

MATTRESS RECYCLING STUDY

Stocks, flows and feasibility



Australian Bedding
Stewardship Council Limited
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RPS AND SRU REPORT

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GLOSSARY OF TERMS

Term	Definition
Collection	Mattresses collected for recycling.
Collection rate	Collection expressed as a percentage of total waste arisings. See also 'Diversion rate', 'Recovery rate' and 'Recycling rate'.
Consumption of Mattresses	Mattresses put onto the market in Australia from local and imported sources. Does not include locally made product that is exported for sale.
Diversion	Recovery of material for sale to end-markets instead of disposal in landfill.
Diversion rate	Diversion expressed as a percentage (by mass) of end-of-life disposal. See also 'Collection rate', 'Recovery rate' and 'Recycling rate'.
Drop off centre/site	A facility where households can drop off selected materials and household items for recycling and reuse. Also called drop off facilities.
Ensemble bases	Bed bases that are manufactured and sold as a set with a mattress. Usually composed of timber frame and textile covering, sometimes with spring set.
End-of-life (EOL) disposal	The process of a waste product reaching its end destination, which may include landfill, recycling or energy recovery.
Free rider / free riding	A company that benefits from the investment or expenditure of other companies but does not contribute to achieve those benefits. In the context of recycling schemes, free riding refers to the situation where a non-member company's products are collected and recycled but when that company has not contributed to the costs of collection and recycling, nor to the scheme's research & development activities to develop markets for EOL materials.
Hard waste	Large items that cannot fit in a household bin. Items like white goods and furniture, including mattresses.
Internally consistent	An internally consistent modelling scenario is one where any assumption used in the modelling makes sense given all the other assumptions.
Kerbside waste/ collection	Waste collected by local councils from residential properties, including garbage, commingled recyclables and garden organics, but excluding hard waste.
Landfill	Discharge or deposit of solid wastes onto land that cannot be practically removed from the waste stream.
Latex foam	Latex foam is a foam produced by vulcanising liquid latex into a solid foam. Latex foam can be produced with natural latex, which is harvested from rubber trees or synthetic latex, which is produced from petrochemicals.
Local use	Recyclate used within Australia by an Australian company in the manufacture of a new product.
Local/Locally	In Australia.
Material recycling	Reprocessing, by means of a manufacturing process, of a used mattress into a product, a component incorporated into a product, or a secondary (recycled) raw material.
Materials recovered	Materials diverted from landfill for use or reprocessing irrespective of where the recovery or reprocessing takes place.
Mattress Scheme / Mattress Product Stewardship Scheme	Where the industry takes responsibility for the end-of-life management of its products by funding research and development, market development, collection and recycling infrastructure, and marketing and promotion.
Out the gate	Material leaving a facility following reprocessing and excluding most contamination. See also 'In the gate'.
Mattresses	A mattress is a large, rectangular pad designed to be used as a bed or on a bed frame, as part of a bed. Mattresses may consist of a quilted or similarly fastened case, usually of heavy cloth, that contains materials such as hair, straw, cotton, foam rubber, or a framework of metal springs. Mattresses may also be filled with air or water.

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Term	Definition
Pocket spring	Pocket springs are individually wrapped, often in a non-woven textile and to a lesser degree a natural fibre textile, and unlike open coil springs are independent of each other. Structured on a singular basis, they were sewn inside a pocket of material.
Processing facilities	Facilities which either receive materials directly from collection systems or from recovery facilities for further sorting and/or processing to provide material for use in the generation of new products.
PU	Polyurethane usually in the form of foam
Recover / recovery / resource recovery	The process of recovering resources from waste for reuse or reprocessing. This includes collection, sorting and aggregation of materials, to convert waste into a reusable material.
Recovery rate	Recovery (at a defined point) as a percentage of end-of-life disposal. Similar meaning to 'Recycling rate' but can include material into energy recovery. See also 'Collection rate', 'Diversion rate' and 'Recycling rate'.
Recyclate	Scrap material either before or after reprocessing.
Recycle/Recyclables/Recycling	In common practice the term is used to cover a wide range of activities, including collection, sorting, reprocessing and reuse.
Recycling	Activities in which solid wastes are collected, sorted, processed (including through composting), and converted into raw materials to be used in the production of new products (the amount of solid waste recycled is net of any residuals disposed). Excludes energy recovery and stockpiles.
Recycling rate	Recovery (at a defined point) as a percentage of end-of-life disposal. Similar meaning to 'Recovery rate' but excludes material into energy recovery. See also 'Collection rate', 'Diversion rate' and 'Reprocessing rate'.
Regional	Regional Australia includes all of the towns, small cities and areas that lie beyond the major capital cities (Sydney, Melbourne, Brisbane, Perth, Adelaide and Canberra). Regional Australia contributes one third of our national output and is home to 8.8 million Australians.
Remote	The term 'rural and remote' encompasses all areas outside Australia's Major cities. Using the Australian Standard Geographical Classification System, these areas are classified as Inner regional, Outer regional, Remote or Very remote.
Reprocess / reprocessing	To put a material that has been used through an industrial process to change it so that it can be used again.
Reprocessor / reprocessing facility / reprocessing infrastructure	Facility that uses an industrial process to change the physical structure and properties of a waste material so it can be used again. This can include facilities that dismantle products, such as tyres, e-waste and mattresses, and energy from waste facilities that use materials to generate energy.
Resource recovery	Total materials recovered including materials sent to recycling and energy recovery, including export and stockpiling, net of contaminants and residual wastes sent to disposal.
Resource recovery rate	The proportion calculated by dividing resource recovery by waste generation (also referred to as the 'recovery rate').
Spring sets	Modern spring mattress cores, often called "innersprings" are made up of steel coil springs, or "coils". Connections between the coils help the mattress retain its shape. Most coils are connected by interconnecting wires; encased coils are not connected, but the fabric encasement helps preserve the mattress shape.
Solid waste	Non-hazardous, non-prescribed, solid waste materials, ranging from municipal garbage to industrial waste.

EXECUTIVE SUMMARY

Recycle My Mattress – the mattress industry’s member funded recycling scheme

Recycle My Mattress is a voluntary, member funded product stewardship scheme administered by the Australian Bedding Stewardship Council Limited (ABSC). Its establishment commenced under Community Resources Limited in partnership with Soft Landing Mattress Recycling and was transferred to the ABSC in late 2020. The scheme supports the recycling of mattresses and mattress bases in Australia, and a whole of lifecycle approach to the bedding industry.

Members of the ABSC have commissioned and undertaken several investigations to support the establishment of a levy-based product stewardship scheme with broad industry participation. In particular, this has included analysis of potential levy models, albeit the assumptions underpinning these models and their potential outcomes for the industry, have been based on uncertain data. For these and other reasons, members have not determined a consensus approach to take forward.

The national drive towards broader product stewardship

The *Product Stewardship Act 2011* (the Act) has been driving the establishment and growth of mandatory, co-regulatory and voluntary product stewardship schemes over the last decade. In recent years, the Federal Government has significantly expanded its drive towards a circular economy, and the development of local markets for recovered resources. This has included the passing of the landmark *Recycling and Waste Reduction Bill 2020* legislation in December 2020.¹

The Federal Government has also recently provided funding to support the establishment and expansion of product stewardship schemes in Australia, through the \$10 million National Product Stewardship Investment Fund (PSIF). In November 2020 the ABSC was notified that it was successful in its grant application to the Federal Government’s PSIF, to design and implement an expanded mattress product stewardship scheme.

This provides the industry with an opportunity to successfully implement an expanded national scheme, which would be operated by the newly established Australian Bedding Stewardship Council (ABSC).

The purpose of this report

RPS and SRU were commissioned to build on the ongoing investigations by undertaking a Mattress Stocks and Flows Study (the Study). This included reviewing, refining, validating and building on the work done to date. The Study provides a detailed assessment of the stocks and flows of mattresses in Australia, and financial modelling of feasible levy options.

The report provides:

- A detailed material flows analysis (MFA)
- Financial modelling of two feasible and internally consistent funding model options
- An assessment of the potential economic and social impacts from mattress recycling
- A recommended funding model that is likely to provide the appropriate trade-off between multiple scheme objectives.

Key findings

The stocks and flows (MFA) assessment showed that imports are likely to be much higher than previously estimated, comprising 770,000 of the total national sales of 2 million mattresses. The MFA also shows that the industry is already collecting a high proportion of mattresses for recycling (around 59 per cent), however,

¹ While the core element of this legislation relates to the export prohibition of specific unprocessed materials (plastic, paper, glass and tyres), the aim of the bill is to complement existing legislation, such as the Act, in the drive towards a circular economy.

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current recycling practices only recover between 44-64 per cent of material or less, with the rest going to landfill.

The investigations also found that there is a demand for mattress recycling in Australia, with many recyclers servicing Australia's eastern and western seaboard population centres. However, these recyclers need to charge for their services to cover their costs.

The demand for other bedding products is significantly limited. While Soft Landing accept some mattress bases, their recycling results in a significant cost burden to the recycler due to the high disposal cost of timber and textile material. Other recyclers interviewed by the Study team do not accept bases.

Overall, while the MFA found that while recycling is occurring, there is an opportunity to build on the progress to date. In particular, with local governments still funding most of the recycling, there is an opportunity to broaden the membership base and deliver outcomes that are more strongly aligned with the principles of product stewardship.

The Study's levy modelling considered two discrete, internally consistent, funding models that aim to deliver this outcome. The first (Funding Model A) is focussed on encouraging participation and a broad membership base. However, this is likely to provide a lower initial rebate to support collection and recycling activities. The second (Funding Model B), aims for near full cost coverage of collection and recycling, at the expense of a potentially lower participation rate, and greater free riding.

The key finding from the levy modelling is that there are inherent trade-offs in the selection of a funding model. For example, If the levy rate is increased, it is likely that scheme participation will fall. Whether this increases the total amount of levy proceeds collected depends on whether the increase in the rate more than offsets the drop-off in the base to which the rate is applied to. The table below summarises the results.

Participation and collection outcomes with funding models		
	Funding Model A	Funding Model B
Funding Model parameters (the contribution sought from members)		
Levy rate	\$15 / mattress	\$35 / mattress
Implications of this choice for the feasible rebate rate, likely participation, and likely diversion outcomes		
Rebate rate	\$15 / mattress (average)	\$29 / mattress (average)
Rebate structure	Tiered ¹	Tiered ¹
Participation ² (2021)	70% (1.4 million mattresses)	53% (1.1 million mattresses)
Participation ² (2026)	75% (1.6 million mattresses)	58% (1.3 million mattresses)
Collection rate ³ (2021)	59%	59%
Collection rate ³ (2026)	65%	69%
Cash balance (2035)	\$9 million (real, 2020 prices)	\$5 million (real, 2020 prices)

Note ¹: Providing higher rebates to recyclers that provide better environmental outcomes

Note ²: The participation rate influences how many mattresses the levy is applied to, based on the total sales of mattresses in the year.

Note ³: The assumed collection rate influences how much mattress recycling activity is required to be funded from levy proceeds. The estimated levy rates are therefore a function of this assumed collection rate. It should be noted that the baseline collection rate (59 per cent) was based on the best available data at the time and should be further tested and confirmed.

Sensitivity analysis was used to test the robustness of these models to uncertainties in recycling costs, participation rate, collection outcomes and the end-market value of recovered materials.

Overall, the financial analysis shows that Funding Model A provides a somewhat more stable cashflow in a broader range of potential future circumstances. Moreover, it retains the flexibility to transition to higher cost recovery in the future, as the scheme matures and costs reduce. On the other hand, Funding Model B provides for greater cost recovery from commencement.

Recommended next steps

Building on the extensive work to date on the establishment of an expanded mattress scheme, this Study recommends commencing the design and implementation of a scheme based on the Funding Model that is acceptable to / supported by a sufficient proportion of the industry to limit free riding (e.g. > 80 per cent). Funding Model A or B are potentially aligned with this objective but must be tested with industry.

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The exact parameters and intricacies for the model should be confirmed by testing and iterative refinement with current and potential future members. Overall, a simple and gradual approach, which is resilient to uncertainties and facilitates continual improvement, is likely to deliver superior long-term outcomes for the environment and the community.

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1 INTRODUCTION

1.1 Background

The Australian Bedding Stewardship Council (ABSC) has been established to support the development of improved end-of-life outcomes for mattresses and other bedding products. Among other priorities, the ABSC is seeking to launch a national product stewardship scheme for these products. To support this, the company has commissioned a Mattress Stocks and Flows (MSF) study, and has also been awarded funding under the Federal Government's Product Stewardship Investment Fund (PSIF) to design and implement the scheme.

RPS and SRU have been retained to develop the MSF study (the Study). The Study includes a Material Flow Analysis (MFA) for mattresses, which aims to understand the creation, use and disposal pathways for mattresses. The Study also investigates potential models for a product stewardship scheme, the likely funding approaches, the likely economic, environmental and social impacts of such a scheme.

