

End-of-life mattress report 2022

Prepared for the National Bed Federation

September 2022

Foreword

This is our fourth overview of the fate of 'end of life' mattresses in the UK. It contains good news and bad.

On the positive side, in the eight years since we have been looking at the data, the number of mattresses sent for recycling has more than doubled – from just 10% to around 24%. Industry take-back schemes have more than trebled and more local authorities have introduced positive initiatives to divert mattress disposals away from landfill or EFW and towards circular recycling options.

However the 'real' rate of recycling - the fate of the mattresses or their components and materials after sorting and processing, is rather lower (an estimated 14%). And there remain many barriers and challenges to improving upon these figures in the near future. We are still a long way short of our target of 75% diversion from landfill by 2028 – and we believe we should be revising that target to be more about 'real' recycling not just 'sent for' recycling – a lot more demanding!

But despite the significant challenges of the Coronavirus pandemic and subsequent economic shocks the sector has faced in the past two years - and will continue to face for at least the next year or two – encouraging and ongoing progress is being made towards more circular business models, whether those be focused on robust recycling processes, improved collection services or more considerably designed products and materials choices.

We hope this report provides manufacturers, customers, component suppliers, recyclers, local authorities and regulators with a useful picture of where we are, where we need to go and some helpful suggestions about how to get there. We have a much clearer picture of how governments, the waste industry and the bed industry can and should collaborate in order to achieve a greener future where waste is minimised and the value of materials and resources maximised.

As always, we invite and welcome comments, corrections and suggestions on this report, as we recognise its many limitations and potential inaccuracies from varied data sources.

Simon Spinks

Chairman, NBF Circular Economy Committee

End-of-life mattress report 2022

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Reference: NBF EoL mattress report final draft_v4.docx

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Glossary

Defra	the (UK) Department for Environment, Food and Rural Affairs
EfW	energy from waste
EoU	end-of-use
EoL	end-of-life
EPR	Extended Producer Responsibility (scheme)
HWRC	household waste and recycling centres
LA	Local Authority
NBF	National Bed Federation
PE	polyester
PRO	producer responsibility organisation
PU	polyurethane (foam)
RDF	refuse-derived fuel
SRF	solid recovered fuel

Assumptions

Average weight of one EoL unit → 25kg

Number of mattresses per tonne → 40 units

Units

Conventional SI units and prefixes used throughout.

kt, Mt thousands, millions of metric tonnes mass (1 tonne = 2,205 lb)

g, kg grammes, kilogrammes mass (1 kg = 2.205 lb)

Data

All data sources have been allocated a level of uncertainty, which can be found in Appendix 4: Technical Appendix.

Definitions

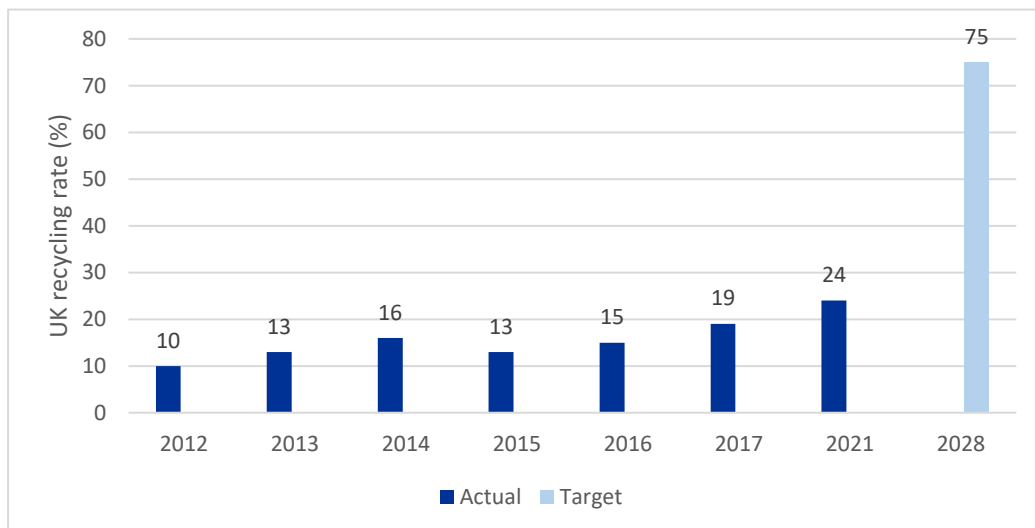
EfW	A number of treatment processes and technologies used to generate a usable form of energy from what was previously waste. This energy can be in the form of electricity, heating and/or cooling, or conversion of the waste into a fuel for future use e.g. transport fuels, or a combination of these forms.
End of Life (EoL)	The end stage of a product's life cycle, after which they are disposed of.
Environmental hotspot	Key areas of environmental concern which policy instruments should aim to address.
EPR	An environmental policy approach in which the manufacturer's and distributor's responsibility for a product is extended to cover the entire life cycle, taking into account the cost of disposal, collection and transport at end of life, as well as considerations of recyclability at the development phase.
Material recovery	Any recovery operation, other than energy recovery and reprocessing into materials that are to be used as fuels or other means to generate energy.
Real recycling	Measurement of the recycling rate taking place after sorting and the final recycling process. This results in the yield losses due to contamination etc. during the recycling process being excluded from the recycling rate calculation.
Recycling	Action by which waste materials are reprocessed into products, materials or substances to be used whether for the original or other purposes.
Replacement rate	The percentage of new mattresses bought to replace mattresses being discarded.

Executive summary

This study provides a review of the end of life (EoL) management of mattresses in the UK in 2018, 2019, 2020 and, where possible, 2021. It follows three previous studies focused on 2012 to 2018. It must be stressed that, as in many industries, the COVID-19 pandemic has provided its challenges to the sector over this period; examples include restricted customer access to try mattresses before buying in high street retailers, closures or reduced operations at household waste recycling centres (HWRCs), and restrictions on end markets for recovered materials.

The study estimates that the current 'sent for recycling' rate for EoL mattresses in the UK is around 24% (see Figure 1, based on 2019 data to reflect pre-pandemic level). This represents a slight increase on previous years but, more significantly, it shows that the industry is set to fall short of the NBF's target of "75% of EoL mattresses diverted from landfill by 2028", since landfill is still the most common means of managing the 76% of EoL mattresses that are not recycled.

Figure 1: UK recycling rate for mattresses 2012-2017, the current (2021) rate, and the 2028 target



To achieve its target by 2028 and future-proof the mattress industry, the NBF supports the UK Government's potential move to include mattresses under an Extended Producer Responsibility scheme. The structure of this report mirrors the goals of an EPR.

1. Goal 1a: Effective collection

There are three key collection methods used in the UK:

- Take-back schemes operated by retailers. The study found retailer take-back to have increased since the previous study. It is considered an effective collection method as it takes mattresses directly from homes, hotels, etc and so they are less likely to get wet or damaged in transit or storage. However, the cost to the consumer can be prohibitive with some retailers charging as much as £45 for this service.
- Bring schemes operated by Local Authorities, i.e. consumers take their mattresses to HWRC sites. This typically represents a free disposal method to consumers but clearly relies on the consumer having the means of getting the mattress to the HWRC. The collection infrastructure in place at the HWRC dictates the end fate of the mattress. For example, in space-constrained HWRC sites it is likely that the mattresses will not be segregated and hence are destined for EfW or landfill. Additionally, the mattresses need to be dry to be recycled and hence the skips or containers need to be weather-proof.

- Bulky waste collections operated by Local Authorities. This overcomes the logistical challenge for the consumer on how to get the mattress to the HWRC but, much like the retailer take-back scheme, there is typically a collection fee (of around £20). As with the bring schemes, mattresses are also not likely to be segregated from the rest of the bulky waste.

Collection was deemed one of the most crucial areas to address by stakeholders across the supply chain and the lack of incentives for the Local Authorities to recycle mattresses was well cited. Beyond UK-wide municipal solid waste (MSW) recycling targets, there are no specific targets set for HWRCs unless contracted to do so. Therefore, the current system is heavily dependent on the individual actions of Local Authorities and consumers.

