	Contact name	Comments
1				
2				
3				
4				
5				
6				
7				
8				

TYRE RETAILERS SURVEY FORM

COMPANY DETAILS

Company Name:	
Company Type:	
City:	
State:	
Contact Name:	
Contact Phone Number:	
Email:	
Survey Date:	

Green cells are for data input.

Orange cells are for optional data input.

Red cells require selection from drop down menu.

Tyre type definitions:

Passenger: car, 4WD and motorbike tyres

Truck: truck, bus, etc.

Off-the-road: mining, construction, agricultural, etc.

** All data collected should be for the 2013-14 financial year

TYRES COLLECTED

COMMENTS

	Passenger	Truck	Off-the-road	Total
Who collects yours scrap tyres?				
Total collected?	SELECT			
EPU rating				
Data accuracy? ± %				
Please estimate the proportion of tyres which might be ending up in the seconds/ used tyre market				

TYRE LIFESPAN

Based on your knowledge of end-of-life tyres, please can you estimate the average lifespan of a tyre	Passenger	Truck	Off-the-road	Total

USED/ END-OF-LIFE TYRE DESTINATIONS - Do you know where your tyres go, and what they are used for

COMMENTS

Facility/ End point	Purpose	Passenger	Truck	Off-the-road	Total
	Second-hand (Reuse) SELECT				
	SELECT SELECT				
	SELECT SELECT				
	SELECT SELECT				
	SELECT SELECT				

IMPORT CODES USED (IF APPLICABLE)

Please advise which import codes your business uses to import tyres	
---	--

MARKET TRENDS

COMMENTS

Please provide your estimate of trends for the tyre recycling market.	Passenger	Truck	Off-the-road	Total
2009-2014 ± %				
Current ± %				
Anticipated next 1-2 years ± %				

MARKET FEEDBACK

Please provide comment on the state of the market for tyre recycling, including availability of material, prices, markets, competitors, etc.	
Passenger	
Truck	
Off-the-road	

MARKET PRICES - Please provide an indication of the following costs (a range is acceptable)

Form	Passenger	Truck	Off-the-road	Total
Collection costs Whole tyres \$/ t				
Transport cost \$/ t				
Disposal \$/ t				
Export cost \$/ t				

INDUSTRY CONTACTS

Do you know of other collectors/ reprocessors handling tyres? Please name these companies.	
--	--

CONFIDENTIALITY

Can we provide your information to NEPC/ DoE?	
Can we publish your company figures in the report?	

CONTACT ATTEMPTS	Date	Time	Contact name	Comments
1				
2				
3				
4				
5				

TYRE RETREADERS SURVEY FORM

COMPANY DETAILS

Company Name:	
Company Type:	
City:	
State:	
Contact Name:	
Contact Phone Number:	
Email:	
Survey Date:	

Green cells are for data input.

Orange cells are for optional data input.

Red cells require selection from drop down menu.

Tyre type definitions:

Passenger: car, 4WD and motorbike tyres

Truck: truck, bus, etc.

Off-the-road: mining, construction, agricultural, etc.

** All data collected should be for the 2013-14 financial year

TYRES RETREADED (from Australian sources)

COMMENTS

	Passenger	Truck	Off-the-road	Total
Who do you receive the tyres from? Please provide business names	SELECT	SELECT	SELECT	SELECT
Total received?	SELECT			
EPU rating				
Data accuracy? ± %				
Material loss - recycled	SELECT			
Material loss - landfilled	SELECT			

SOURCE OF TYRES (by jurisdiction) - where do your tyres come from?

COMMENTS

By jurisdiction of origin (not by jurisdiction where recycled)	Passenger	Truck	Off-the-road	Total
ACT	SELECT			
NSW	SELECT			
NT	SELECT			
QLD	SELECT			
SA	SELECT			
TAS	SELECT			
VIC	SELECT			
WA	SELECT			

SOURCE OF TYRES (by remoteness) - where do your tyres come from?

COMMENTS

Estimated proportion of tyres received from:	Passenger	Truck	Off-the-road	Total
Metropolitan areas (major cities)	SELECT			
Regional (smaller cities, large towns and surrounds)	SELECT			
Remote (townships, rural areas)	SELECT			

SALE DESTINATIONS (sold into Australia) - Where do your tyres end up?

COMMENTS

Form	State of Destina	Purpose		Passenger	Truck	Off-the-road	Total
Whole tyres	VIC	Retreads	SELECT				
SELECT	SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT	SELECT				
SELECT	SELECT	SELECT	SELECT				

OVERSEAS IMPORTS OF TYRES FOR RETREADING

COMMENTS

		Passenger	Truck	Off-the-road	Total
Imported Quantity	SELECT				
Country of origin					

IMPORT/ EXPORT CODES USED (IF APPLICABLE)

COMMENTS

Please advise which export codes your business uses for export tyres	
--	--

TYRE LIFESPAN

Based on your knowledge of end-of-life tyres, please can you estimate the average lifespan of a tyre	Passenger	Truck	Off-the-road	Total