1.2 Australian Bedding Stewardship Council

The ABSC is a member-based charitable organisation whose focus is on developing and implementing a cost effective, environmentally and socially beneficial product stewardship scheme for bedding. Scheme development was instigated by Soft Landing Mattress Recycling and key bedding industry organisations and became a member-funded scheme in development in 2016. It was administered by Community Resources Limited from 2016 until 2020.

The bedding stewardship scheme, formerly operating as the Soft Landing Product Stewardship Scheme and renamed Recycle My Mattress, is a voluntary arrangement aligned with the Australian Product Stewardship Act 2011. It is currently funded by membership fees and member loans and is a grant recipient under the National Product Stewardship Investment Fund.

1.3 Purpose of this report

This report builds on previous investigations into the establishment of a levy-based product stewardship scheme with a broader membership base. It includes a detailed assessment of stocks and flows, using an MFA approach, and financial modelling of two feasible levy models.

The MFA and financial analyses presented in this report are intended to provide a foundation for final discussions with stakeholders to confirm and implement a preferred scheme model.

Previous investigations have considered a wide range of levy scenarios and a wide range of potential outcomes in terms of mattresses levied, recycling cost and scheme costs. The analyses in this report builds on and consolidates those previous investigations by:

- Presenting two 'internally consistent'² scenarios of feasible models that demonstrate the inherent trade-offs in the selection of a levy model
- Providing a range of sensitivity analyses
- By doing the above, allowing these models to be taken to stakeholders to fine tune the understanding of trade-offs and finalise the preferred model
- Enabling forecasting of the likely impacts of that model.

² An internally consistent scenario is one where the assumptions for a specific outcome (e.g. scheme participation) make sense given the other assumptions (e.g. levy rate). Such scenarios embed the trade-offs that are likely to affect the desirability and feasibility of a levy approach (e.g. a higher levy rate is likely to lead to a lower participation rate).

The following subsections expand on the existing scheme, the previous investigations, and the purpose of this report.

Existing mattress recycling scheme

Soft Landing, which started operating in 2009, established a voluntary product stewardship scheme in 2016, funded by members who are bedding industry participants. The scheme supports the recycling of mattresses and mattress bases, including products that are cot, single, king single, double, queen or king size and that meet the following definition:

- **Mattress:** A fabric case filled with soft, firm or springy materials used for sleeping on; fillings can include foam, latex, rubber, metal springs, textiles, polymers and natural fibres
- **Mattress Base:** A fabric case filled with a rigid timber frame, springs, textiles, polymers and natural fibres upon which a mattress is situated.

Soft Landing has recycled over 2 million mattresses since July 2015.

Under the scheme, the following types of eligible mattresses are recovered for recycling from manufacturing, retail and commercial scheme participants:

- Memory foam and plain foam mattress
- Pocket sprung mattress
- Coil Sprung mattress
- Latex mattress
- Ensemble bases
- Orthopaedic mattress
- Pillow top mattress
- Futon mattress.

The ABSC is currently developing specifications for what is considered as compliant / non-compliant recycling under the scheme.

Previous investigations into a levy-based model

Members of the scheme have commissioned and undertaken several investigations into the establishment of a broader product stewardship scheme, funded by participating organisations through a per mattress levy. Previous investigations have considered the relative merits of applying the levy at either the retail or manufacturing stage.

A key challenge with retail application is likely to be in obtaining sales data from participating retailers.

On the other hand, a levy on manufacturers and importers³ would be limited to member brands only, and therefore not apply to non-member (i.e. free riding) products. Moreover, some stakeholders have raised concerns about the extent to which the levy could be passed through, and whether this would distort competition.

Based on these investigations, the scheme undertook modelling and assessed the implications of levy scenarios that applied levies:

³ The scheme currently has a limited importer membership base and obtaining more representation from the import sector has been identified as a challenge.

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- At either a manufacturer or retail level
- At a rate of either \$5 or \$10 per mattress
- Covering a market share equivalent of either 0.8 million, 1 million or 1.2 million mattresses
- To fund annual scheme expenditure of between \$800,000 and \$5 million
- To fund the recovery of either 0.36 million, 0.6 million or 1.2 million mattresses per year
- Based on a recycling price of either \$30, \$35 or \$45 per mattress.

For each scenario, which was defined as a unique combination of the above assumptions, the modelling calculated the 'recycling cost not covered', which is the gap that the retailer / consumer would pay over the recycling price.

The scheme concluded from the modelling that the incentive paid to fund recycling would have to reduce as the number of mattresses recycled increase, unless:

- The levy is increased
- Recycling and / or collection costs reduce
- Scheme participation grows.

RPS and SRU investigations

RPS and SRU have built on these initial investigations by obtaining more detailed stocks and flows data, and by defining two discrete 'internally consistent' levy scenarios. These scenarios consider that only some combinations of levy assumptions are logically consistent.

For example, If the levy rate is increased, it is likely that scheme participation will fall. Whether this increases the total amount of levy proceeds collected depends on whether the increase in the rate more than offsets the drop-off in the base to which the rate is applied to.

This, in turn, critically depends on potential participants' perceived acceptability of the levy rate. There is likely to be a threshold point where the levy rate is considered excessively high, and therefore the level of participation reduces very significantly and rapidly.

These dynamics can only be investigated by presenting levy scenarios to potential participants and modelling the likely impact of their preferences on what would be considered an 'optimal' levy rate.

The choice of incentive / rebate amount also results in similar dynamics but in this case, on the number of mattresses likely to be recovered for recycling. All else equal, the higher the rebate amount, the higher the likely number of mattresses recycled.

To inform the determination of a preferred levy rate and rebate amount, RPS and SRU have considered how these trade-offs eventuate in two hypothetical funding models. The models are 'internally consistent' as they incorporate the expected trade-offs between funding model choices (e.g. higher participation for lower levy rate, higher recycling with higher rebate etc.).

This report documents the approach, results and findings of the Study. The remainder of this report is structured as follows:

- Section 2 documents the MFA, which describes the current situation over which a national scheme aims to deliver improvements
- Section 3 discusses the potential objectives of a national scheme
- Section 4 analyses the potential funding and economic, environmental and social impacts of a national scheme
- Section 5 concludes.

1.4 Limitations and remaining uncertainties

RPS and SRU have attempted to obtain as reliable an evidence base as feasible within the constraints of this Study, to underpin our assessment of material flows and costs. However, some of the more uncertain aspects of the analysis include:

- The volume of mattresses being imported into Australia
- The full range of costs of different mattress collection methods.

Appendix B provides an overall assessment of data reliability. The report discusses the limitations in the data where relevant.

2 MATERIAL FLOW ANALYSIS

This material flow analysis builds on the information derived previously by ABSC on mattress manufacture, use and recycling. It draws extensively on information provided by many of the mattress manufacturers and recyclers, along with other stakeholders such as local government. The contributions of each of these parties is acknowledged in providing the most comprehensive picture yet of mattress flows.

2.1 Mattress sales

Mattresses feature in all homes as well as in hotel accommodation, hospitals, aged care facilities, education and defence facilities, and holiday homes.

Mattress sales comprise local manufacture and imports. Industry sector reports estimated that local manufacture had a 70 per cent market share in 2019 and that the local manufacture share could be dropping below 60 per cent. Import data from customs suggested a much higher level of imports than the 30 per cent market share, however the data includes the import of mattress components leading to double counting and is therefore not a reliable source of data.

The following is a summary of mattress sales based on our analysis of the sector and information provided by a range of industry players and others. It is likely to be accurate within a 15 per cent margin; it fluctuates annually by this margin. Sales of locally produced mattresses were strong in calendar year 2020. There is some suggestion the downturn in tourism will see fewer accommodation-based sales over the next year or two. The mix between local and imported supply can also be influenced by retailer decisions on sourcing. One large brand (Koala) has recently substituted its sourcing of product from locally produced mattresses to imports.

Table 1: Mattress production and sales (2020)

Production, imports and exports	Quantity (mattresses)
Locally produced	1,330,000
Imported	770,000
Exported	100,000
Total national production	1,430,000
Total national sales	2,000,000

Local manufacturers

According to IBIS World, in 2018-19 the turnover of the local industry was estimated to be \$589m with a profit of \$48m. There is a large range of mattress types, sizes and qualities. Generally, the locally produced segment represents the higher quality end of the market, and imports account for a larger share of the budget market.

The local manufacturing of mattresses occurs across all states. Major manufacturers operate sites in most capital cities. In addition, there are a large number of smaller manufacturing enterprises in Victoria giving that state a large share of production, comprising 50 per cent of Australian manufacturing sites.

Across Australia there are a large number of businesses manufacturing mattresses: industry observers estimate there are around 65 businesses and 101 manufacturing sites. The total employment is calculated at just over 2,000 according to an IBIS World 2018-19 industry report. The market is dominated by four large companies who account for most of the locally produced mattresses.

The major local manufacturers are outlined below. Each of these four major manufacturers are likely to be producing over 200,000 mattresses annually. In addition, each also produces ensemble bases.

Sealy of Australia

The largest manufacturer is Sealy of Australia. This is a wholly owned local company. Sealy of Australia originated in Brisbane as Madad Pty Ltd in 1923.

For many years, the company's flagship brand, Sealy Posturepedic, has been the number one selling premium bedding brand in Australia.

Sealy has five manufacturing plants: in Brisbane, Melbourne, Sydney, Adelaide, and Perth. It has over 750 employees around Australia and a reputation for professionalism and quality. Sealy of Australia & Sealy Inc. have developed a foothold in Asia with offices in Hong Kong, Singapore, Taiwan, and Malaysia. In 2011, Sealy China, a joint venture between Sealy Australia and Sealy Inc, opened a bed and mattress factory in Shanghai to service the Chinese market. Sealy also has manufacturing, sales and distribution facilities in NZ

Sealy have also recently entered into a Joint Venture (JV) with Tempur Sealy US to manage the UK Sealy business, recently acquired from the Silent Night Group, which was the previous licensee.

The headquarters of Sealy of Australia is

1299 Boundary Road
WACOL QLD 4076
1300 656 454

AH Beard

AH Beard is an Australian family-owned company that has manufactured mattresses for five generations since 1899. It manufactures the King Koil brand of mattresses, amongst others.

The company has manufacturing at several sites across Australia and New Zealand: in Sydney, Melbourne, Hobart, Adelaide, Perth, Brisbane, and Auckland. It employs over 400 people.

The headquarters of AH Beard is

1/35 Bryant Street, Padstow,
NSW 2211
customercare@ahbeard.com
1300 654 000

Australian Comfort Group

The Comfort Group is a fourth-generation family-owned and run business that began life in the 1930s with Sidney Turner making mattresses out of an Auckland shed. It has evolved into Australasia's largest bedding and foam manufacturer, operating across manufacturing facilities in Brisbane, Melbourne, Sydney, Perth and Launceston in Australia and Auckland and Christchurch in New Zealand.

The Comfort Group has grown and developed an extensive stable of brands, such as Sleepyhead, SleepMaker, Dunlop Foams, Beautyrest, Serta, Dunlopillo, Design Mobel and Wonderest.

The company has also been manufacturing mattresses for the Koala brand.

The company has its Australian headquarters at:

447 Foleys Rd, Deer Park Melbourne, VIC 3023
1800 147 157

Future Sleep

Future Sleep manufactures Future Sleep, Royal Comfort and True-Blue mattresses at an NSW site and sells through its Fantastic Furniture stores, through franchised Original Mattress Factory outlets and also through Freedom and Snooze.

Others local manufacturers

There are a number of medium and smaller mattress manufacturers. These include the following:

- Makin Mattresses
- Regal Sleep Solutions
- Sleeppezee Bedding
- Slumberest
- Slumbercorp
- Melbourne Mattress Factory
- Factory Direct
- Mattress Builders Melbourne
- Mattress Company
- Rockdale Mattresses
- Sherman
- Chiropedic.

Between these and other small operations, the relatively smaller manufacturers have an estimated share of 15-20 per cent of local sales.

Imports and Exports

Over the past decade imported mattresses have been increasing in market share although some in industry suggest that this may have peaked. The vast majority of imports are coming from China. The size of the import industry is estimated at \$200m.

The imports are closely linked to currency value. Inner-spring mattresses are bulky and not logistically ideal for international trade. Foam mattresses can be compressed and boxed, and this form of merchandising has worked better for imports. The increase in foam mattresses in recent years accounts for much of the increase in imports over the past decade.

Mattress sizes and categories differ globally. The Australian market operates with dimensions linked to four primary sizes: single, double, queen and king. These do not match the dimensions and naming in many other countries and therefore mattresses need to be made specifically for the Australian market.

There is also a minimal number of mattresses exported. This trade is valued at \$9m with most going to NZ and China. Some of these mattresses are for a premium section of the market and can retail for over \$10,000 or much higher.

Retailers

IKEA is a major importer and retailer of mattresses. Their sales are estimated to be over 300,000 units annually. This is therefore the single largest source of imported mattresses.

The company operates a mattress removal & recycling service.

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When consumers have a new IKEA mattress delivered, IKEA can pick up the old mattress in the same trip for an on-the-spot swap. The mattress removal service costs \$30 per mattress and is operated by a third party.