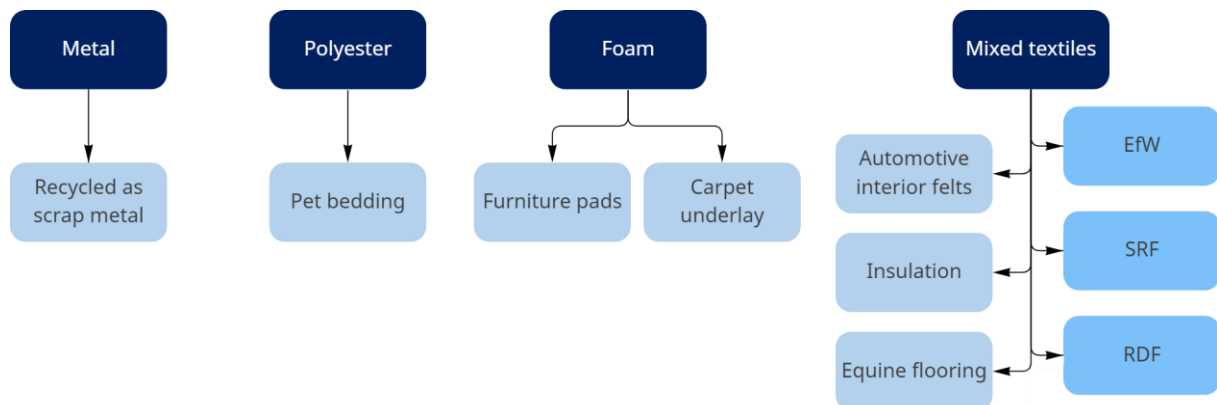
2. Goal 1b: Environmentally sound treatment of products

To understand the treatment of products at EoL, the real recycling rate (which only accounts for the material actually recycled, i.e. accounting for the yield rate of the recycling process) was used. ‘Real recycling’ is currently a very hot topic in discussions associated with the recycling of packaging, and the approach used in this study was considered a means of future-proofing the analysis. The real recycling rate was calculated at a very high level. Very encouragingly, some recyclers demonstrate best practise and potential capabilities of the sector with manual deconstruction to separate different types of materials, achieving an individual recycling rate of over 80%, whereas others focus on simply recovering the steel and have a recycling rate of below 50%.

3. Goal 1c: High utilisation of products/materials

Access to end markets appears to depend on economies of scale. Larger recyclers have the quantities of recyclable materials (including steel, polyester, foam, textiles etc) that enable trading (examples shown in Figure 2), whereas the smaller recyclers do not have the quantities of individual materials to trade and hence are more likely to trade in a more limited number of materials.

Figure 2: Examples of end markets for mattress materials



4. Goal 2: Overall circularity of the sector can increase through design improvements

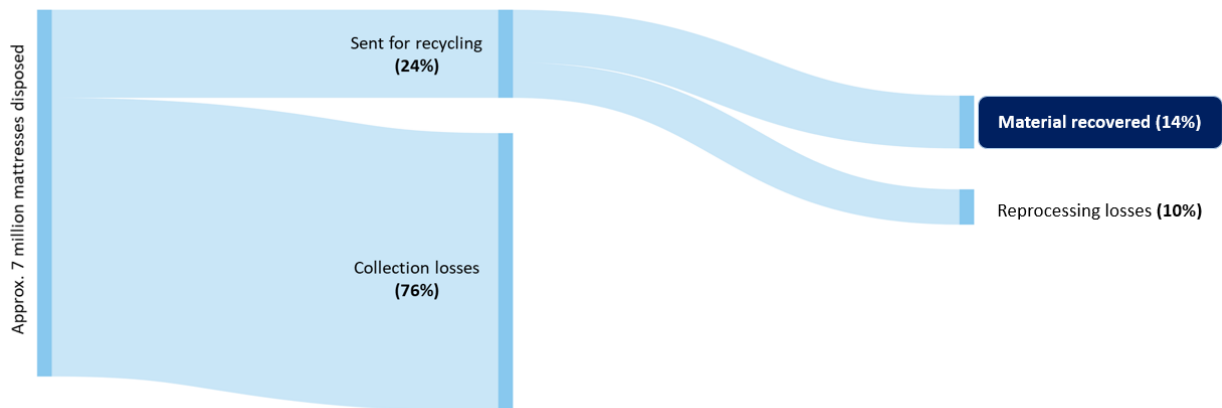
The design phase is essential when considering the EoL of mattresses - for example, using recyclable materials and designing for ease of disassembly. Recyclers reported problems with pocket-spring mattress design, and with the use of natural fibres as they decompose in damp conditions - so regular foam mattresses are preferred. This is in contrast to the retailers actively seeking natural fibres to use in their mattress products, due to their perceived lower environmental impacts. In order to understand the true impacts of mattress design on the environment, a full life-cycle assessment should be undertaken on all materials rather than focusing on one stage in the life cycle, namely EoL.

Additionally, rationalising the number of materials contained in a mattress would aid recycling; however, this should not compromise the functionality of the mattress.

To conclude, this study shows that:

- Recycling of EoL mattresses in the UK is somewhat haphazard.
- Large quantities of material are lost during recycling (as shown in Figure 3 mainly due to constraints at the collection stage).
- An EPR would provide the revenue and incentives to develop the collection infrastructure needed to meet the recycling targets.¹
- There are already examples of good / best practice in terms of collection and reprocessing. The challenge is: how to roll these practices out.
- End markets for recovered materials represent a challenge, especially for the smaller recyclers, and this is a key area for future improvement.

Figure 3: Sankey diagram to show the material lost and recovered in the current mattress recycling process



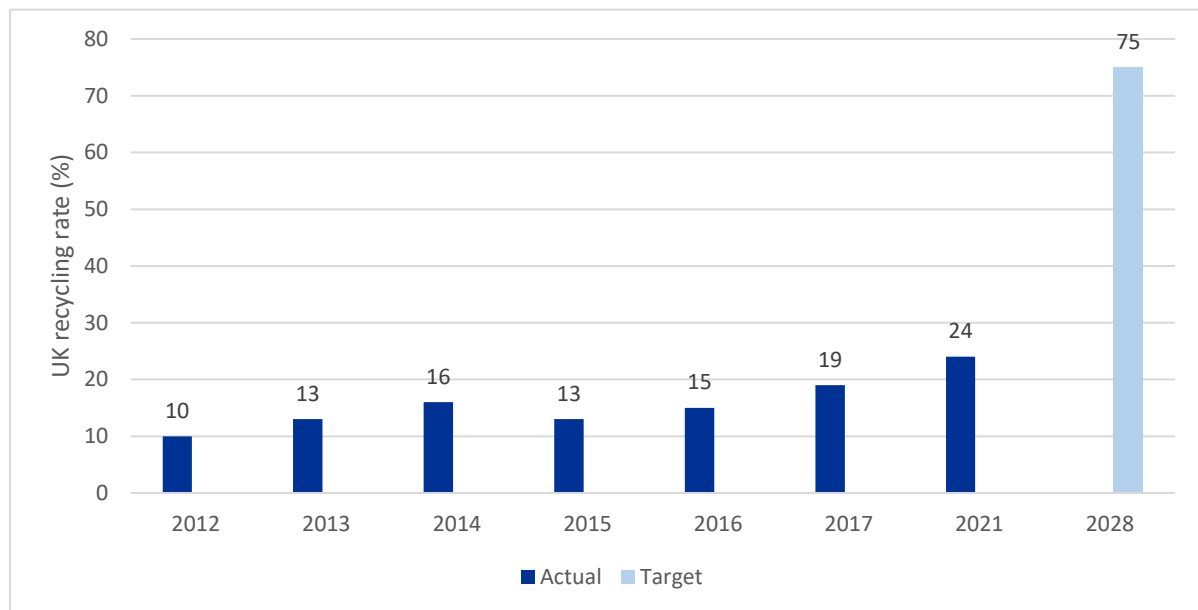
Though this report has more of a focus on qualitative analysis in comparison to previous NBF end-of-life mattress reports, quantitative analysis has been used to strengthen this narrative. As data for calculations in this report have been gathered from a variety of sources, all figures have been assigned a level of confidence with respect to the sources used. These are laid out in the Appendix 4: Technical appendix.

¹ This is effectively demonstrated in Connecticut, USA where, in the first year since the introduction of a mattress EPR scheme, the mattress recycling rate rose from 8.7% to 63.5%. <https://www.productstewardship.us/page/Mattresses>

1 Introduction

Since 2012, the NBF has been reporting on the end-of-life (EoL) management of mattresses across the UK, with a particular focus on the recycling rate. Figure 4 provides a summary of the results. Although there is a positive message, i.e. the recycling rate has more than doubled between 2012 and 2021, the reality is that the recycling rate is still very low with the equivalent of less than 1 in 4 mattresses being sent for recycling in 2021 - and a dramatic increase is needed to meet the 2028 target of 75% of EoL mattresses being diverted from landfill. (Note that a 75% diversion from landfill can be achieved through processing for energy from waste and hence this does not represent a true recycling target).

Figure 4: UK sent for recycling rate for mattresses between 2012 and 2021, and the 2028 target



Please note: The methodology for calculating the recycling rate has evolved across the four EoL surveys. Due to these changes, figures across the time series are not necessarily comparable.