RETREAD MARKET TRENDS

COMMENTS

	Tyre type	Passenger	Truck	Off-the-road	Total
What is your market share of the total Australian tyre retreading market? (%)					
Please estimate the average growth in the retread market for the following periods:					
2009-2014	± %				
Current	± %				
Anticipated next 1-2 years	± %				

CAPACITY

COMMENTS

At what capacity is your business operating?	
--	--

MARKET FEEDBACK

Please provide comment on the state of the market for tyre recycle, including availability of material, prices, markets, competitors, etc.	
Passenger	
Truck	
Off-the-road	

MARKET PRICES - Please provide an indication of the following costs (a range is acceptable)

COMMENTS

	Form		Passenger	Truck	Off-the-road	Total
Processing costs	SELECT	\$/ t				
Processing costs	SELECT	\$/ t				
Transport cost		\$/ t				
Disposal		\$/ t				
Export cost		\$/ t				

INDUSTRY CONTACTS

Do you know of other collectors/ reproprocessors/ retreaders handling tyres? Please name these companies.

COMMENTS

CONFIDENTIALITY

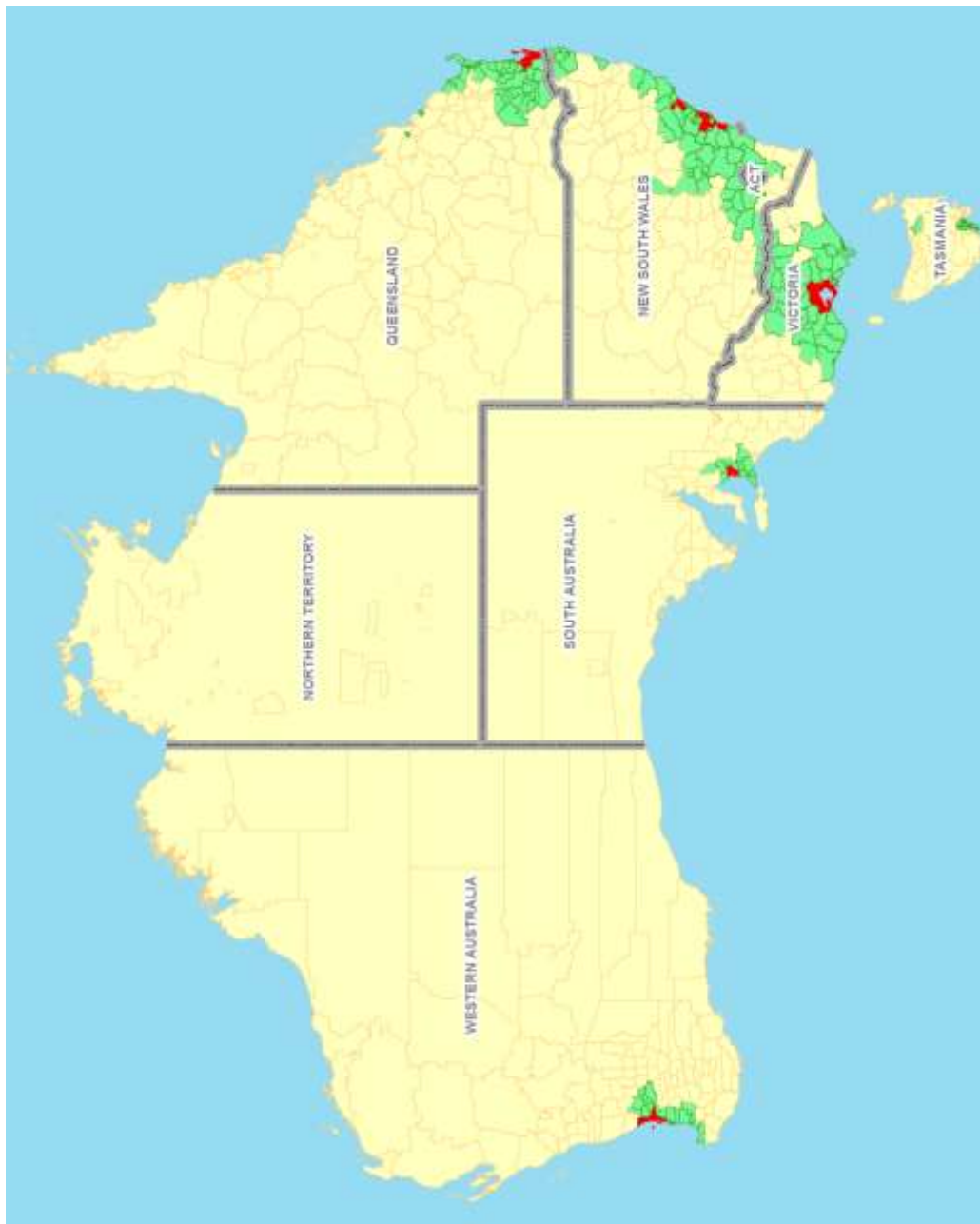
Can we provide your information to NEPC/ DoE?

Can we publish your company figures in the report?

CONTACT ATTEMPTS	Date	Time	Contact name	Comments
1				
2				
3				
4				
5				

APPENDIX B

REMOTENESS CLASSIFICATION MAP



Remoteness classification by local government area