IKEA is not currently a member of the Australian Bedding Stewardship Council.

Other major retail outlets include:

- Harvey Norman
- Amart
- Myer
- David Jones
- Fantastic Furniture
- Forty winks
- Snooze

Many of these retailers also operate services for the recovery and recycling of mattresses. This can be through collection points at stores, based on a pick-up service by the truck delivering the mattress or a separate collection service for its customers. A charge for collection is often included.

Online sales

A growing share of sales are through online sales. Some of the major online retailers are:

- Koala
- Sleeping Duck
- New Aim
- Ecosa
- Emma
- Eva
- Peacelily
- Sherman [see note below]

Factory direct sales

A number of manufacturers sell direct to consumers. These are large in number but small in terms of sales, and include:

- Makin Mattresses
- Melbourne Mattress Factory
- Factory Direct
- Mattress Builders Melbourne
- Mattress Company
- Rockdale Mattresses
- Sherman (online only)
- Sleeppezee

- Chiropedic

Summary of mattress sales in Australia

The IBIS World 2018-19 report estimates the total mattress domestic demand at \$808m. Their report suggests an annual growth rate in industry revenue of 3.8 per cent over the five years to 2023-24 .

Despite the Covid 19 pandemic, mattress sales are buoyant in 2020. In part, the flow of Job Keeper money, lack of other spending opportunities and increased time spent at home are likely contributors to the strong sales period.

The price of mattresses varies enormously based on size and quality. According to local industry sources, an average price for a Queen-sized mattress is now \$800-\$1,200. This can range from as low as \$300 at the budget end through to \$2,000-\$3,000 at the premium end. Most sales are in the \$600-\$1500 range.

Sales are made up of a combination of each of the following:

- Replacement of a bed or mattress in an existing home
- New beds in new residential houses and units
- Replacement of accommodation bedding
- Beds in new accommodation
- Bedding in health care and aged care sites.

Reuse and refurbishment of mattresses

There is a strong cascading of mattresses within families and into sites such as holiday homes. There are some second-hand sales of mattresses, but this is inhibited by bulky product size and consumer resistance, including hygiene concerns. Product deterioration and technical development also work in favour of new mattress sales.

There is also some refurbishment of mattresses where the outer cover and some padding is replaced. This amount of refurbishment activity is small, and sales are usually through charity recycling outlets or charity organisation support programs.

Changes in product mix over time

The type of mattress has changed over time. There were periods where water beds were sought after; their market share is now very small. Air-filled mattresses also have a small market. In recent years fully foam mattresses are more popular. In terms of mattress design, pocket springs are an increasing proportion of sales.

Manufacturers and retailers can change the composition of mattress materials for improved performance or marketing. Such materials include memory foam, latex foam, wool, cashmere, alpaca and gel infusion.

2.2 Mattresses in use

Population of Australia

The current population of Australia was 25.6 million as of Monday, September 21, 2020. While it is fair to assume almost all Australians sleep on a mattress, many share a mattress and therefore population is only one factor in estimating the total quantity of mattresses. In addition to primary sleeping arrangements, there are also beds available in hospitals, accommodation, and holiday homes.

Hospitals

The number of Australian hospital beds in 2017-18 totalled 96,300.

Between 2013–14 and 2017–18, the number of public hospital beds per 1,000 population remained relatively stable, fluctuating between 2.51 and 2.56 beds per 1,000 people. In 2017–18, there were 693 public hospitals in Australia, with 62,000 available beds.

Between 2012–13 and 2016–17, the number of licensed beds in private hospitals grew by an average of 3.6 per cent per year. The number of licensed beds per capita also increased during this period from 1.3 per 1,000 population in 2012–13 to 1.4 in 2016–17. In 2016-17 there were 657 private hospitals with 34,300 licensed beds (including day hospital facilities).

Based on the above, there is an estimated total of 110,000 hospital beds in 2020. Most of these are expected to be foam technology and have a more frequent than average replacement cycle.

Accommodation

The total number of bed places in hotel rooms in Australia in 2016 was 676,000. Based on strong growth in this sector until 2020, there is an estimated total of 750,000 beds in accommodation in 2020.

Holiday Homes

The number of holiday homes in Australia is around 300,000. This is higher for residents of Melbourne and Canberra than for other centres. Assuming an average of four mattresses per holiday home, this would equate to 1,200,000 mattresses. Many of these have been transferred from principal places of residence. Their less frequent usage means their average life is likely to be higher than for other mattresses, although the rise of Air B&B and the like might increase the turnover in mattresses in holiday homes, as renters expect better quality and there is a higher level of usage.

Residential Aged care

Today, more than 200,000 Australians live or stay in residential aged care on any given day. There are around 2,672 such facilities in Australia. This equates to an average of around 75 beds per facility. The growth in this sector is likely to lead to a total of 250,000 beds in this sector in the near future.

There are an estimated 100,000 beds in residences linked to universities / education facilities. Many of these are occupied by international students. With Australian students in this accommodation, this needs to be seen as a subset of the total population derived bed numbers as it is their primary place of residence.

Defence sites also include residences for staff and families. These are also a subset of total population derived bed numbers based on this being their primary place of residence.

As a percentage of total mattresses in use in Australia, each of these categories represent only a small fraction of the total mattress population.

2.3 Mattress size and material profile

Mattress sizes

Mattresses come in different sizes in different countries. The Australian market is based around the four basic sizes – single, double, queen and king. Each of these is increasing in weight over time and the average weight for each size mattress at purchase is higher than the mattress it replaces. Table 2 provides their dimensions and average current end-of-life weights.

Table 2: Assumed average mattress weights

Size	Dimensions	Weight
Single	92 X 188 X 25 cm	21 kg
Double	138 X 188 X 25 cm	30 kg
Queen	153 X 203 X 25 cm	35 kg
King	183 X 203 X 25 cm	42 kg

There are small volumes of king singles and super king size mattresses. The ratio of sizes sold is changing, with bigger sizes increasing in market share each year. Many single people now sleep on double bed mattresses.

Table 3 provides the estimate market proportions of each size sold.

Table 3: Mattress market composition (by size)

Size	Proportion of market
Single	25%
Double	9%
Queen	48%
King	18%

Mattress materials

The material composition of mattresses varies greatly, with some having different quantities of steel springs and different foams, and a range of additional materials.

The following is an estimate of the typical composition of mattresses being sold. The profile of end-of-life mattresses will be different based on historic manufacturing trends.

Table 4: Typical component composition of a mid-priced Queen size inner spring mattress

Materials	Weight (kg)
Typical materials	
Steel Spring set	20
Comfort foam	3
Gel comfort foam	1
Quilting Foam	2
Foam Rails	4
Felt	1
Additional materials in premium products	
Wool	2
Latex	3
Polyester blend	1

Other bedding products

As well as mattresses, there are a range of other bedding products that are manufactured or sold by members of the bedding industry. There are also products that are collected by mattress recyclers alongside their mattress activity.

The demand for other bedding products is significantly limited. While Soft Landing accept some mattress bases, their recycling results in a significant cost burden to the recycler due to the high disposal cost of timber and textile material. Other recyclers interviewed by the Study team do not accept bases. For simplicity and to improve the financial attractiveness of the scheme, the levy models in Section 4 focus on mattresses only. While other bedding products could be included as the scheme evolves, this Study recommends starting with mattresses only.

The following subsections summarise these products.

Bed bases

Around 20 per cent of mattresses sales also include a matching or ensemble bed base. These are made by the same mattress manufacturers and incorporate some of the same materials. The ratio of ensemble bases to mattresses ten years ago was higher than today and therefore the amount coming through recycling collections is likely to decrease over time. Most bed bases, including ensemble bases now have a timber slat base rather than springs, so recycling opportunities are very limited. For this reason, many mattress recyclers will not collect bases. The slatted ensemble bases, currently accepted by Soft Landing, are essentially not very different from beds.

Pillows and quilts

Most bedding retailers also supply pillows and quilts, and the stewardship coverage of these products will also need to be assessed by the ABSC. The pillow market is dominated by polyurethane (PU) foam and latex foam. The PU foam pillows have reasonable recycling markets and may be compatible with mattress recycling collections and processing. Quilts have a very different material profile and align more with other textiles.

Sheets and other bed linen

ABSC will also need to decide if these other products should be included in a stewardship scheme. The products have a much shorter lifespan and a less complex range of materials. The dominant materials in these products are cotton and cotton/polyester blended fabric.

At a global level these are starting to be collected and processed for further textile use. In Australia, the Hanes Group, through its Sheridan brand, has been offering a point-of-sale return option for their products. The recovered products are exported to South Asia for recycling. Sheets and other bed linen are relatively simpler to recycle than other textiles due to the consistent cotton/polyester fibre makeup.

2.4 Mattress lifespan

According to industry sources, most mattresses have a lifespan of around 8 to 10 years. One consumer report shows that as of 2016, people are now changing their mattress every 8.9 years, as opposed to every 10.3 years in 2007. Based on population growth and estimated annual sales, this 8-10-year lifespan appears accurate.

While the average provides a useful metric, a reasonable proportion of mattresses reach end-of-life after just one or two years, while others are taking well over twenty years to reach end-of-life.

A survey conducted in the US in 2016 confirms these findings on product life, with 81 per cent of people sleeping on a mattress less than 10 years old and 85 per cent on a mattress 11 years old or less.⁴ Half the survey sample had purchased a mattress in the past four years: 79 per cent for themselves, 9 per cent for a child, 5 per cent for a guest room and 1 per cent for a second home. The survey found 33 per cent of

⁴ <https://bedtimesmagazine.com/2017/01/triggers-replace-their-mattresses/>

respondents were planning to buy a mattress in the next 3-4 years, confirming the expected 8-10-year turnover.

The reasons for replacing a mattress include pain and poor sleep quality from the old mattress, or simply a desire to upgrade. Australians are also moving to a new house more regularly than previous generations, which is likely to contribute to replacing mattresses more regularly.

According to industry sources, most mattresses do not actually fail before replacement. Reasons for changing include:

- Pain relief
- Poor sleep patterns
- A desire for improved comfort
- New designs
- Marketing
- Growing out of mattress size
- Changing house or sleeping arrangements.
- Decline in the mattress's performance

At the point of replacement with a new mattress, there are very few options to keep the replaced mattress for further use.

2.5 End-of-life pathways

The usual end-of-life pathways are:

- Landfill or transfer station disposal
- Collection for recycling
- Charity donation
- Dumping
- Storage/stockpiling
- Informal passing to friend/relative
- Transfer to holiday house.

A report by Sustainability Victoria suggests that in that State, over 300,000 mattresses are sent to landfill every year, equating to over 5,700 per week.⁵ Extrapolated to the whole of Australia, that would amount to over 1,250,000 end-of-life mattresses annually.

This appears to provide a very conservative estimate when considering the estimated annual sales of 2 million. Allowing for some increase in population and housing stock, and purchase of new mattresses that are not replacing an existing mattress, this study has adopted a figure of 1,800,000 as a more realistic estimate of annual waste arisings.

Discussions with local government and key mattress recyclers corroborate this figure.

⁵ <https://www.sustainability.vic.gov.au/You-and-your-home/Waste-and-recycling/Furniture-and-household-items/Mattresses>

Reuse and refurbishment

The quantity of mattresses recovered for subsequent sale or refurbishment is relatively low. With current collection methods, where mattresses are exposed to the weather and then transported either with other materials or in a compacted form, ongoing use is unlikely. Increasing reuse, whether in Australia or through exports, is likely to require a system of grading mattresses and changes to current collection systems.

What is often required for recycling (compaction density), is not what is required for reuse (maintenance of clean units in an undamaged form). While most mattresses are beyond viable reuse or refurbishment, an increasing number are being discarded at a young age in near new condition. Capture and reuse of these, even if in small numbers, is likely to be environmentally preferable and significantly increase the economic viability of recovery efforts as the reuse will deliver a higher value return.

It is recommended that a specific assessment is made into the potential for reuse considering hygiene, collection systems, market potential and ownership issues.

Some mattress companies promote that when mattresses are returned to them, they donate some of them to charity partners. One company claims to have donated over 5,000 mattresses and pillows to those in need, through its major partner, The Salvation Army, and smaller local charities. This partnering with charities may be the best option for any reuse activity.

2.6 Mattress collection and reprocessing

Collection

There is a range of mattress recyclers across Australia. At least 21 organisations claim to undertake this activity, although some are collectors who then deliver the mattresses to others for recycling. While there are three or four larger recycling entities, many of the other recyclers are small in scale.

The sector is segmented into two types of recycling methods. There are those who dismantle mattresses manually and extract different materials and then discard the residue. Some of these claim quite high diversion percentages, however there is no independent verification and increasing doubts about many of the claims. Based on the profile of mattresses sold today, it has been estimated that 80 per cent of the mattress, mostly steel and polyurethane foam could be recycled through this method.