1.1 The problem

Waste mattresses are considered by Local Authorities (LAs) as a problematic waste stream due to their relative size and bulkiness, relatively high incidences of fly-tipping and low value for recoverable materials. In addition, unlike waste streams such as packaging, there is no direct mandate for Local Authorities to recycle mattresses and hence it is undertaken on an ad hoc basis.

1.2 The potential solution

The UK Government has determined mattresses to be a potential product category suitable for an Extended Producer Responsibility (EPR) scheme. An EPR extends a producer's responsibility for a product to the post-consumer stage of its lifecycle.² EPR is not a new policy instrument and Figure 5 shows that the OECD developed the two goals of an EPR 40 years ago.

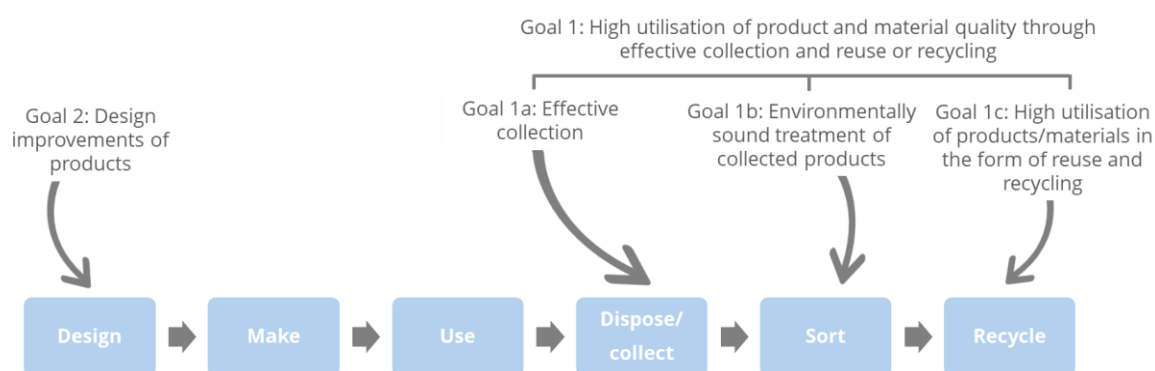
² Extended Producer Responsibility: Updated guidance for efficient waste management, OECD, 2016: <https://www.oecd.org/development/extended-producer-responsibility-9789264256385-en.htm>

This policy instrument would aim to:

- Goal 1: Maximise the end-of-life collection and management of mattresses.
- Goal 2: Encourage design improvements for products.

Zero Waste Scotland has recently explored the business case for the potential for introducing a mattress EPR in Scotland, with the intention to expand this to a UK-wide scheme. The NBF was closely involved in this research, which recommended that an industry-led, mandatory scheme would be more appropriate for industry. However, it is understood that Defra is keen for industry to introduce schemes on a voluntary basis before asking for governmental support to expand.

Figure 5: The original aims of an EPR



Source: Based on the [OECD guidance manual](#)

1.3 This study

In response to these growing discussions, and the likelihood of top-down policy interventions being implemented, an updated picture of the UK mattress industry is required. It is anticipated that Defra will look to expand its understanding of the sector and will welcome more up-to-date information.

The focus of this report is aligned to the EPR goals shown in Figure 5. Table 1 provides a summary.

Table 1: The alignment of this study with the EPR goals

Goal	Description	Project focus
1a	Effective collection	The study investigates the alternative waste collection methods, such as retailer takeback, bulky waste collection, HWRCs, etc.
1b	Environmentally sound treatment of collected products	The study investigates the 'real recycling rate' being achieved by the recyclers (though not differentiating between reuse and recycling beyond LA reported figures, due to limited data availability).
1c	High utilisation of products/materials	The study quantifies the material recovery rates for each material (i.e. material recovery rate for steel, foam and polyester, etc).
2	Design improvements of products	The study focuses on the design attributes that impact on the EoL management options, i.e. the recyclability of materials and the ease of disassembly of the mattresses.

1.4 Scope

Our previous report, which was conducted over the Winter 2018/2019, focused on the analysis of 2017 data. This current study predominantly focuses on collecting and analysing three to four years' worth of data, namely 2018, 2019, 2020 and, where possible, 2021. This research project assesses the flow of EoL mattress through their production, sale, use and final disposal stage.

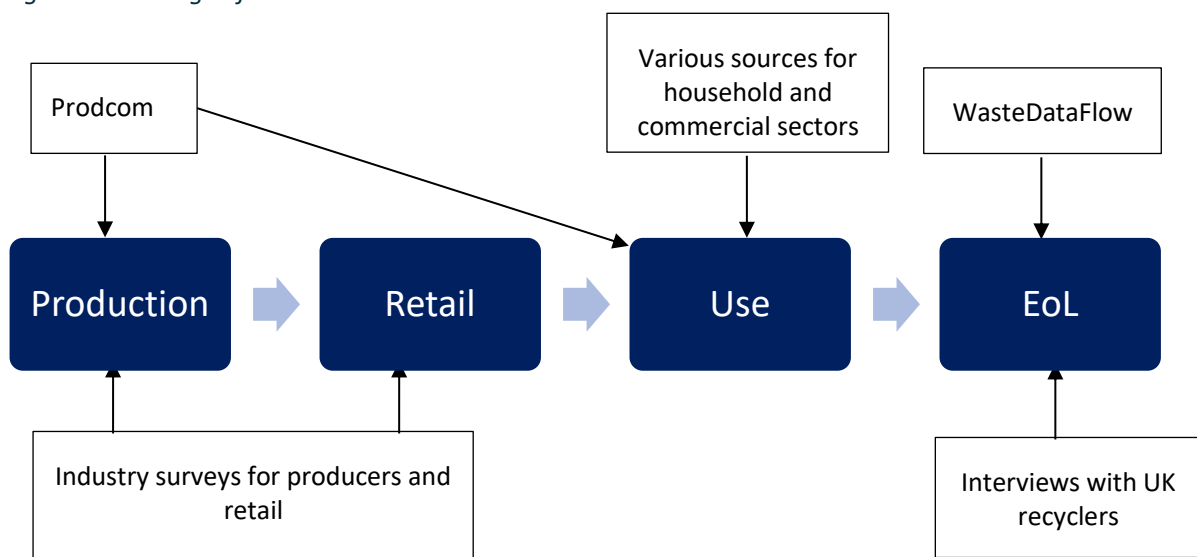
2 Data sources

Four data sources were utilised in this research project

- Prodcom – A European database containing government statistics on production, imports and exports.
- WasteDataFlow (WDF) – A public database on Local Authority reported waste treatment including reuse and recycling.
- Industry surveys for both UK based manufacturers and retailers.
- Interviews with UK recyclers.

Figure 6 shows the coverage of the four data sources across the mattress lifecycle.

Figure 6: Coverage of data sources



2.1 Prodcom analysis

The number of new mattresses added to the UK's in-use stock per year can be calculated from official government statistics. New mattress sales (or apparent consumption) is the sum of the mattresses imported into the UK and those produced in the UK, minus the number exported.

Further to Prodcom analysis, the in-use phase of the mattress life cycle has also been quantified using official ONS census and accommodation type data, as well as various sources to estimate the market size of commercial mattresses in-use (Section 3.2).

2.2 WasteDataFlow analysis

To quantify Local Authorities' (LAs') handling of mattresses, the publicly available data on municipal waste collection and treatment published on the WasteDataFlow portal was analysed.

LAs report on their handling and treatment of municipal waste to the environmental agencies of the respective home nations who validate the data before it is uploaded onto the WasteDataFlow portal. As of January 2022, the most recently available data was from the 2020/21 financial year. LAs' responses to questions on reuse, recycling and the end destinations of the wastes they handle were used to interrogate the collection and treatment of mattresses between 2017 and 2020.

In general, LAs only report on mattresses if they are segregated from other bulky wastes to be sent for mattress-specific treatment. In LAs where the mattresses are collected and processed with other bulky waste there is, in general, no data recorded in WasteDataFlow. Though the above is true in general, there were a small number of LAs (including Powys, Fermanagh and Omagh, and Antrim and Newtonabbey) where mattress collections were reported that ultimately were exclusively sent to landfill or energy recovery (i.e. not mattress-specific treatments). This is the main reason for the 7% difference between the 2017 data processed during this analysis and that reported in the previous (2019) report (see Table 16).

To maintain consistency with previous analyses, we are defining LAs' reported recycling as the total tonnage of mattresses they collect and send for mattress-specific processing. Later we will present lower figures for real recycling carried out on LA collected mattresses, which incorporate what we know about the yield rates of recycling processes used at mattress recycling facilities.

2.3 Industry surveys

To collect insights into the production and EoL stage of mattresses, a survey was sent to both manufacturers and retailers through the NBF's membership and network. After experiencing difficulties in the previous study, we aimed to increase participation through making the surveys accessible online to avoid any potential administrative burden. The surveys notably focused on four key areas:

1. Sales statistics (including numbers of mattresses placed on the market).
2. Mattress returns (including the number of units returned via retailers or wholesalers due to faults, distance selling regulations or comfort guarantees).
3. Mattress take-back (including the number of units collected, cost and profit and demand trends).
4. The management and end-fates of used mattresses through both returns and those collected through take-back service.

The online surveys were disseminated by the NBF and received a total of 11 and 19 responses for the manufacturers and retailers surveys respectively.

The surveys can be viewed through clicking the below links:

- Manufacturers = <https://www.questionpro.com/t/AUaNiZquV2>
- Retailers = <https://www.questionpro.com/t/AUaNiZqluJ>

2.4 Local authority surveys

In order to maximise the response rate from LAs, we used the contacts made during the 2019 study and asked representatives for an update on their operations, in addition to using LA data from WasteDataFlow. This year we received 10 responses, which provided an insight into the sources of EoL mattresses, kerbside collection services and the disposal of EoL mattresses.

2.5 Interviews with UK mattress recyclers

In order to gain an updated picture of the UK mattress recycling sector, we set out to engage with all active recyclers on the market. The total 22 identified recyclers were contacted through a combination of phone call interviews and online surveys. The total number of recyclers engaged with (via interview and survey) was 12.

The areas covered in both the interviews and the surveys included:

- Number of mattresses recycled and methods of recycling.

- Sources of mattresses (not singling out disposals resulted from comfort guarantee trials, though an estimate of the total scale is provided based on recycler input).
- Recycling rate of mattress materials (not differentiating between product-level reuse and material-level recycling).
- Opportunities and barriers to increasing mattress recycling rates.

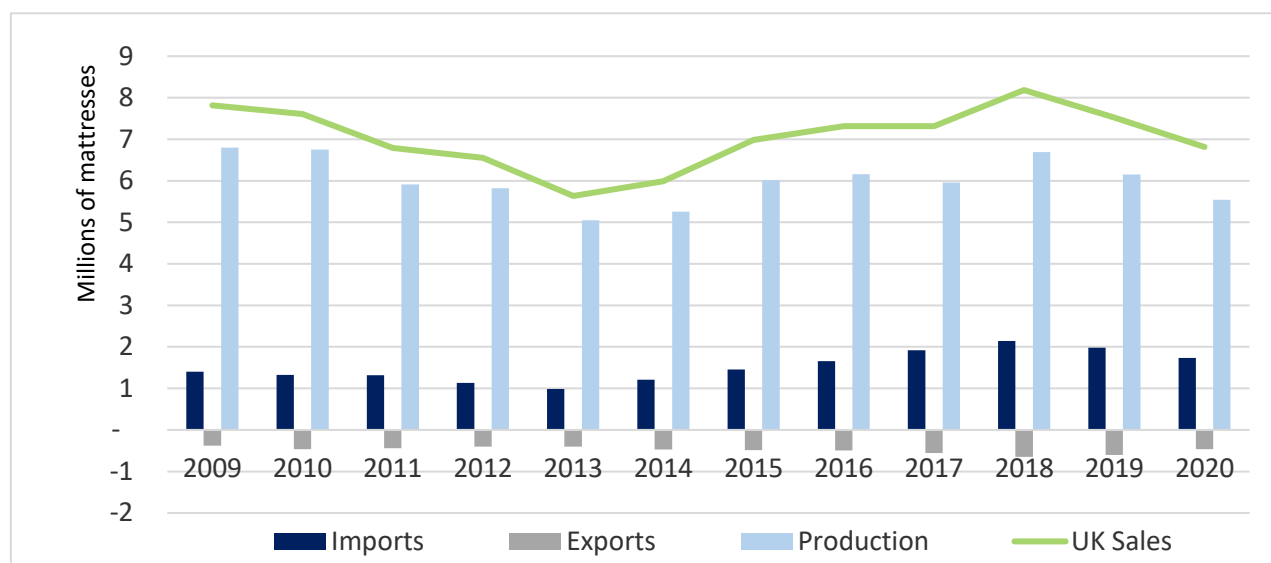
3 Background analysis

3.1 How many new mattresses are placed on the UK market?

The number of new mattresses added to the UK's in-use stock per year can be calculated from official government statistics (see Figure 7 and Table 2). New mattress sales (or apparent consumption) is the sum of the mattresses imported into the UK and those produced in the UK, minus the number exported (further detail can be found in Appendix 1).

Since 2009, the average number of new mattresses consumed in the UK annually is 7.1 million. In 2019 the number was 7.5 million.

Figure 7: Apparent consumption of mattresses (UK) calculated from 'Production + Imports – Exports'



Sources: [UK Trade Info](#) by SITC codes and the ONS' UK manufacturers' sales by product. Data downloaded 29/11/2021.

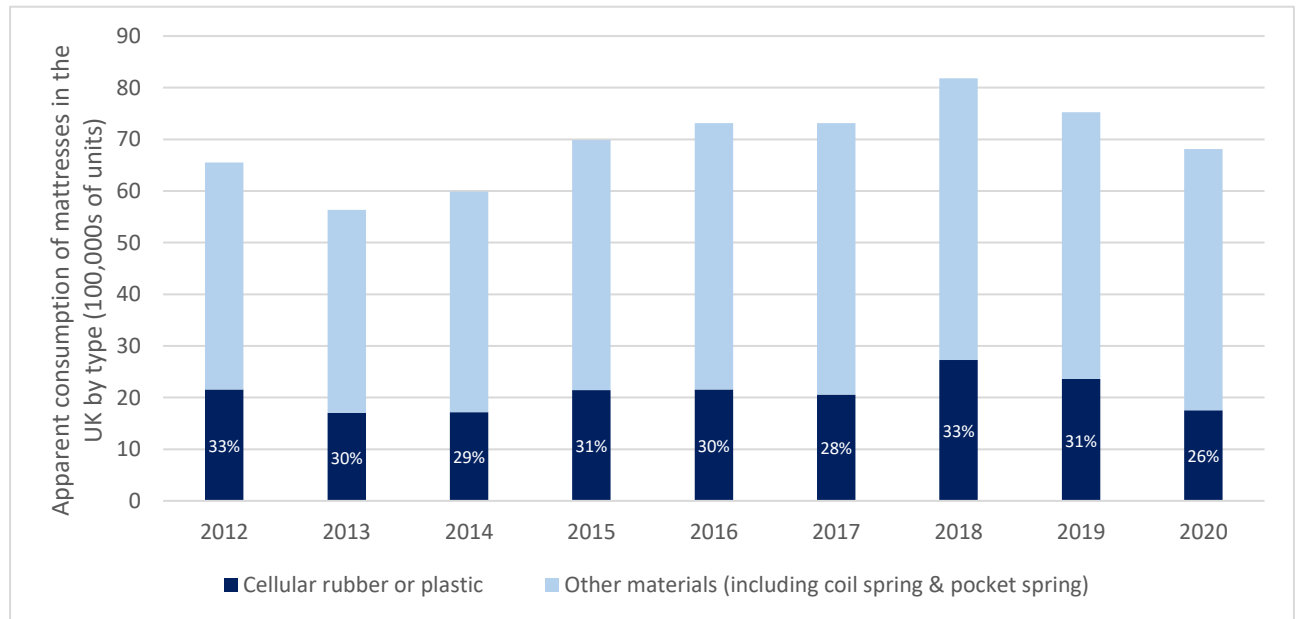
Table 2: Summary of trade and production data (in millions of units)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Imports	1.40	1.33	1.32	1.13	0.98	1.21	1.46	1.65	1.92	2.14	1.98	1.73
Exports	0.38	0.47	0.44	0.40	0.40	0.47	0.49	0.50	0.56	0.65	0.61	0.46
Production	6.80	6.75	5.91	5.82	5.05	5.26	6.01	6.16	5.96	6.69	6.15	5.54
UK sales (Apparent consumption)	7.82	7.61	6.79	6.55	5.63	5.99	6.98	7.31	7.31	8.18	7.52	6.81

The proportion of mattresses consumed in the UK which are imported has gradually increased, averaging 18% between 2009 and 2014 and 25% between 2015 and 2020. Of these imports, 70% are from EU countries, with Poland and Denmark being the top two sources of mattresses coming into the UK. Similarly, the EU accounts for two-thirds of the mattress exports from the UK, with Ireland and France being the top two destinations for UK-produced mattresses.³

No change in the proportion of cellular rubber and plastic mattresses consumed in the UK is evident in this data, with the average market share of these products being 30% over the 2010 - 2020 period.