The other recycling method involves processing high volumes by shredding mattresses and then utilising magnets to recover the steel spring components. With this method, it is feasible to process hundreds of thousands of mattresses annually. The diversion of materials beyond the steel is near impossible and rarely undertaken. Using this method, and based on Brisbane City Council experience, a diversion for recycling of 50-60 per cent would appear to be the upper limit. The residual material is light but more compact and in almost all cases goes to landfill.

Future analyses should consider the potential for maximising recovery under both the manual and shredding techniques. It should also consider some form of independent verification of the claimed diversion.

Materials present in collected mattresses

Steel spring sets

The steel in the springs is recyclable back into other steel applications. The high tensile nature of the steel, and its light weight to volume ratio, can make the springs difficult to handle and some metal recyclers are increasingly reluctant to take this material. There is probably a need to ensure a long-term outlet for this material or possibly shredding at dismantling sites. While large companies have had more success in getting their steel springs recycled, smaller organisations have less prospects for achieving this. If metal recyclers choose to no longer accept steel spring sets, the whole mattress recycling sector is likely to become unviable. Some operators have met metal recycler specifications by mixing the spring steel with other steel

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formats. The growth in pocket springs and the contamination of the steel with the pocket textile, can become a problem in the future.

Polyurethane foam

There is a large volume of PU foam in mattresses in different densities. Some of these have gels and other additives and these may restrict the recycling options. Generally, this material can be sent for recycling to a carpet underlay company which can utilise pre- and post-consumer foam offcuts.

As well as the separate foam material, there is also foam backed textile material. The carpet underlay companies Air Step and Dunlop Flooring can utilise some of this material but do not pay for this material. All foam product needs to be delivered to sites in Melbourne and Sydney in a baled form free of staples and other metallic material.

Textiles are often a mix of cotton, polyester, felt and other materials. There are few options for recycling this globally and none in Australia. The potential to produce a felt from textile scrap is something that could be considered in combination with the clothing industry. The mattress industry is reluctant to take any material that is not new into their production, which is likely to inhibit the recycling of the textiles back into mattresses.

While not used in mattresses, timber is generated from the dismantling of bed bases. This material is usually pine and has some small market demand for use as firewood or mulch. The staples and other metal components limit broader use. Timber is generally not revenue generating and is often a significant cost. This will remain a challenge for ensemble base recycling.

Mattress recyclers

Soft Landing

Soft Landing recycles mattresses from councils, hospitals, hotels and retail chains.

Soft Landing was established in 2009 to train and provide jobs for people experiencing barriers to employment in Illawarra NSW. Soft Landing was designed to be self-sustaining and capable of growth. The organisation now has sites in Sydney, Illawarra, Newcastle, Melbourne, ACT and WA.

In 2016, Soft Landing commenced a national roll out with processing centres opened in Wanneroo near Perth and Hume in the ACT. In 2017, Soft Landing commenced operations in Tottenham, Victoria. It has now transferred to a new site in Melbourne.

Soft Landing works with councils across each state to overcome illegal dumping, as well as servicing residents and retail and manufacturing partners.

The charge as of December 2020 for Soft Landing to collect and recycle a mattress from a home is \$50 per piece and \$35 for additional pieces.

Salvaging metal and foam from mattresses diverts thousands of tonnes of waste from landfill annually.

Soft Landing has recycled over two million mattresses, created employment for over 300 people and saved substantial landfill space.

Mattress Recycle Australia

This company commenced in 2018 and is a large recycler using shredding to recover a range of materials. It currently operates bulk collection services across NSW, ACT, QLD, VIC and SA. It services a range of local government and retailer sites. It has a mobile shredder that can be taken to sites of large aggregation.

The steel is extracted and repurposed into products such as rail wheels and mining consumables. Beyond this the company claims to be trialling the use of textile into acoustic panelling and commercial tiles. Timber from bases is repurposed into mulch.

Bed Collect

Bed Collect is a bed recycling and refurbishing business based in Melbourne. It is 100 per cent Australian owned. They have been operating since 2012 and since then, they claim to have diverted more than 50,000 beds away from landfill, recycled more than 80 per cent of all components from mattresses and bases collected.

Any steel springs that can be salvaged from mattresses they collect is sent to their manufacturing plant to be used in refurbished mattresses for charitable organisations. Since commencing operations, Bed Collect have provided more than 10,000 high quality refurbished beds to charities like St Vincent de Paul Society, The Salvation Army and Haven Home Safe.

Phone: 1300 662 084

Email: info@bedcollect.com.au

Sleep Renovation

Sleep Renovation is a Melbourne based mattress manufacturing/refurbishment company supplying mattresses and bases to welfare organisations throughout Victoria.

Their product Enviromatt is exclusive to charities. They have been producing and supplying Enviromatt to charities since 2011. Enviromatt has helped in raising over \$3.5 million for charitable causes. They grade the mattress or bases. If it is in good condition it is cleaned, sanitised and sent to charity. If it is stained but in good structural condition it is refurbished and sent to charity. If it is in bad condition, it is sent to a recycler.

1300 551 245

info@sleeprenovation.com.au

Mattrec Port Kembla

Mattrec collect in the following areas:

- Illawarra
- Sutherland Shire
- Southern Sydney
- Western Sydney
- Southern Highlands
- Macarthur
- Nowra

Mattrec collect and also dismantle mattresses, to recover the steel for recycling. They use a high-pressure water system for separation.

0406 395 487 email info@mattrec.com.

Sydney Mattress Recyclers

Sydney Mattress Recyclers has been providing a mattress removal service since 2009.

They attend residential premises and commercial depots, collect unwanted mattresses that would otherwise be sent to landfill and take them back to their recycling facility in Sydney.

PO Box 451, Greenacre, NSW

1300 881 442

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info@sydnemattressrecyclers.com.au

<http://www.sydnemattressrecyclers.com.au>

The company claims the mattress materials sent to waste are reduced to 0.05 m3 from an average of 1.3 m3 for a queen size mattress (approximately 3 per cent of its original volume).

Their fee for collection is \$60 and the fee for drop-off is \$33.

Mattress Removal WA

Mattress Removal WA operates a collection and recycling operation in the Perth area. Recycling fees charged per mattress start from \$45 (single size) for 1 mattress and then \$25 per mattress thereafter.

<https://www.mattressremoval.com.au/>

Phone: 0432 361 040

Email: info@mattressremoval.com.au

Mattress Recyclers

Mattress Recyclers operate a refurbishment operation in the Brisbane area. Mattress Recyclers charge \$50 per mattress recovered in Brisbane, and \$60 for mattresses recovered in Sydney and the Gold Coast.

The mattresses are sanitised by steam to kill harmful bacteria and bugs before the refurbishment process. They are covered in new quilted quality jacquard fabrics combined with foam.

<https://www.mattressrecyclers.com.au/>

Unit 7, 14-16 Babdoyle Street, Loganholme

Call Brisbane & Gold Coast - 0401 181 767

Sydney - 0405 910 030

The Mattress Recycler

The Mattress Recycler is a locally owned business established in 2006 in the Geelong area. It is one of the longest running mattress recycling businesses in Australia. Due to the difficulty in arranging the recycling of the steel spring sets, the company temporarily ceased collections in December 2020. However, the company is now operating again after securing a commercial arrangement with a steel off taker.

The Mattress Recycler offers a collection service to pick up unwanted mattresses and bases in the Greater Geelong and Surf Coast Region.

Over a 12-year period, it kept almost 250,000 mattresses and bases out of landfill.

Their commercial pick-up service area includes Geelong, Ballarat, Melbourne, and surrounding areas. They pick up unwanted mattresses from bedding shops, Salvos stores, universities and boarding houses, hospitals and motels.

They offer councils an on-demand mattress collection service from transfer stations and depots across Victoria.

29B Grandview Pde, Moolap, Vic 3221

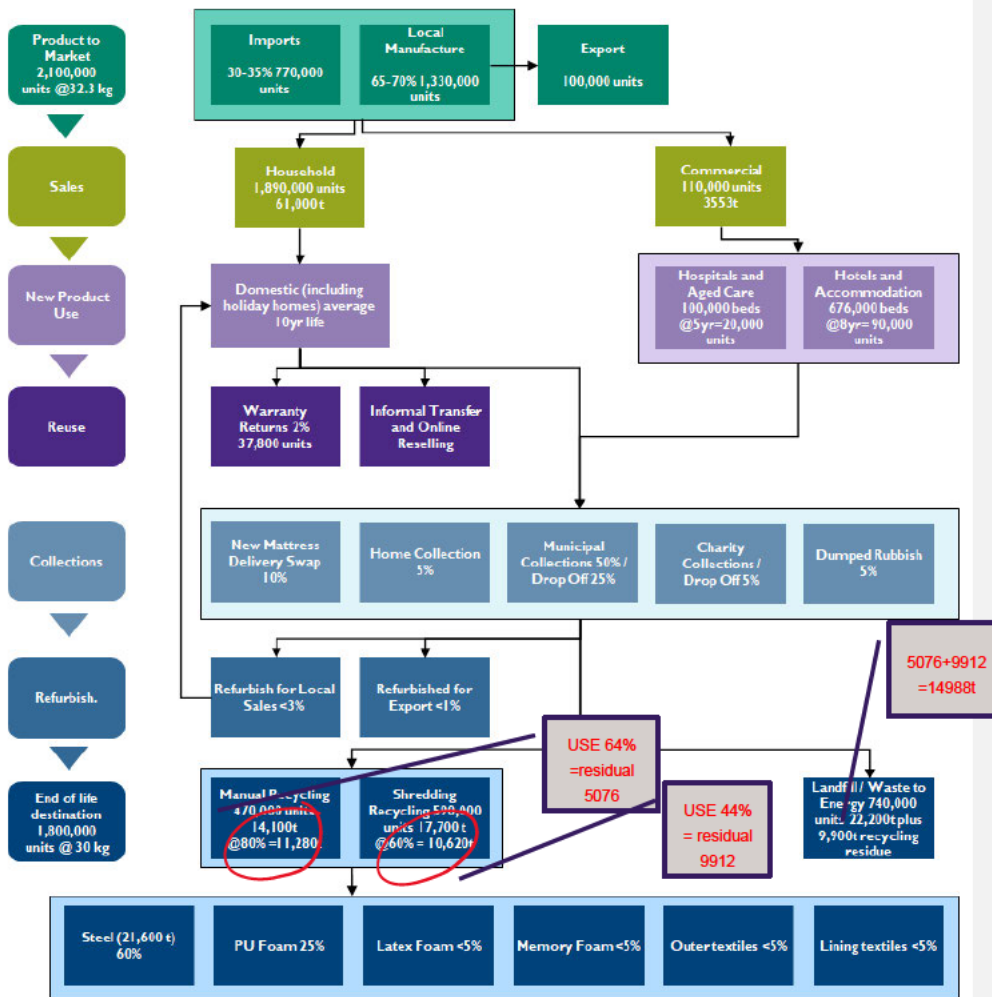
035248 2227

info@themattressrecycler.com.au

2.7 752988 Summary of material flows

Figure 1 summarises the estimated quantities (for calendar year 2020) and flows of mattresses from production to end-of-life. It shows 21,900 tonnes of materials being diverted for recycling presently with 30,000 tonnes going to landfill either directly or as unrecovered material from recyclers. The degree of stockpiling across the sector is not able to be quantified, however the larger operators claimed low stockpile levels due to space constraints and regulatory requirements.

The flowchart shows only mattress collection and recycling. Recyclers also collect some ensemble bases, which if included, would likely add another 12 per cent to the estimated total units recycled.



Commented [JW1]: Recycling % needs to be adjusted. Can't count rate of what's recyclable and not count all waste in total. So should therefore use 64% and 44% respectively. Therefore: 9912t (leftover from shred) and 5076(LO manual) should be added to 22,200t to landfill, ie 37188t. If 48kg mattress = 1m³, then 37188t = 1785m³.

Figure 1 Material flow diagram

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3 OBJECTIVES OF A NATIONAL SCHEME

3.1 Role of product stewardship

National waste and circular economy objectives

The development of a mattress product stewardship scheme aligns with a range of policies that promote a circular economy approach to waste management. To reduce waste going to landfill and improve recycling rates in Australia, the Federal Government has legislated a *Recycling and Waste Reduction Bill 2020*.

The legislation also incorporates the existing *Product Stewardship Act 2011* and includes improvements to encourage companies to take greater responsibility for the waste they generate, including through better product design and increased recovery and reuse of waste materials.⁶

The bill aims to facilitate a circular approach for recovered materials in Australia, by encouraging recycling and remanufacturing, and limiting waste exports. In doing so, the bill is expected to increase employment and economic activity.

The Australian Bedding Stewardship Council, and its members have undertaken a great deal of work in framing its response to the circular economy challenge. Both manufacturers and retailers have contributed substantial effort in developing a comprehensive approach to mattress end of life requirements. The establishment of the ABSC and the research that it, and predecessor organisations, have undertaken has contributed to the present levels of recovery and diversion for recycling. In contrast to other industries at the start of their Product Stewardship scheme development, the ABSC is well advanced and informed in its approach.

Main objectives of a stewardship scheme

Reducing environmental impacts

Without a coordinated and well supported end-of-life pathway for mattresses, these are likely to flow into landfill in the hundreds of thousands. In landfills mattresses are problematic as the spring sets can wrap around and foul compaction equipment. Despite compaction efforts, they also retain some bounce characteristics that limit land use.

A well-designed scheme would consider the lifecycle impacts of the existing pathways for mattresses, and ways to encourage outcomes that reduce these lifecycle impacts.

Increasing resource value

The landfilling or dumping of mattresses results in the loss of tens of thousands of tonnes of valuable resources. These include both steel and polymer-based materials that could otherwise be utilised in new product applications. This reduces our requirement for further new material extraction and processing with its carbon and other environmental impacts.

Diversion from landfill and mitigation of dumping / litter

Many mattresses are dumped by consumers either in the street or in gullies or other areas of conservation significance. In part this is motivated by avoidance of the cost of mattress disposal. While this dumping is an environmental impact, it is also of increasing concern to governments arising from its hazard and visual amenity.

⁶ <https://www.environment.gov.au/protection/waste/recycling-waste-reduction-bill-2020>

Achieving equity

The cost of dealing with a mattress at end-of-life can vary significantly based on location and mattress type. This is in addition to the variation in each consumer's ability to arrange and pay for collection and processing.

At the present time, local government is incurring the bill for the management of end-of-life outcomes for mattresses. This is a costly impost, and many councils are increasingly resisting this cost impost.

Extended Producer Responsibility

At a global and local level there is an expectation from companies, government and the wider community that producers will take a shared responsibility for the end-of-life outcomes for their products. An extended producer responsibility approach opposes the view that once produced or sold the company is resolved of any ongoing role in good environmental outcomes. This has seen manufacturers and retailers come together under an industry wide entity to manage optimal outcomes for their products. One aspect of this is usually the introduction of a levy to shift the financial cost of end-of-life management back into the wholesale or retail cost of the product.

Research and development

The end-of-life management of a product requires more than just support for collections and recycling of the product. A key requirement is the development of reliable data on the sales, life and destination of the product. This enables a product stewardship entity to track improved outcomes and, most importantly, to efficiently frame efforts and funding support for better recovery and reprocessing. This could include enabling a greater percentage of materials recovery, better quality of materials recovery (e.g. lower contamination), lowering cost, and / or the furthering the development of end-markets for the recovered material.

There is also a need to commission and fund research into optimising collection, reprocessing technologies and end market development. A range of products from computers to batteries to paint are supporting their product end-of-life outcomes with this research effort. As an example, the paint industry has supported technology for paint and paint packaging separation, recycling of steel, recycling of plastic packaging and dewatering of paints. They are now focussed on sludge processing outcomes.

3.2 Design considerations for a mattress scheme

Scope

A product stewardship scheme for mattresses (Mattress Scheme) would need to consider which types of mattresses and other bedding schemes would be included in the scheme's activities. There are likely to be advantages in first targeting the products that are likely to have clear economic and / or environmental payoffs from recycling. For example, all mattresses, other than air or water beds, are costly to dispose of in landfill as they take up a large amount of air space per unit of mass, and have some valuable materials with end-markets. Other products, such as bed bases and pillows, do not have well developed end-markets as yet.

The Mattress Scheme is likely to benefit from targeting the 'low hanging fruit' first, to generate sustainable cashflow and momentum, while investigating approaches to develop sustainable pathways for the other products.

Objectives

To ensure the scheme's activities are targeted to achieve intended outcomes, the Mattress Schemes should clearly define which objectives it has a mandate to deliver (refer to Section 3.1), the time priority of these

objectives, and the weight given to each objective. Setting clear objectives will help guide the development and operation of the scheme.

Funding models

There are several approaches to funding a product stewardship scheme. The selected funding approach for a Mattress Scheme should consider the scale and timing of cashflows required to achieve scheme objectives. The scale of funding and how the funds are collected should be informed through a review of international models (focusing on mattress schemes), and local non-mattress schemes (with objectives and scale similar to the proposed Mattress Scheme). Section 3.3 discusses alternative approaches to funding models.

Investments to achieve objectives

The funding would then be used to invest in activities that deliver on the scheme's objectives, such as providing rebates to incentivise improved collection and recycling practices, and research and development (R&D) to develop improved practices or end-markets.

3.3 Comparison of funding models

In assessing the pathway towards a product stewardship levy for mattresses, a number of key factors are important.

Addressing these factors will allow a decision on:

1. The level of the levy
2. The type of levy
3. The point of application of the levy

Level of the Levy

If we look across a range of product levies in Australia and in other jurisdictions, the threshold question is – what are we seeking to achieve with the levy? A clear understanding of objectives is crucial to guide the levy design.

In some cases, it is bridging the gap between the cost of collection and processing and the value of the recovered materials. In other cases, levy funds are provided to fund development of key data on recovery, research on increased recycling and supporting needed infrastructure. Other levies are designed to gather a consumer contribution in an equitable manner so that there is no financial barrier at end-of-life to good consumer behaviour.

In the case of mattresses, where there is already significant recovery and recycling activity, a shift from the cost of collection and processing being paid at disposal to the point of purchase would take out, or ease, the financial barrier to ensuring recycling. Many collection and recycling services are now charging consumers \$50-75 per unit, and for many, this impost will be a barrier to recycling and an invitation to dumping.

Currently, local government is also paying substantially for collection and processing costs and may not continue this as unit numbers increase. With this in mind, the product levy may need to be framed to fund a substantial proportion of the collection and processing cost.

The systems of collection and processing remain in a development phase with a mix of collection methods and a split between manual and shredding processing. The range of materials recovered is narrow with 30-40 per cent of material often still destined for landfill. For these reasons, it would be beneficial for the levy to also be used for further development of mattress recycling. This could include tracking progress in mattress recovery, research into new material recycling options and support for infrastructure.

It is also reasonable for access to the levy funds to be linked to transparency around the amount of material from each mattress that is being recovered. This would help to incentivise those making a more diligent effort to maximise recovery and would disincentivise short cuts or cherry picking the recycling of only basic materials such as the steel spring sets. A small incentive for independently verified data provision would also provide valuable information to support the continual improvement of recycling practices.

Type of Levy

There are a range of levying methods that have been adopted for different products here and in other jurisdictions. The purpose of each is based on equity within the sector, achieving the financial objective and sustainability over time. If applied at a nominal rate (below 3 per cent) it will likely have little inflationary impact or negative impact on sector sales.

The simplest levy structure is for a flat rate per unit applied as far up the supply chain as practical. There might be little value in applying the levy at different rates based on mattress size as the costs of collection, processing and support for the sector are largely the same for all mattresses. By applying a flat rate rather than a percentage of wholesale price, the levy will be a slightly higher (but still small), proportion of the mattress sale price for cheaper mattresses. If this impact was deemed too significant in price increase at the budget end of the market, then a tiered levy based on wholesale prices could be considered.

Over time the rate of collection and recovery and recycling will increase. It may be seen as equitable to reduce the size of the levy as the number of uncollected units reduces. There is also precedent for those who are contributing more to scheme success paying a lower levy amount. This could include those active in designing for disassembly or using more recyclable materials. This method can be complex. Levy contributions based on company turnover are difficult, as activity that is not directly mattress related are harder to measure and exclude.

Point of application of the levy

Across most product stewardship schemes the levy is usually applied at the manufacture or import stage. One advantage of this is to be able to track imports through customs and ensure there are no free riders. It is also the case that there are usually fewer manufacturers than retailers. This is more pronounced with some other products but is still the case with mattresses. It is usually easier to track numbers and levy payment at the manufacturing and import stage. While not negating the role of retailers in stewardship, the name product stewardship implies a primary responsibility for producers and linking this to levy collection is a form of instilling this.

It is also an important principle that the levy be passed, as much as practical, through the supply chain to be paid by the consumer, rather than coming off the margins for manufacturers or retailers. If universally applied, it should not distort the market by favouring one manufacturer or retailer over another. If the levy is a small amount, relative to the sale prices, it may be that the levy is absorbed into product pricing over time.

A levy could be applied at a retailer level but this would be significantly harder to track and administer. It is highly recommended that the levy amount doesn't need to be individually identified in the consumer purchase transaction. As the levy on a mattress sold today is effectively being used to fund a mattress reaching end-of-life, the linking of the levy to the new purchase can be confusing for consumers for no gain. It is usual for an independent entity to be established both for the collection of levy amounts and for administering the spending of the levy. This helps to protect information of a commercial nature.

A voluntary levy is easier to introduce and it may result in near full coverage of local and import mattresses. If however, there is concern about significant players staying outside the levy introduction, then government regulatory support should be obtained for encouraging or forcing the free riders to contribute. This may or may not be an issue. There is often a cut of point for very small importers or manufacturers to be required to contribute to a fund. For very small entities, there is often a diminished return in seeking to apply the levy universally.

Preferred levy approach

It is important that mattress producers, importers and retailers develop an agreement on the objectives of the product stewardship scheme prior to finalising the design of the levy.

This will involve consultation with key stakeholders including, local government, state and federal governments, mattress collectors and recyclers, the Product Stewardship Centre of Excellence and consumers. Previous investigations into a levy model for a mattress scheme have included consultation with stewardship entities managing other products. Further consultation on specific shortlisted levy models is likely to provide additional insights.

The levy should also be structured at a level that will provide sufficient funds for fulfilling a strong end-of-life outcome.

Confirmation of the following will be needed:

1. A fee per mattress unit produced locally or imported into Australia.
2. The fee set the same for mattresses regardless of material type, size or location of sale.
3. The fee to be voluntary but backed by a government encouragement to ensure there are no significant free riders.
4. The levy be applied at the point of manufacture / import at a level that matches scheme needs but minimises mattress price increase.

The financial and economic assessment in Section 4 aims to assist in identifying a suitable levy rate.

Table 5: Comparison of the advantages and disadvantages of various funding model options

Aspect of funding model	Alternatives	Advantages	Disadvantages	Examples
Who are the liable parties that make the contribution	Imports	<ul style="list-style-type: none"> Availability of customs data Level playing field for local manufacturers 	<ul style="list-style-type: none"> Customs data can be inaccurate or too coarse Can be gamed 	<ul style="list-style-type: none"> Tyres Mobiles
	Manufacturers / Wholesalers	<ul style="list-style-type: none"> Highly concentrated market 	<ul style="list-style-type: none"> Risks of free riding 	<ul style="list-style-type: none"> drumMUSTER PaintBack Packaging TVs and Computers Call2Recycle (USA)
	Retailers / Consumers	<ul style="list-style-type: none"> Captures all channels (local and import) 	<ul style="list-style-type: none"> Difficult sector to engage with Requires changes to retail processes and systems 	<ul style="list-style-type: none"> Call2Recycle (Canada)
Allocation of costs	Per unit	<ul style="list-style-type: none"> Cost reflective Equitable Ability to differentiate by unit type Clearer to the consumer 	<ul style="list-style-type: none"> Requires robust auditing Administratively complex Likely to triggers regulatory requirements (ACCC) 	<ul style="list-style-type: none"> Tyres Mobiles Call2Recycle (USA and Canada) drumMUSTER Paintback
	Revenue	<ul style="list-style-type: none"> Equitable form a 'stewardship' perspective Auditable Can be 'banded' 	<ul style="list-style-type: none"> Disincentive to membership Can 'cap out' at the highest band, as manufacturers unwilling to pay more 	<ul style="list-style-type: none"> Packaging Bedding?
	Collections	<ul style="list-style-type: none"> Reflects recycling actually achieved 	<ul style="list-style-type: none"> Requires robust auditing Administratively complex 	<ul style="list-style-type: none"> TVs and Computers Cartridges
Cost visible to consumer	Yes	<ul style="list-style-type: none"> Allows consumers to show their preferences 	<ul style="list-style-type: none"> Consumer backlash Market share effects 	<ul style="list-style-type: none"> drumMUSTER Paintback Call2Recycle (Canada)

4 POTENTIAL IMPACTS OF AN EXPANDED SCHEME

4.1 Feasible models for mattresses

Based on the comparison of potential funding models in Section 3.3, RPS and SRU consider that the most feasible funding approach for the ABSC are likely to be those that apply:

- A very simple levy structure (e.g. uniform rate per mattress, or a differential tiered rate with at-most 3-4 tiers)
- At the import and manufacture wholesale stages to limit free riding and distortionary effects on competition
- With a proportion of the levy proceeds being used to provide rebates for the collection and recycling of mattresses
- And the remaining funds being used to pay for program operation, R&D, and marketing.

The levy rate and method of application should be tailored to maximise participation, as this is an important driver for the feasibility of the program.

The program funds need to be directed at both the two thirds of mattresses currently being recovered and the one third that are not. The levy will need to be set to provide funding support for all mattress recovery, whether local government continues to play a central role or not.

The following subsections provide the indicative financial, economic, environmental and social impacts of an expanded program with a uniform rate applied to manufacturers and importers of mattresses that service the Australian market.