Figure 8: Apparent consumption (in 100,000s of units) of mattresses in the UK by type (using UK Trade Info [as in Figure 7])



3.2 How many mattresses are in-use in the UK?

Similarly to the 2019 report, census population data and official statistics on accommodation type were used to derive an estimate for the number of mattress units that are in-use. The assumptions made are that one mattress is needed per bedroom, and that there are 0.98 bedrooms per person.^{4,5}

³ See Table 12 for more info on the UK's trade partners for mattresses.

⁴ 2011 census data highlighted that there were 54,922,804 bedrooms in England and Wales for the population of 56,075,912. This means that there were 0.98 bedrooms per person.

⁵ 2021 census data was not available at time of writing.

Table 3. Total number of household mattresses in the UK (2018 – 2020)

Year	Region	Population ⁶	Number of bedrooms/mattresses
2018	England and Wales	59,116,000	57,934,000
	Scotland	5,438,000	5,329,000
	Northern Ireland	1,882,000	1,844,000
	All	66,436,000	65,107,000
2019	England and Wales	59,440,000	58,251,000
	Scotland	5,463,000	5,354,000
	Northern Ireland	1,894,000	1,856,000
	All	66,797,000	65,461,000
2020	England and Wales	59,720,000	58,526,000
	Scotland	5,466,000	5,357,000
	Northern Ireland	1,896,000	1,858,000
	All	67,081,000	65,741,000

In order to gain a true representation of the amount of mattresses in-stock across the UK, it is also important to consider the units from commercial sources. This includes hospitality, care homes, student accommodation, hospitals, prisons, armed forces and caravans/mobile homes (see Table 4).

Table 4: Number of commercial mattresses in the UK (2018 - 2020)⁷

Sector	Approx. number of mattresses in use ⁷	Source and further comments
Hospitality	839,000	Estimation using figures from previous EoL mattress report (2019)
Care homes	548,000	Care Quality Commission insights into care home capacity (2020) ⁸
Student accommodation	681,000	UK Student Accommodation Report (2020/21) ⁹
Hospitals	169,000	The King's Fund: NHS hospital bed numbers (2019/20) ¹⁰
Prisons	99,000	UK Prison Population Statistics (2021) ¹¹
Armed forces	140,000	With an approx. 4,000 mattress surplus from purchased mattresses, MoD representative email correspondence (2021)
Caravans/mobile homes	1,245,000	NCC industry statistics (2021) ¹²
All	3,721,000	

⁶ Mid year population estimate from the ONS:

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland>

⁷ Where UK data could not be found, England data was scaled by population to estimate the number of mattresses in the UK

⁸ <https://www.cqc.org.uk/publications/major-reports/covid-insight-6-designated-settings-care-home-capacity>

⁹ <https://www.cushmanwakefield.com/en/united-kingdom/insights/uk-student-accommodation-report>

¹⁰ <https://www.kingsfund.org.uk/publications/nhs-hospital-bed-numbers>

¹¹ <https://commonslibrary.parliament.uk/research-briefings/sn04334/>

¹² https://www.thecc.org.uk/Our_Industry/statistics.aspx

Based on the above methodology, we estimate that there were 69,462,000 mattresses in-use in the UK in 2020. In comparison to 2017 (when 68,387,000 units were in-use), this is an increase of 1.5%.

3.3 How many mattresses were disposed of between 2018 - 2020?

Previous reports used a replacement rate (i.e. the number of mattresses bought to replace a mattress requiring disposal) based on market research carried out by the NBF. A figure of 91% was reached by asking customers at mattress retailers why they were buying a new mattress.

Due to concerns as to how representative the sample surveyed was, we decided in this report to derive the replacement rate for domestic mattresses using the following approaches:

- Estimating the number of 'in-use' (i.e. not guest or spare beds) mattresses based on household composition and population statistics.
- Estimating the number of new mattresses bought to fill new build dwellings every year.

Neither of these approaches is perfect, with the former being an underestimate as it does not account for mattresses not in regular use, and the latter being an overestimate as it assumes all bedrooms in new dwellings are used as bedrooms and that they are filled with new mattresses. As anticipated, these two approaches came back with different values for the replacement rate, which we then averaged to get an overall estimate of 94% (full derivation of the replacement rate can be found in Appendix 2).

To calculate the UK's recycling rate, we needed to uncover the number of mattresses that were disposed of between 2018 and 2020. The same assumption was used as the 2019 report:

$$\text{Mattresses disposed of} = \text{Apparent consumption} \times \text{Replacement rate}$$

As Table 5 displays, an estimated 6.4 million units were disposed of in the UK in 2020. Over the three year period between 2018 and 2020, there has been a 17% decrease in the number of mattresses being disposed of.

Table 5: Derivation of the number of mattress units disposed of in the UK (2016 – 2020)

Year	New mattress sales	Mattress replacement rate (%)	Mattresses added to in-use stock	Mattresses disposed of
2016	7,380,000	91	660,000	6,720,000
2017	7,980,000	91	710,000	7,260,000
2018	8,180,000	94	490,000	7,690,000
2019	7,520,000	94	450,000	7,070,000*
2020	6,810,000	94	410,000	6,400,000

Please note: The 2016 and 2017 datapoints have been included from the 2019 report, which assumed a replacement rate of 91%.

*This number has been used as the average figure for number of mattresses disposed to calculate the pre-pandemic 'sent for recycling' rate of 24%.

4 Goal 1a: Effective Collection

4.1 Current status of mattress collection in the UK

Collection was deemed to be one of the most crucial areas to address by stakeholders across the supply chain. This is further confirmed by the knowledge that mattress (and furniture) fly-tipping incidents accounted for 16% of all incidents in 2020/21, a 7% increase from the previous year.¹³ This results in an unwanted financial burden on local authorities, and therefore, taxpayers.

In the UK, there are three key collection methods used for mattresses. The following section discusses each of these methods, summarising the information gathered from: manufacturer, retailer and LA surveys; interviews with waste management companies; and data from WasteDataFlow.

Table 6: Overview of responses from manufacturer and retailer surveys

	Number of responses	Average number of units manufactured/sold by respondents 2019-2021 ('000s)	Approx. proportion of market represented (%)
Manufacturers	11	1,360	22%
Retailers	19	1,900	25%

Note: The approximate proportion of the market represented was calculated using 2019 production and sales data as detailed in Table 2.

4.1.1 Take-back schemes

Both manufacturers and retailers offer take-back schemes for mattresses, where the consumer/business pays a fee to have the existing mattress removed when the new mattress arrives. These schemes mainly operate through domestic mattress take-backs, with few commercial returns.

Retailers

In comparison to data from the 2019 report, the number of mattresses found to be collected via retailer survey respondents' take-back schemes has risen more than threefold, from 85,000 in 2018 to almost 280,000 in 2021.¹⁴ Regardless of the clear disparities in retailer respondents to the survey between the two reports, since 2019 retailers have reported a large increase in the demand for these schemes, with 20% of respondents having set up a take-back scheme in this time. Most retailers have well-established take-back schemes (i.e. running for longer than three years), with over 90% of survey respondents estimating a growth in demand over the next five years. With this growth comes a potential increase in mattress recycling, as over 50% of survey respondents use mattress recyclers as their main outlet for

“Over 90% of retailers estimate a growth in demand for take-back schemes in the next 5 years”

¹³ <https://www.circularonline.co.uk/news/uk-government-announces-new-crackdown-on-fly-tipping/>

¹⁴ Market coverage of retailers in the 2019 report was estimated to be 9%

mattresses from take-back schemes, rather than original producers, with waste management contractors as the second most likely outlet.

Manufacturers

Whilst most retailers have or are looking to establish a take-back service, manufacturers see more barriers to this. Due to the majority of mattresses being returned during the comfort guarantee period, there is an apparent risk of contamination between this 'cleaner' stream of mattresses and the mattresses received through take-back schemes. This factor may have contributed to the number of mattresses collected by manufacturer take-back schemes decreasing since the last report, from 26,870 units in 2018 to 7,195 units in 2021. Manufacturers also reported little-to-medium growth in the demand for their take-back schemes.

General observations

Across both retailer and manufacturer services, the average price charged for the collection of a used double mattress is £30. With prices varying from £15 to £45, there could be a financial barrier to some consumers. Despite this price variation, and the popularity of the schemes, on average no profit is made by manufacturers or retailers for providing a take-back service, regardless of whether for domestic or commercial sources.