4.2 Financial modelling

Funding models analysed

As a voluntary program, the Mattress Scheme will inevitably be required to make a number of trade-offs in terms of program design. A key trade-off in this respect is how to set the level and form of the levy contribution rate. A relatively higher levy rate provides more funding to enable a greater level of cost coverage and funding for R&D. However, a higher levy rate also discourages participation, and risks free-riding and competitive distortions.

The fund's objectives will inform whether the rebate is set for full cost recovery for collection and processing, or a partial contribution. In either case, the rebate structure will need to consider the likely higher cost of collecting the small minority of mattresses that reach end-of-life in outer regional and remote areas. This could be as simple as including a freight contribution.

The optimal / preferred trade-off will be determined through discussions with stakeholders and further analysis. To inform these discussions, this report presents two scenarios of funding models:

- **Funding Model A:** A rebate rate of \$15 with only partial coverage of collection and recycling costs.
- **Funding Model B:** A rebate rate of \$35 with fuller coverage of collection and recycling costs.⁷

⁷ As explained below, the rebate is designed for 'fuller' and not full cost recovery. RPS and SRU consider that while a program could cover the full average costs of recycling, it would only be appropriate to cover collection costs up to a certain threshold (e.g. \$5 per mattress) to encourage more cost-effective collection methods. That said, consumers and retailers who are willing to pay more than this amount for more convenient collection methods should be permitted to do so, albeit at their own cost.

Funding Model A

This funding model assumes that when a mattress enters the Australian market, either through local production or import, the manufacturer or importer pays a levy rate of \$15 / mattress (in real 2020 prices) to a Mattress Scheme. The modelling assumes that the levy rate, costs and revenues increase in line with general inflation.

The chosen flat levy rate of \$15 was calculated as the approximate minimum rate required for the Mattress Scheme to maintain a positive cash balance over the modelling period (2021 – 2035). The Mattress Scheme utilises those funds to deliver the chosen objectives, which would include one or more of the following (refer to Section 3):

- Covering some of the costs of collection and recycling, but continuing to allow some of those costs to be borne by stakeholders that are bearing those costs currently (e.g. councils)
- Increasing diversion (assumed to gradually increase from 59 per cent in 2021 to 65 per cent in 2026 and thereafter, compared to remaining at 64 per cent in the base case)
- Undertaking R&D to:
 - improve recycling practices and / or reduce the lifecycle environmental impacts of mattresses
 - reduce the costs of collection and recycling
- Providing incentives (e.g. through a tiered rebate) to encourage the industry to innovate to achieve these same objectives (i.e. better environmental and cost outcomes).

Funding Model B

Funding Model B is similar to Funding Model A except that it assumes a levy rate of \$35 / mattress. The model is assumed to achieve greater diversion (69 per cent by 2026), due to providing a higher rebate, but lower participation, due to the higher levy contribution rate.

Otherwise, the model objectives and outcomes are the same as that of Model A, except that it provides greater equity by aligning the end-of-life costs of mattress recycling with the industry, and by providing rebates to those entities that are currently funding collection and recycling.

Key assumptions

Mattress Scheme costs

To support the delivery of its objectives, the Mattress Schemes includes a budget for collection and recycling rebates, R&D and marketing, and fund administration and operation.

The Mattress Scheme budget is estimated at \$5 million per year (refer to Appendix A) plus the cost of providing rebates. The program budget was estimated by using a 'bottom-up' approach, which required summing the total expected annual amount for each expenditure item (e.g. salaries, R&D, marketing etc.), and reconciling this total against similar programs (i.e. a 'top-down' approach).

Recycling costs (excluding collection)

RPS and SRU estimated collection and recycling costs based on data provided by recycling stakeholders. This data was provided on a commercial-in-confidence basis and is therefore not detailed in this report, however, Appendix A provides some underpinning assumptions.

Figure 2 and Figure 3 provide the estimated cost composition of a shredding and manual recycling, exclusive of collection costs, expressed on a per tonne and per mattress basis respectively.

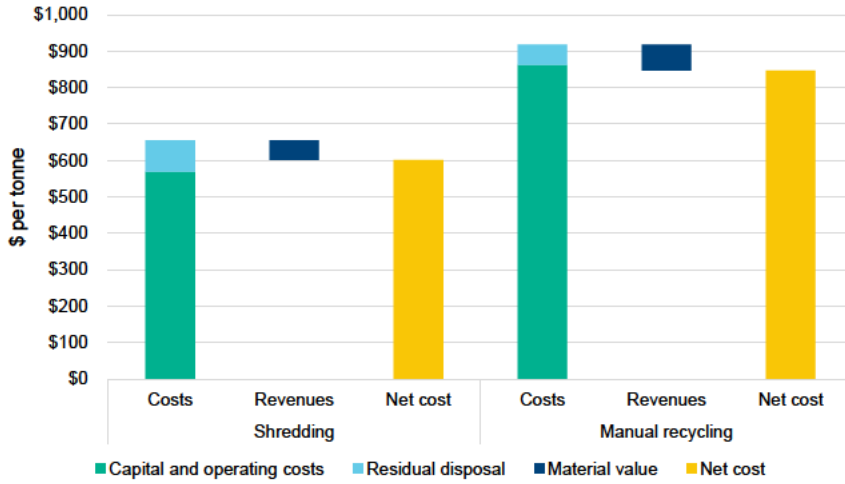


Figure 2 Net cost of mattress recycling (per tonne)

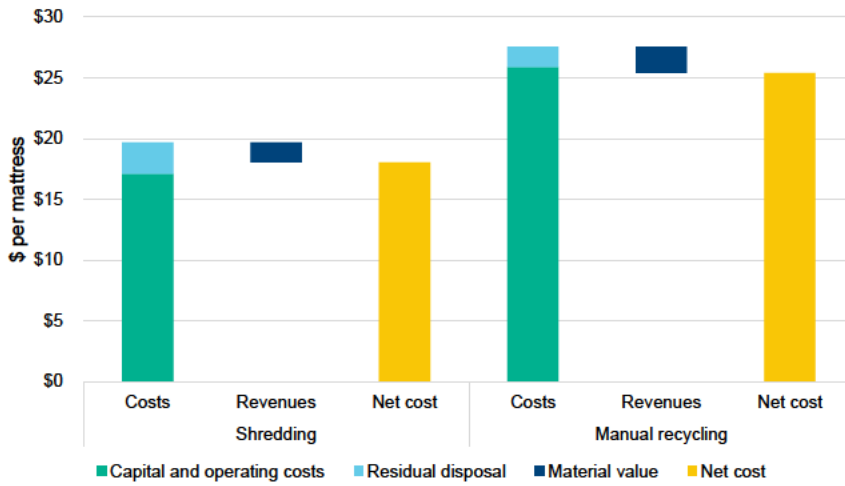


Figure 3 Net cost of mattress recycling (per mattress)

The estimates should be interpreted as the theoretical 'efficient cost' of mattress recycling. That is, as the industry grows, it is expected to achieve cost efficiency through best practices (i.e. learning by doing), competition, increased scale, and innovation. A Mattress Scheme can incentivise the industry to develop these cost efficiencies by setting rebate rates at the expected efficient costs.

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The estimates show that shredding is expected to have a lower per mattress cost of recycling (approximately \$18 per mattress) compared to manual recycling by deconstructing the mattress (at approximately \$25 a mattress). However, manual recycling is expected to deliver stronger economic and social benefits (Refer to Section 4.3).

Collection costs

Through stakeholder consulting RPS and SRU identified that there are a wide range of collection methods used to deliver mattresses to the recyclers gate. These include:

- Drop-off at recycler's gate
- Bulk pick-up by recycler from Council facilities
- Bulk home collection through Council hard rubbish services (scheduled or booked in-advance), or a similar 'milk-run'
- Retailer pick-up on delivery
- On-demand home collection through a collection agent (e.g. retailer, recycler etc.).

The cost of collections can vary significantly from the most cost effective where consumers deliver the mattress to a designated central aggregation point such as a transfer station, local government depot, or retailer, through to an at-call collection service that services a wide area for households that request collection. The collection cost across this spectrum of methods varies by up to 400 per cent. While acknowledging the role for a 'white glove' at call collection service, it would not be feasible nor equitable to fully cover these costs. Prices currently charged for these services, understood to operate in urban areas, can be as high as \$80 per mattress.

The rebate structure assumed by the modelling is based on funding only the most cost-effective methods (i.e. direct drop-off, bulk pick-up from Council facilities, bulk home collection). However, retailers and recyclers are likely to continue offering more premium collection services. The modelling assumes that the additional cost of these services are absorbed by the collection agents, or equally passed on to the consumer. This approach provides equity as the Mattress Scheme funds cost-effective collection while allowing consumers who have the capacity and willingness to pay for premium services to have the option to use these services at an additional cost.

Based on stakeholder consultation and supported through further desktop research, the rebate structure assumes that the incremental collection costs for a recycler are \$0 (for drop-off at the recycler's gate) and \$5 / mattress (for a bulk pick-up from Council facilities). Less cost-effective collection methods include home collection, and their costs vary significantly. The financial modelling assumes that a maximum of \$5 / mattress would be contributed to the cost of these other methods.

Funding analysis results

Box 1 and the subsections that follow, demonstrate through the results of the levy modelling the trade-offs inherent in the selection of a levy model.

The results show that covering more of the costs of collection and recycling will require trade-offs in other areas. The results below are based on the assumption that greater cost coverage would require:

- A higher levy being required
- A lower participation rate, because a higher impost potentially discourages participation
- Greater free riding for the same reasons
- More constrained cashflow.

Box 1 Trade-offs for a voluntary levy

Voluntary product stewardship approaches provide industry with flexibility on how to design and implement a scheme. This allows the industry to establish a program in a way that best delivers on the industry's objectives for that program.

However, a key drawback of voluntary approaches is free riding. All else being equal, a higher contribution from the industry will raise more funding and enable more to be contributed to the cost of recycling. However, a higher contribution also potentially discourages participation.

In fact, increasing the contribution above a certain threshold rate / amount could result in less funds being collected overall as the decline in membership offsets any increase provided by a higher contribution.

The contribution / levy amount should be selected with these challenges in mind.

The results below demonstrate this trade-off. They inform RPS and SRU's recommendation for the ABSC selecting a preferred model, which is expected to appropriately balance the competing objectives.

Assumed participation and diversion

Table 6 summarises the estimated participation and diversion outcomes with Funding Model A and Funding Model B.

Table 6: Assumed participation and diversion with funding models

Participation and collection outcomes with funding models		
	Funding Model A	Funding Model B
Funding Model parameters (the contribution sought from members)		
Levy rate	\$15 / mattress	\$35 / mattress
Implications of this choice for the feasible rebate rate, likely participation, and likely diversion outcomes		
Rebate rate	\$15 / mattress (average)	\$29 / mattress (average)
Rebate structure	Tiered ¹	Tiered ¹
Participation ² (2021)	70% (1.4 million mattresses)	53% (1.1 million mattresses)
Participation ² (2026)	75% (1.6 million mattresses)	58% (1.3 million mattresses)
Collection rate ³ (2021)	59%	59%
Collection rate ³ (2026)	65%	69%
Cash balance (2035)	\$9 million (real, 2020 prices)	\$5 million (real, 2020 prices)

Note ¹: Providing higher rebates to recyclers that provide better environmental outcomes

Note ²: The participation rate influences how many mattresses the levy is applied to, based on the total sales of mattresses in the year.

Note ³: The assumed collection rate influences how much mattress recycling activity is required to be funded from levy proceeds. The estimated levy rates are therefore a function of this assumed collection rate. It should be noted that the baseline collection rate (59 per cent) was based on the best available data at the time and should be further tested and confirmed.

Funding Model A is expected to encourage greater participation and provide more resilient cashflow, but slightly lower diversion.

Program costs and revenues

Figure 4 and Figure 5 below show the annual revenue, costs, and net and cumulative cashflows for the example funding models.