4.1.2 Collection at Household Waste Recycling Centres (HWRCs)

Bring schemes

Bring schemes involve the consumer taking their mattress to the HWRC using their own transport. As mattresses are large, bulky items which are unlikely to fit in the average household vehicle, this means of mattress disposal is less common, despite incurring the least cost (i.e. free). It is common practice for mattresses to be stored in HWRCs in an open container, as they are a particularly bulky item. Containers are often placed outside due to storage issues, leaving them open to the elements, and so the mattresses get wet and damaged. Most recyclers cannot process mattresses after they become wet (unless shredded for metal recovery), so the end-of-life options for these mattresses are often limited to EfW and landfill.

General observations

The collection and storage facilities at HWRC centres directly affects the number of mattresses sent for recycling. Since the 2019 study, there appears to be more proactivity with respect to introducing recycling and EfW disposal routes for mattresses, but no specific activity to address collection and storage facilities. 40% of the Local Authorities that took part in our LA survey reported that their mattresses, either separated or amongst bulky waste, are still sent to landfill. Although a willingness to divert these mattresses from landfill is seen, there are still barriers to overcome to encourage and enable more LAs to drive mattress recycling, such as:

- Limited number of mattress recyclers passing Health & Safety tests during due diligence visits.
- Potential recycling opportunities are uneconomical largely due to the long haulage distances to the recyclers.
- Not currently a cost-effective alternative to landfill.
- Difficulties separating mattress units from mixed bulky waste streams.
- Lack of incentives for LAs to separate mattress units, i.e. no mandatory recycling targets for mattresses.

These barriers and concerns have been reported in the 2019 and 2016 study and are yet to be resolved.

4.1.3 Doorstep collections via LAs or their contractors

Bulky waste collection

Household bulky waste collection services allow consumers to have their mattresses collected from their doorstep by the council without the exchange aspect of a take-back scheme. This is carried out for a fee of around £20, with many offering set fees for multiple items and very few allowing for free collection of bulky waste (e.g. Liverpool County Council through Bulky Bob's). Unlike take-back schemes, the mattresses collected through bulky waste collections are often not segregated from the other bulky waste, resulting in 'easier' disposal via EfW or landfill. As with the bring schemes, the mattresses, along with the rest of the bulky waste are stored at HWRCs and left exposed to the elements, rendering them mostly unrecyclable.

General observations

This overcomes the logistics challenge for the consumer of how to get the mattress to the HWRC but, much like the retailer take-back scheme, there is typically a collection fee (of around £20). As with the bring schemes, mattresses are also not likely to be segregated from the rest of the bulky waste.

4.2 The future of mattress collection

From the information summarised in this section, some next steps to facilitate the implementation of an EPR for mattresses, and to improve the collection processes of the industry, are as follows:

1. Encouragement of take-back schemes

In a study carried out by *Which?*¹⁵, they reported that 45% of consumers use take-back schemes to dispose of their old mattresses. This statistic is encouraging, as these schemes are considered best practice for keeping mattresses clean and dry – ready for recyclers/reuse organisations to process. This further confirms the increase in demand for the schemes, as reported through the retailer surveys.

2. Targets for HWRCs

Beyond UK-wide municipal solid waste (MSW) recycling targets, there are no specific targets set for HWRCs unless contracted to do so. Therefore, the treatment of mattresses with consideration of their onwards reprocessor relies on the individual actions of LAs and consumers. Setting mattress-specific recycling targets will ensure careful collection and storage at HWRCs (i.e. mattresses kept clean and dry), and increase the number of mattresses sent for recycling.

Examples of this can be seen in Greater Manchester, whose recycling initiatives have caused the recycling rate of mattresses in the North West to increase by over 100% between 2019 and 2020. The Local Authority partners with a waste management company that collects the mattresses from HWRC sites. Through a contract with a nearby mattress recycler, these

Example of best practice:

What happens to mattresses in the London Borough of Hackney Council is considered best practice since it is a standalone contract and specifies a service agreement that at least 80% of the mattresses will be recycled and no more than 20% will be incinerated or landfilled

¹⁵ <https://www.which.co.uk/reviews/mattresses/article/how-to-dispose-of-a-mattress-avTgx0t48NMG#how-to-get-rid-of-a-mattress>

mattresses are all sent for recycling, so the waste management company cannot accept wet, fly tipped etc mattresses, thereby creating a need for the HWRC sites to provide adequate storage facilities.

3. Increased numbers of mattresses being transported

Compression technologies are needed that increase the number of mattresses that are able to be transported per artic lorry. This will decrease haulage costs, increase the number of mattresses collected by LAs/recyclers and so will increase the overall viability of mattress recycling across the UK.

Example of best practice:
TFR Group has developed a mattress compression system to allow a standard 40ft trailer to carry 600 mattresses, instead of 90.

4. Public awareness of mattress collection services

The North London Waste Authority (NLWA) reported that over a third of people didn't know a mattress could be recycled.¹⁶ Despite efforts by retailers encouraging mattress recycling through their take-back schemes, this clearly highlights the need for campaigns to raise awareness of best practice for end-of-life disposal of mattresses.

4.3 Returns

Retailers and manufacturers were also asked how many mattresses were returned to their operations between 2019 and 2021. This only includes mattresses which were returned due to faults, distance selling regulations or during the comfort guarantee period (typically <6 months old). Using data from survey respondents, a total of 152,246 mattresses were returned to these manufacturers and retailers in 2021. Given that these respondents accounted for around 25% of the market share, there are approximately 600,000 mattresses returned each year.

These extended guarantees for faults and comfort have resulted in increases in the return rate of mattresses. This increase could be caused by the rise in demand for online, 'bed in a box' mattresses, see high-level estimates in Section 5.1.2.

4.4 Waste management companies

For this report, we received responses from two national waste management companies. Despite the reported barriers to mattress recycling, such as the hygiene levels of mattresses, one company reported a 90-95% recycling rate. However, the contractual arrangements with the LAs was cited as a major factor in the service offering provided by the waste management companies. In many cases, mattresses are not singled out for special attention within these contracts and hence the waste management companies take the least-cost option, which is typically landfill or EfW.

¹⁶ Results from the NLWA's #LoveYourMattress campaign survey

5 Goal 1b: Environmentally sound treatment of products

Before looking at the processes undertaken within mattress recycling facilities, we must consider how many mattresses are sent for recycling, and the difference between this figure and the 'real recycling' rate.

In comparison to previous reports, this report will look at the recycling sector from more of a high-level, qualitative perspective. As we are looking to future-proof the industry, and how to achieve the 75% diversion from landfill target, we must address comments, barriers and opportunities made by all members of the supply chain with respect to mattress recycling.

5.1 How many mattresses are sent for recycling?

To put forward the next steps for improving the environmentally-sound treatment of mattresses, we must first understand and estimate how many mattresses are sent for recycling.

This study involved calculating a bottom-up derivation of the mattress recycling rate between 2018 and 2020.¹⁷ The recycling rate was estimated based on the number of EoL mattresses being received by recyclers as a proportion of the total number being disposed of. These recycling rates were calculated based on a combination of sources, including:

- Self-reporting by UK recyclers.
- Analysis of available statistics from WDF, looking at mattresses sent for recycling by Local Authorities.

5.1.1 Reporting by Local Authorities

Most mattresses, upon disposal, are handled by Local Authorities, either at HWRCs or through kerbside collection services. Thus, quantifying these flows is key to deriving a reliable recycling rate for mattresses in the UK.

Through an analysis of WasteDataFlow, it was evident that all UK regions saw an increase in LA reported mattress recycling and reuse between 2017 and 2020 (data in Appendix 3), apart from Wales (though Wales still has one of the highest rates per capita in the country, second only to London). Reported mattress recycling was up 50% over the period with particularly strong growth seen in the North West (as a result of Greater Manchester's efforts) and Scotland (due to availability of local mattress recycling capacity at Hamilton Waste and Recycling).

LAs generally send their segregated mattresses to be treated by either specialist mattress recyclers where they are either dismantled or shredded, metal recyclers, or general waste management companies. In the following calculation of how many of the LA-collected mattresses are actually recycled, taking into account the processes applied to the collected mattresses, we assumed the following¹⁸:

¹⁷ We are unable to calculate the 2021 recycling rate due to the Local Authority and production data not being available at the time of writing this report.

¹⁸ Please note that the individual figures for steel, polyester and foam (% by weight of the average mattress composition) do not contribute to further calculations within this report, as quantifying the material for end markets was not carried out due to lack of data availability.

- Mattress recyclers that dismantle, recycle the steel, polyester and foam from the mattresses (accounting for 51%, 12%, 16% of the mattress weight respectively). These figures were based on 9 WasteDataFlow entries¹⁹ for steel recovery from shredding. The average steel recycling rate for mattresses sent to recyclers by local authorities is 51% by weight. There was limited data for the weighted average figures for polyester and foam content recycled, as only 2 recyclers cited figures of 16% & 12%, and 20% & 16% by weight for each material respectively.
- Mattress recyclers that shred, metal recyclers and general waste management companies only recycle the steel (51% of the mattress weight) with the remaining combustible material used in the preparation of SRF or RDF. This figure of 51% is higher than the responses gained from limited recycler responses, who cited figures between 30-45% steel recovery.