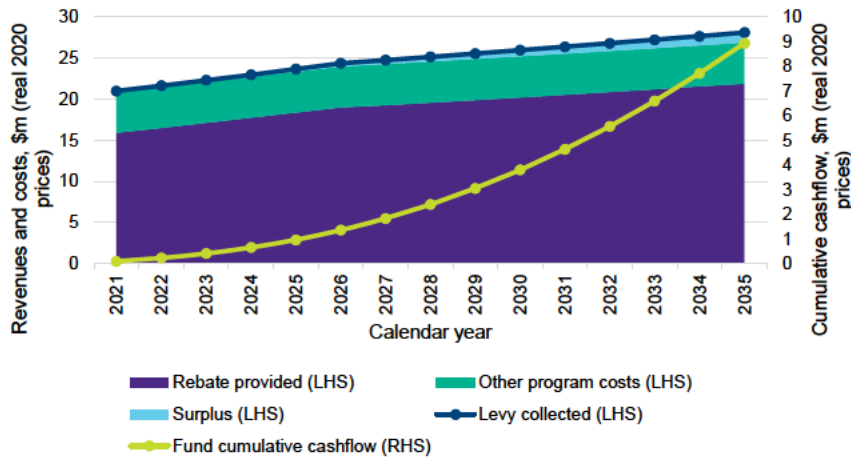


Figure 4 Cashflow (Funding Model A)

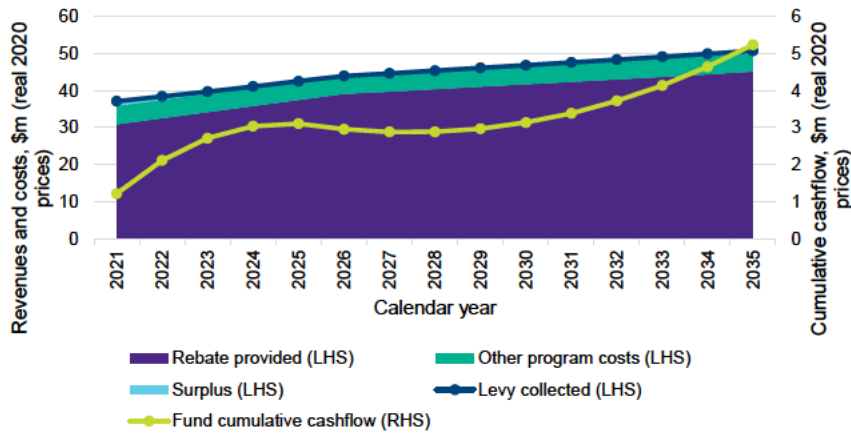


Figure 5 Cashflow (Funding Model B)

The figures show that revenues marginally exceed costs to maintain a small surplus that can be allocated to discretionary activities that are in line with the program's mandate. This could also provide contingency for addressing legacy issues that pose environmental and health risks, such as mattresses that were stockpiled due to lack of recycling funding. The surplus may be expended as it is incurred, or accrued over time to fund larger expenditures in future years. Any expenditures should be focussed on contributing to the achievement of the agreed program objectives.

Summary of analysis

The models presented above are intentionally simplified but can be increased in their complexity (e.g. tiered levy rates and rebates based on mattress size, type, location, recycling method and / or jurisdiction etc.).

Overall, the funding analysis shows that a Mattress Scheme is financially feasible but requires trade-offs. A higher levy contribution is likely to achieve greater diversion and be more consistent with the principles of product stewardship (i.e. industry funding the end-of-life management of the products it brings to market), but potentially at the expense of program participation rates.

Funding Model A provides some advantages over Funding Model B. In particular, the model is more resilient to potential uncertainties (tested further in Section 4.4), maintaining stable cashflow in a broader range of potential future circumstances. This ensures that cashflow is available to continually improve the program and recycling outcomes over the longer term through research and development (R&D), supporting improvements in recycling practices and reductions in cost.

While the modelled outcomes show a marginal cash surplus, these surplus funds should be hypothecated back to activities that contribute to the achievement of program outcomes.

4.3 Potential economic and social impacts

Potential approach to conduct a CBA of a Mattress Scheme

Economic cost benefit analysis (CBA) can be used to assess the net benefit or cost of a Mattress Scheme to the community. CBA compares the economic, environmental and social costs and benefits of implementing a project or policy, compared to the scenario where the project or policy is not implemented (i.e. the base case or the 'counterfactual').

In the case of a Mattress Scheme, incremental costs and benefits would include program administration and expenditure on non-rebate activities, collection costs, recycling costs, the value of the material recovered, and any net saving in the counterfactual costs of end-of-life management (e.g. avoided landfill). The incremental benefits would also include the avoided environmental externalities in the counterfactual (e.g. the environmental impacts of mattress in landfill or the amenity impacts of mattresses being illegally dumped). These externalities are likely to result due to the slow degradation of mattresses in landfill. This can cause:

- Steel to oxidise, with rust leaching into soil and/or groundwater
- Plastic and latex foam and fabrics may biodegrade very slowly (aerobe and anaerobe environments)
- Additives from foam materials (e.g. catalysts, emulsifiers, foam stabilizers and blowing agents) may leach into soil and/or groundwater

The emitted substances can potentially be toxic, which can damage ecosystems or human health. Heavy metals (often used as catalyst additives) do not degrade and can be toxic (examples of arsenic, lead, mercury and cadmium). Given the large contact surface per weight unit of foam materials, the long-term leaching of additives is likely to occur from foam materials in mattresses. Environmental impacts also include upstream externalities, such as the embodied carbon in the steel and foam produced from virgin resources.

It should be noted that avoided landfill levies should not be included in a CBA, as such levies do not represent a net cost or benefit being incurred by the community, but instead a payment from one party to another within the same community group.

Finally, the incremental benefits also include the community’s willingness to pay (WTP) for product stewardship outcomes, to the extent that community members value the long-term environmental and social benefits delivered by applying product stewardship principles.

This Study provides quantitative and qualitative data to support a full CBA, once a preferred model(s) for a Mattress Scheme has been confirmed. Such a CBA should consider the likely locations of additional diversion and the types of recycling methods likely to be used, as these factors affect net costs and benefits.

Net benefit or cost per mattress diverted

The project team obtained data on collection and recycling costs, and material values. The following analysis of this data provides an indication of the net economic cost per mattress diverted, excluding avoided environmental externalities and WTP (refer to Figure 6).⁸ The figure demonstrates the net economic cost for diverting mattress that would have otherwise been sent to landfill, to instead be sent for recycling.

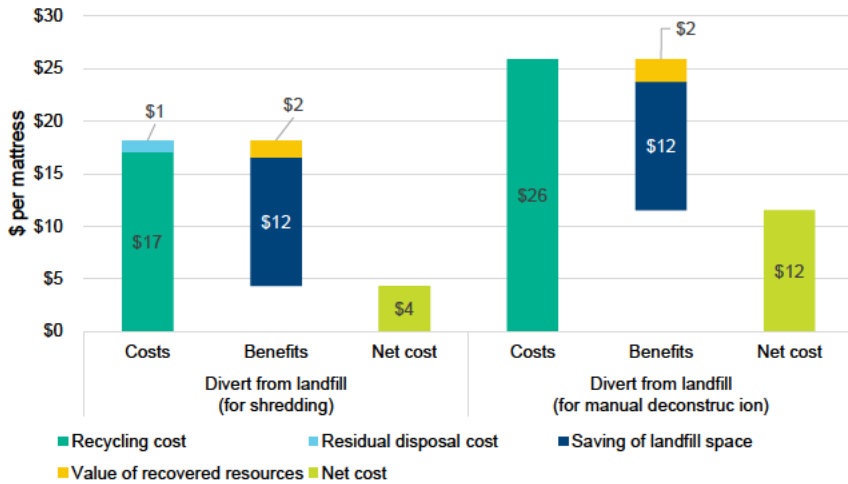


Figure 6 Net economic cost of mattress recycling

Figure 6 shows that diverting a mattress from landfill provides a net benefit as long as the WTP to divert, inclusive of the WTP to avoid environmental externalities, exceeds \$4 per mattress (for shredding) or \$12 per mattress (for manual deconstruction).⁹

WTP research commissioned by Soft Landing

Soft Landing commissioned Bedbuyer in 2018, who carries out independent product reviews by conducting store visits at a range of bedding outlets, to survey participants on their WTP to recycle mattresses. The survey found that:

⁸ Externalities would include the aforementioned leaching, amenity and slow biodegradation impacts, and embodied carbon.

⁹ Adding WTP and environmental externalities is likely to lead to double counting. Therefore, it is recommended that in a future CBA, any WTP values estimated through research are assumed to include the value of avoided environmental externalities, unless the externality and non-externality components are explicitly distinguished in the WTP survey approach.

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- 49 per cent of respondents would not pay
- 28 per cent of respondents would pay \$20-\$30 to drop-off a mattress for recycling
- 19 per cent of respondents would pay \$20-\$30 to have a mattress collected and recycled
- 7 per cent of respondents would pay \$50-\$70 to have a mattress collected and recycled by a social enterprise.

It should be noted that the survey that was commissioned did not use WTP techniques that are suitable for inclusion in a CBA, such as contingent valuation / choice-modelling techniques. That said, the results suggest that some respondents report a WTP greater than the threshold of \$4-\$12 estimated by this project.

It should also be noted that the decision to implement a product stewardship program need not be based on a CBA. Other factors include regional development objectives and social objectives. These are discussed in the following subsections.

Economic impacts

The construction and operation of a recycling facility is likely to increase employment and activity in the region that it operates. Previous analyses have shown that increasing recycling contributes to economic development and that the employment density (i.e. jobs per tonne) from recycling is much higher than from landfill (e.g. refer to EEA, 2011 and Friends of the Earth, 2010).

The research conducted as part of this projects showed that almost all of the mattress recycling capacity in Australia is located in metropolitan areas. As such, there is an opportunity to increase recycling while also delivering economic stimulus to regional areas.

Based on data provided by stakeholders, the incremental diversion assumed in the financial modelling (refer to Section 4.2) would deliver approximately 20-25 additional direct jobs for recycling operations in regional areas by 2035. This excludes additional employment in logistics and flow-on employment impacts to other sectors of the economy through multiplier effects. The total employment impacts are likely to be 4-5 times the direct.

Social impacts

Mattress recycling, like some other product recycling covered by stewardship schemes, is able to be completed by employment of differently abled staff. The Endeavour Foundation for example, employs disabled workers, supported by the National Disability Insurance Scheme (NDIS). The staff receive training and experience, which improves their long-term employment prospects and productivity in the labour force. Soft Landing utilises NDIS supported labour in some of their recycling operations, and also supports indigenous and refugee workers. The Endeavour foundation also utilises NDIS supported labour for electronic waste recycling.

Bedbuyer survey respondents reported a higher WTP for recycling by social enterprises.

4.4 Sensitivity analysis

Figure 7 shows the impact of alternative values for key assumptions on the results for Funding Model A.

The results show that the model is relatively robust to circumstances being different to that assumed in the central case, including:

- Higher recycling costs (25 per cent higher)
- Stronger market values (50 per cent higher)
- Lower participation (73 per cent by 2026 instead of 75 per cent), or
- Higher diversion (69 per cent by 2026 instead of 65 per cent).

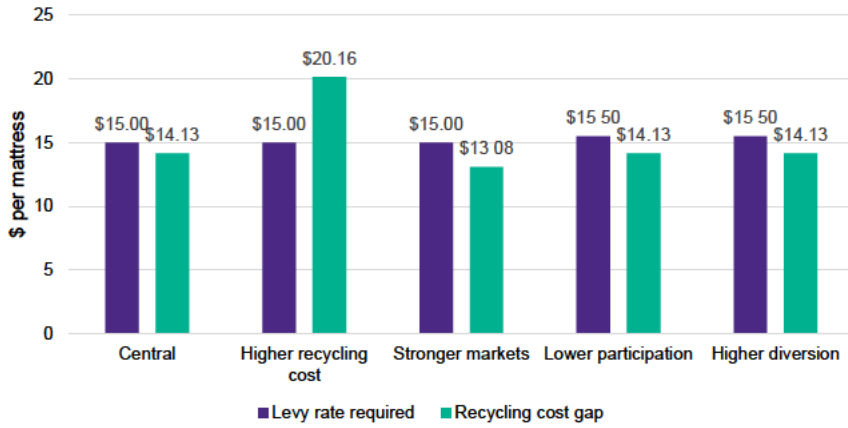


Figure 7 Required levy rate and recycling cost gap – sensitivity analysis (Funding Model A)

Figure 8 shows a similar analysis for Funding Model B.

The results show that the model is less robust to circumstances being different to that assumed in the central case, including:

- Higher recycling costs (25 per cent higher)
- Stronger market values (50 per cent higher)
- Lower participation (56 per cent by 2026 instead of 58 per cent), or
- Higher diversion (80 per cent by 2026 instead of 74 per cent).

In particular, the results show that a much higher levy rate is required if recycling costs are higher (\$41.50 per mattress).

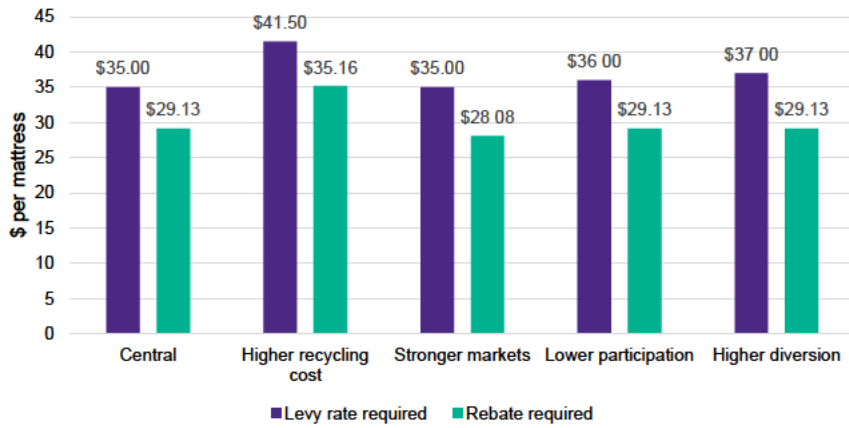


Figure 8 Required levy rate and recycling cost gap – sensitivity analysis (Funding Model B)

The sensitivity analysis shows that Funding Model A is somewhat more financially resilient.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary findings

There is a strong commitment by mattress manufacturers and retailers to embrace extended producer responsibility. A large volume of mattresses in Australia are already being collected and recycled, providing a foundation for building a national product stewardship scheme.

RPS and SRU's investigation into material flows found that while a high proportion of mattresses are already being recovered (approximately 59 per cent):

- Presently, local governments incur most of the cost of end-of-life management of mattresses and associated bedding products
- The dominant recycling technology (shredding) yields a relatively low level of materials recovery (approximately 60 per cent or lower), resulting in a large proportion of material still going to landfill, albeit providing a significant saving in landfill airspace by compacting the material
- Collection and recycling are mostly concentrated in metropolitan areas.

The MFA assessment also showed that imports are likely to be much higher than previously estimated, comprising 770,000 of the total national sales of 2 million mattresses.

The objectives of a national stewardship scheme for mattresses (Mattress Scheme) could include improving recycling practices and reducing environmental impacts, increasing diversion, achieving equity, data collection and provision, and / or R&D to improve the cost and environmental performance of recycling. A Mattress Scheme should be clear about its objectives, and adopt a funding model that aligns with those.

The ABSC should determine the preferred objectives and funding models following extensive stakeholder consultation and further research. That said, funding models with simple levy and rebate structures applied as far upstream of the mattress supply chain as possible are likely to be more effective.

Two simple funding models investigated in this study showed that a Mattress Scheme is financially feasible, but requires trade-off in terms of:

- The amount of collection and recycling costs covered by rebates
- The level of the levy
- The likely industry buy-in (participation rate)
- The likely incremental diversion that would be feasible to fund.

Overall, the financial analysis shows that Funding Model A provides a somewhat more stable cashflow in a broader range of potential future circumstances. Moreover, it retains the flexibility to transition to higher cost recovery in the future, as the scheme matures, and costs reduce. On the other hand, Funding Model B provides for greater cost recovery from commencement.

A Mattress Scheme will provide economic stimulus, particularly to regional areas where there is currently a capacity gap, and social and environmental benefits. More data on WTP is required to assess the likely net economic benefit or cost of a Mattress Scheme. However, the demonstration of a net benefit using CBA need not be a prerequisite for program implementation.

5.2 Recommended next steps

Building on the extensive work to date on the establishment of an expanded mattress program, this Study recommends commencing the design and implementation of a program based on the Funding Model that is acceptable to a sufficient proportion of the industry to limit free riding (e.g. > 80 per cent). The exact parameters and intricacies for the model should be confirmed by testing and iterative refinement with current and potential future members. Overall, a simple and gradual approach, which is resilient to uncertainties and

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facilitates continual improvement, is likely to deliver superior long-term outcomes for the environment and the community.

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Appendix A Financial and economic assumptions

The following tables outline the assumptions used in the financial and economic analysis. There is limited publicly available data on the costs and benefit of mattress recycling. Therefore, most of the assumptions were informed by data directly provided by stakeholders, reported pricing structures for the mattress collection and recycling industry, the authors' desktop research on cost components, and benchmarking against general waste management costs. The tables indicate the source(s) for each assumption, as well as the approach used to derive the value ultimately used in the analysis.

Table 7: General parameters – financial modelling

Item	Assumption	Source(s)	Justification / derivation
Time period of analysis	15 years (2022 to 2041)	Consultant assumption	Adopted to test the viability of the program over a long term (15 years). Limited to 15 years as outcomes beyond this timeframe are very uncertain.
Population growth	1.6% per year	Australian Bureau of Statistics	Expected long-run population growth

Table 8: Collection costs

Item	Assumption	Source(s)	Justification / derivation
Bulk collection from Council facilities	\$5 per mattress (\$155 per tonne)	Price quotes reported by Queensland recycler	Difference in price charged for drop-offs at the recycler's gate vs bulk pickup from Council facilities
Milk-run style kerbside collection from houses within a discrete catchment (e.g. 5 km radius)	\$15-\$20 per mattress (\$464-\$619 per tonne)	Multiple sources: <ul style="list-style-type: none"> Price quotes reported by Queensland recycler Benchmarked against estimated hard rubbish collection costs¹ Adjusted upwards to acknowledge that mattresses are more voluminous and less economical compared to a standard hard rubbish collection 	Prices quoted to Queensland recycler suggested that this collection method requires a price premium of \$10 per mattress (\$310 per tonne), compared to drop-off at gate. This also appears to reconcile with estimated benchmark costs for general hard rubbish collection of \$270 per tonne ¹ . However, this price appears to not reflect the full cost of this method, which is likely to be higher than hard rubbish collection due to mattresses being bulkier and less economical to collect.
Premium collection methods (e.g. swap on delivery of new mattress, at-call pickup etc.)	\$30-\$80 per mattress	Market research on published prices	Costs and prices vary significantly

Note ¹: Derived from <https://www.smh.com.au/national/nsw/what-a-waste-councils-cleaned-out-by-cost-of-rubbish-collection-20130817-2s3gi.html>

Table 9: Assumed proportion of recycling methods under a stewardship program

Item	Assumption	Source(s)	Justification / derivation
Manual deconstruction	50%	Consultant assumption	Stewardship program assumed to incentivise a balanced proportion
Shredding	50%	Consultant assumption	Stewardship program assumed to incentivise a balanced proportion

Table 10: Recycling costs - manual deconstruction

Item	Assumption	Source(s)	Justification / derivation
Typical throughput	20,000 mattresses per year	Data from recyclers	Typical operation servicing a town catchment / proportion of a city's volume
Typical footprint	2,000 m ² of industrial zoned land	Consultant assumption informed by discussions with recyclers	Required for stockpiles (of both inputs and outputs), equipment (e.g. baler), working areas and small office
Typical lease rate	\$70 / m ²	Market data	Typical for industrial-zoned land in urban fringe areas
Establishment cost	\$1,000,000	Consultant experience	Project development, planning, licensing and approvals
Equipment CAPEX	\$200,000	Data from recyclers	Baler and miscellaneous fit-out
Operating costs	\$231,500 per year	Data from recycler, Consultant assumption	Includes 2.2 FTE @ \$75,000 per year, plus \$50,000 for utilities and sundry costs
Corporate overhead contribution	\$50,000	Scaled based on expected turnover (approximate)	Typical for a business of this size
Weighted average cost of capital (WACC)	5% (real, pre-tax) ~ 7% (nominal)	Current market conditions	This is the rate of return expected by financiers of the recycler (shareholders and lenders) 5 or 10 years ago, the cost of finance would be much higher (e.g. 10-15%). The WACC used in this assessment reflects the historical record low interest rates
Recovery period for CAPEX	20 years	Consultant assumption	Period over which the initial investment is expected to be paid back, including a rate of return on that investment
All-in per unit cost¹	\$26 per mattress \$863 per tonne	Calculated based on above assumptions	

Note ¹: Excludes material value and residual disposal cost

Table 11: Recycling costs – shredding

Item	Assumption	Source(s)	Justification / derivation
Typical throughput	100,000 mattresses per year	Data from a feasibility assessment commissioned by a Council	Typical operation servicing a collection of towns or a city
Typical footprint	2,000 m ² of industrial-zoned land	Consultant assumption informed by discussions with recyclers	Required for stockpiles (of both inputs and outputs), equipment (e.g. shredder, baler), working areas and small office
Typical lease rate	\$70 / m ²	Market data	Typical for industrial-zoned land in urban fringe areas
Establishment cost	\$1,000,000	Consultant experience	Project development, planning, licencing and approvals
Equipment CAPEX	\$570,000	Data from a feasibility assessment commissioned by a Council	Primarily a shredder but also includes other required equipment
Operating costs	\$220,000	Data from a feasibility assessment commissioned by a Council	Includes 2.2 FTE @ \$75,000 per year, plus \$50,000 for utilities and sundry costs
Corporate overhead contribution	\$50,000	Scaled based on expected turnover (approximate)	Typical for a business of this size
Weighted average cost of capital (WACC)	5% (real, pre-tax) ~ 7% (nominal)	Current market conditions	This is the rate of return expected by financiers of the recycler (shareholders and lenders) 5 or 10 years ago, the cost of finance would be much higher (e.g. 10-15%). The WACC used in this assessment reflects the historical record low interest rates
Recovery period for CAPEX	20 years	Consultant assumption	Period over which the initial investment is expected to be paid back, including a rate of return on that investment
All-in per unit cost¹	\$17 per mattress \$569 per tonne	Calculated based on above assumptions	

Note ¹: Excludes material value and residual disposal cost

Table 12: Recycling efficiency and residual disposal

Item	Assumption	Source(s)	Justification / derivation
Recycling efficiency – shredding	44% (60%)	Data from recyclers	44% of total mass (60% of mass of recoverable material)
Recycling efficiency – manual deconstruction	64% (80%)	Data from recyclers	64% of total mass (80% of mass of recoverable material)
Residual disposal cost (financial)	\$154 per tonne	Data from previous RPS CBAs and published landfill levies	Calculated as the national average (some jurisdictions would be higher or lower due to differences in landfill operating costs and gate fees)
Residual disposal cost (economic, excludes landfill levy)	\$65 per tonne	Data from previous RPS CBAs	Calculated as the national average
Value of landfill space (adjusted for mattress density)	\$13 per mattress (\$407 per tonne of bulky material)	Equilibrium (2017)	Takes into account that mattresses are bulky (density of approximately 48 kg / m ³), freeing up more airspace to store a certain mass of municipal waste

Table 13: Market values (clean vs low-quality)

Item	Assumption	Source(s)	Justification / derivation
Scrap steel market value	\$100 / tonne	Stakeholder data and consultant experience	High quality uncontaminated material
Scrap PU foam market value	\$500 / tonne	Stakeholder data and consultant experience	High quality uncontaminated material
Other	\$0 / tonne (or -ve) ¹	Stakeholder data and consultant experience	Likely to require disposal
Assumed quality discount	50%	Stakeholder data	Proportion of the full scrap market value that can be captured by the recycler as the material is either contaminated (with other material) or in a form that is not preferred by off takers (e.g. spring)

Note ¹: In fact, the other material is likely to require a disposal cost

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The ABSC provided RPS and SRU with preliminary estimates of the expected annual budget for a product stewardship program, inclusive and exclusive of rebates / incentives for recycling. The budget exclusive of rebates (Program Costs), comprised the following items:

- Staff costs
- Other operating expenses (general and administrative)
- Marketing and research expenses
- Contingency.

Prior to this Study, the ABSC considered two approximate annual budget amounts for the above items (approximately \$1.6 million and \$5.0 million).

RPS and SRU recommend the larger estimate for a mattress program (approximately \$5 million). This is based on the fact that the mattress recycling sector and end-markets for the materials have significant scope for improvement, which would benefit from R&D and market development activities.

Some of the challenges with mattress recycling at present include its almost exclusive concentration in greater metropolitan areas, high logistical costs due to the bulkiness of mattresses, low levels of materials recovery, poor end-market values and free-riding.

Therefore, a larger budget with a sufficient allocation towards marketing and research is likely to deliver longer term productivity and environmental gains for consumers and the environment.

RPS and SRU have also benchmarked this figure against another program currently in development, and consider it in line with current expectations for a product stewardship program budget.

Table 14: Program budget

Item	Assumption	Source(s)	Justification / derivation
Staff costs	~ \$0.6 million		
General and administrative	~ \$0.3 million		
Marketing	~ \$2.5 million	ABSC estimates, RPS and SRU analysis,	Refer to explanation above
Research	~ \$0.8 million	benchmarking against publicly available budgets	
Contingency	~ \$0.6 million		
Total annual	~ \$5.0 million		

Appendix B Assessment of data reliability

B.1 Material flows data reliability

The data provided for each link in the life cycle chain for mattresses is as accurate as possible. The key data on local and import sales are likely to be accurate to within +/-15%. This data is changing year on year and further effort should be applied to increasing the precision of different aspects of the data in the future. Of those stakeholders contributing key numbers, none have a motivation to under or overstate the data provided. Measures that will increase the precision of the data include establishing an independent third party for company data provision, and a levy discount where data provided has been independently verified/audited.

B.2 Import estimates data reliability

As the customs data code was not limited to finished mattresses but included mattress components, it could not be used to quantify mattress imports. The method used was based on a combination of company provided data, full knowledge of those importing, and the relative size of their operations and sales. This was then matched against the customs data based on unit dollar values and known import of spring sets. This helped to verify and reconcile the mattress import estimate. There are some gaps in quantifying import activity but these are at the margin, aligned to smaller players.

B.3 Collect costs data reliability

The pricing structure of recyclers was used to infer collection costs. Recyclers charge a menu of prices based on selected collection methods. However, there are a wide range of collection methods and industry sources reported that prices charged by recyclers are not necessarily cost reflective.

The collection costs assumed in this Study are considered relatively reliable for the cost-effective methods (i.e. drop-off at the recyclers gate, bulk pick-up from council facilities). However, the cost of more 'premium' collection methods (e.g. home pickup) are less certain.