Table 7: Summary of actual recycling and reuse of LA collected mattresses, taking into account the yield rates of the recycling processes applied to them

Region	2017	2018	2019	2020
East Midlands	323	222	563	458
Eastern	0	0	31	141
London	3,323	4,451	5,446	5,071
North East	104	330	587	351
North West	777	660	631	1,596
South East	320	277	429	504
South West	258	58	111	210
West Midlands	1,348	1,564	1,624	1,781
York and Humber	245	75	276	335
Scotland	0	359	590	722
Wales	599	720	840	522
Northern Ireland	337	551	762	572
Total (tonnes)	7,634	9,266	11,889	12,263
% yield rate of recycled materials	56%	56%	59%	60%
Of which constitutes steel recycling	91%	90%	86%	85%

From this data analysis we learn that approximately 60% of the material in mattresses sent for recycling by LAs is recycled, 1% is reused, and the majority of the rest is processed for energy recovery applications.

“Approx. 60% of the material in mattresses sent for recycling by LAs is recycled”

Though most recyclers are zero-waste-to-landfill there are a few who are not, meaning that some processing rejects are still sent to landfill (<1%). The quality of the underlying data and assumptions precludes any further in-depth analysis, including that of apparent changes between 2017 and 2020. For example, the reuse rate is probably much lower than 1% (approximately 80% of the reuse reported is likely to be mis-categorised recycling, or component (not whole-mattress) reuse).

¹⁹ WDF entries from: Gateshead, Redcar, Sunderland, Wrexham CBC, Vale of Glamorgan Council, Pembrokeshire County Council, Gwynedd Council, Cardiff County Council, Blaenau Gwent

In summary, despite brief HWRC closures caused by national COVID-19 lockdowns, LA-facilitated mattress collection and recycling in 2020 was reportedly at an all-time high.

5.1.2 Self-reporting by Recyclers

Though engagement with mattress recyclers this year has been comparatively low compared to in previous reports, we were able to provide a high-level approximation of the number of mattresses received by recyclers on average since 2018. This has been calculated through updated 2019-2021 figures and, where data was missing, 2018 figures from the previous report. This allowed us to calculate the recycling rate for mattresses.

Table 8: Number of mattresses received by mattresses recyclers

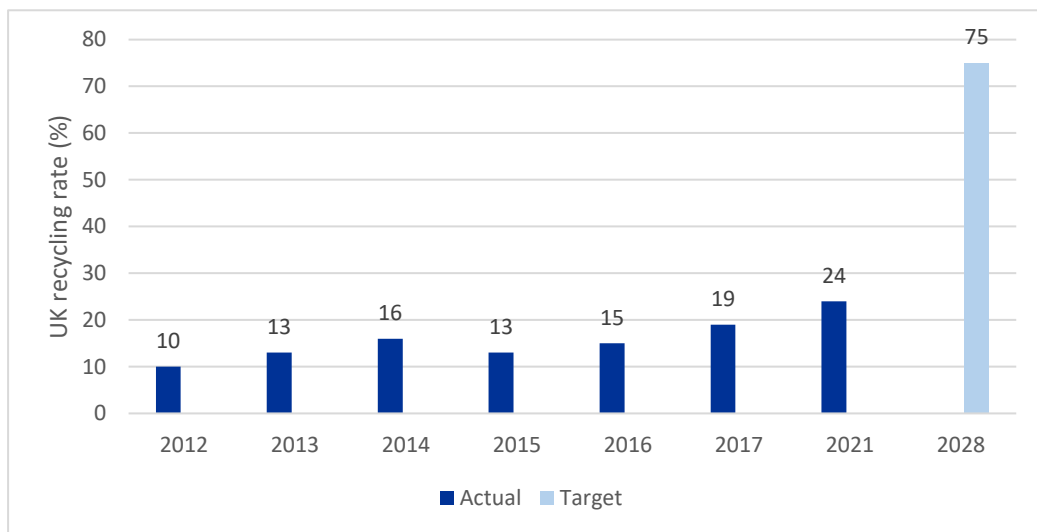
	2018	2019-2021 yearly approximation	% change	% of POM ²⁰ in 2020
Units	1,753,000	1,687,000	-4%	25%

We estimate that the current 'sent for recycling' rate in the UK for mattresses is 24%, based on recycler throughput data divided by the number of mattresses disposed of in the UK (the pre-pandemic 2019 figure for mattresses disposed has been used for this calculation so to avoid the unprecedented figures caused by the pandemic in 2020). It should be noted that the recycler throughput data does not specify the quantity and process route (i.e. reuse vs. recycle) of mattresses returned through comfort guarantee trials; still, input from one recycler that processes 'bed in a box' type of mattresses indicate that the number of mattresses disposed as a result of these extended trials could range between 200,000 to 400,000.

Despite the number of mattresses reportedly received by recyclers decreasing since 2018, the yield of mattress recycling has increased overall. However, if the NBF's 75% diversion from landfill target is to be met by 2028, the sector cannot continue at the same rate as shown in Figure 9. There needs to be serious action to drive this recycling rate up, and through an EPR scheme this can be facilitated as this 'sent for recycling' rate corresponds closely with the collection rate of mattresses. Working towards effective collection (Goal 1a) will in turn, drive an increase in this recycling rate.

²⁰ POM = Placed on market [mattresses]

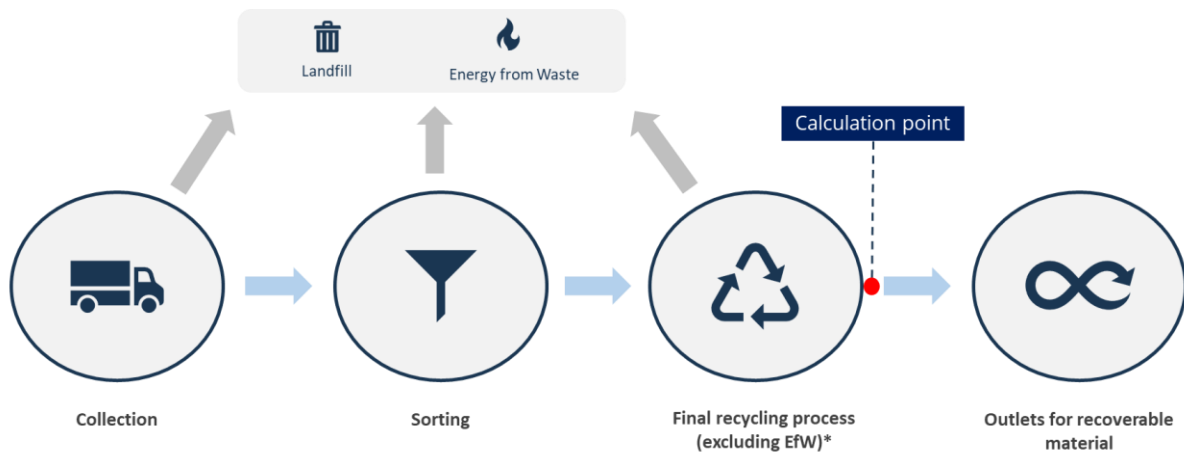
Figure 9: UK recycling rate for mattresses 2012-2017, the current (2021) rate, and the 2028 target



5.2 What is the ‘real recycling’ rate for UK mattresses?

It is recommended that the UK mattress industry adopts ‘real recycling’ as the metric for measuring the recycling rate for mattresses. ‘Real recycling’ refers to the stage in the process that the recycling rate is measured and takes place after sorting and the final recycling process (see Figure 10). It allows industries to differentiate between simple collection rates and real recycling rates. This will provide a level of future proofing since real recycling is the direction of travel across national and European policy.

Figure 10: Overview of ‘real recycling’



**Final recycling process = when no further sorting is needed, and the recyclates enter a production process and are reprocessed into new products/materials.*

Interviews with recyclers found that the larger recyclers have the economies of scale to service more outlets for recoverable material and have yield rates above 80%. Unfortunately, the smaller recyclers do not have the same level of access to these markets and hence the yield rates can be much lower. At worst, only the steel is recovered from the mattresses resulting in a yield rate of circa 50%. The materials that even the larger recyclers find difficult to recycle include horsehair and other natural fibres, which can

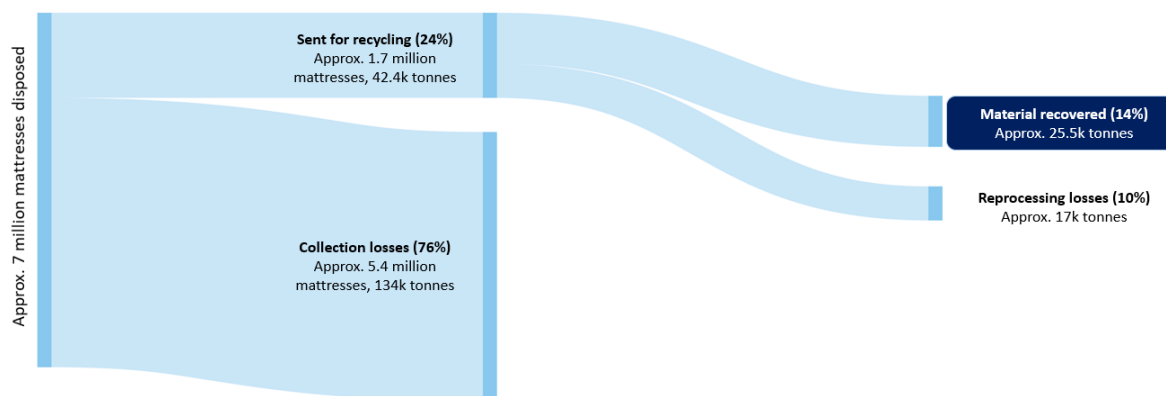
decompose in damp conditions. Other reasons that mattresses cannot be recycled include blood spots, and smelly or wet natural fibres.

For this year’s study we have provided an estimate of the mattress-derived materials and components that are actually recycled (i.e. measuring materials/components that leave the reprocessing facility, not just those that arrive). We have expanded the boundary from which we are measuring by exploring the material recovery at the output point of tier 1.

Using data from recyclers we calculated that 24% of the mattresses disposed were sent for recycling. With the knowledge that the average yield rate of recycling processes is 60% for LA-handled mattresses according to WDF, we can estimate that the real recycling rate is 14% of the total no. mattresses disposed in the UK (the equivalent to approx. 900,000 mattresses per year being recycled). A summary of these findings are shown in Figure 11.

With the current sent for recycling rate, but using a best practice case of 85% material recovery (through efficient and thorough manual dismantling processes), the real recycling rate of mattresses has the theoretical potential to increase to 20% in the UK. As many recyclers use machinery which has more of a focus on recovery for EfW/SRF/RDF, this figure is not attainable using the current recycling infrastructure. However, through an EPR facilitated mattress recycling industry with improved collection facilities, the real recycling rate can increase through national implementation of best practice procedures. Note that the real recycling rate in this report is not further broken down into reuse (at the product/component level) and material recycling post dismantling, due to limited differentiation in recycler survey responses.

Figure 11: Sankey diagram to show the material flow in the mattress recycling process (WasteDataFlow data on real recycling is used as the average yield rate for mattresses sent for recycling)



5.3 How can we increase the real recycling rate?

From the information summarised in this section, some next steps to facilitate the implementation of an EPR for mattresses, and to improve the real recycling rate are as follows:

(N.B. to increase the real recycling rate, we also need to address the barriers to sending mattresses to be recycled.)

1. Making recycling more financially and geographically accessible

There is currently not a cost-effective alternative to landfill, resulting in many LAs/waste contractors etc sending their mattresses to EfW and landfill. Due to unresolved inefficiencies in the collection of mattresses, and in addition to recyclers' gate fees, haulage costs were most cited as the disincentive to mattress recycling.

Transport costs for sending mattresses for recycling are often high due to the regional disparities of mattress recycling facilities in the UK. As listed in Table 9, there are clusters of mattress recyclers located mainly in the West Midlands and the North West of England (names and locations of mattress recyclers listed in Table 9). Furthermore, there has been limited growth in the sector, with few new mattress recyclers being established since 2019.

Table 9: List of main mattress recyclers identified in this study

Company	Size of operation*	Location	Link
Amgen Cymru	Small	Aberdare	www.amgen-cymru.com
Bye Bye Beds	Medium	Birstall	www.byebyebed.com
CAD Recycling Ltd	Medium	Deganwy	www.cadrecycling.co.uk
Carpenter Ltd	Small	Glossop	www.carpenter.com/uk
Circom Ltd	Medium	Coventry	www.circom.co.uk
Eco Matt Recycling	Small	Birmingham	www.ecomattrecycling.co.uk
Endurmeta	Small	Sandycroft, Deeside	www.endurmeta.com/mattresses
EnviroTex Products Ltd / Rematt Ltd	Medium	Accrington, Darwen	www.envirotex.uk , rematt.uk
Green Steel UK	Small	Tredegar	www.greensteel.uk
Hamilton Waste & Recycling Ltd	Medium	Musselburgh	www.hamiltonwaste.com
King Size Mattress Recycling (Since 2021)	Small	Glasgow	www.kingsizerecycling.co.uk/
Mattress Recycling Ltd	Small	Batley	www.mattressrecyclingltd.co.uk
Mattress Recycling Services Ltd	Small	Ripley	www.mattressrecyclingservices.co.uk
Matt UK Ltd	Large	Chatham	www.matt-uk.co.uk
Recycling Waste Solutions	Small	Dewsbury	www.rwsrecycling.co.uk
Take My Mattress	Small	Rochdale	www.takemymattress.co.uk/
Textek	Medium	Telford	www.textek.co.uk/
The Furniture Recycling Group (TFR)	Large	Blackburn	www.tfrgroup.co.uk
USEL (Ulster Supported Employment Ltd)	Small	Belfast, Londonderry, Portadown	www.usel.co.uk

Please note: New mattress recyclers found through this study are highlighted in blue.

**Recyclers are described as having a large operation if they had a throughput in 2017 of >250,000 mattresses per year, medium operation if they had one between 50,000 and 250,000 and a small if they do less than 50,000 a year.*

To ensure the successful nationwide implementation of the collection and treatment aspect of an EPR scheme, there must be serious investment to address these regional disparities and transport concerns, and increase options for mattress recycling throughout the UK. When considering the potential cost of an EPR scheme, the London Borough of Hackney present an interesting case to draw on. In 2019, a £497,701.89 contract was awarded to deliver a 'Mattress Recycling Service'. Said service was required to cover the collection, haul and recycling of mattresses (with 80% by weight recycled). In the contract, it was estimated that 96,641 mattresses (of all sizes and types) were required to be collected and disposed of over the 4 year duration. This equates to a cost of £5 per mattress to implement the scheme - as value that would typically be easily absorbed into the cost of a mattress were it an EPR fee. This low cost of management per mattress also flags the minimal requirements to support improved treatment of mattresses, moving from landfill to recycling.

**It could cost
around £5 per
mattress to
collect and
recycle a mattress**

2. Traceability of materials (recyclers to recycle more easily and more information for retailers etc)

Over 70% of retailers reported that they receive little to no level of detail regarding the end-of-life treatment of their mattresses. Detailed reports describing how the mattresses are processed, the material recovery rates and end fate of these materials will increase transparency throughout the sector. This in turn could reassure and encourage retailers, waste management facilities and local authorities to treat mattresses carefully – thereby reducing the number of mattresses rejected by recyclers and so increasing the recycling rate.

3. Consistency between manufactured mattresses and recyclable mattresses

Introducing EoL assessments at the point of purchase will give consumers the knowledge to choose a mattress based on its recyclability, a move which retailers predict will encourage sales due to an upwards trend in eco-conscious consumerism.

Material substitution at the design phase to ensure more standardisation (without compromising choice for consumers) could result in higher rates of material recovery. Larger tonnages of each material (in terms of % of whole mattress) can be recovered, thereby allowing smaller recyclers to collect more of each material. Space and storage issues appear to be a common problem amongst recyclers, especially for those trying to generate the 'critical mass' needed to sell the less common materials to onward markets.

4. Investment in standards for recycling

A mattress EPR could encourage investment in standards whereby only mattresses deemed (officially) unfit to recycle can be sent to EfW or landfill. This will reduce businesses taking the easier and mostly, cheaper but less circular route of sending mattresses to landfill. Whilst some recyclers have cited that mattresses returned during the comfort guarantee period are sent straight to EfW/landfill, there is a shift in business models towards recycling, or even cleaning and reusing these mattresses.

5. Introducing a ban on mattresses sent to landfill

Legislation that calls for a ban on sending mattresses to landfill can be a driver to increase mattress recycling rates when deployed with supporting policies. A known risk is that by banning mattresses to landfill, often those of poor quality and so likely to be unrecyclable, they will be sent to an EfW facility. This effect has been seen in countries such as Belgium, where a landfill ban was introduced in 2007 and so resulted in many mattresses sent for incineration. Supporting measures are needed to drive further recycling capabilities, e.g. Belgium having an established EPR since 2021 to fund the required

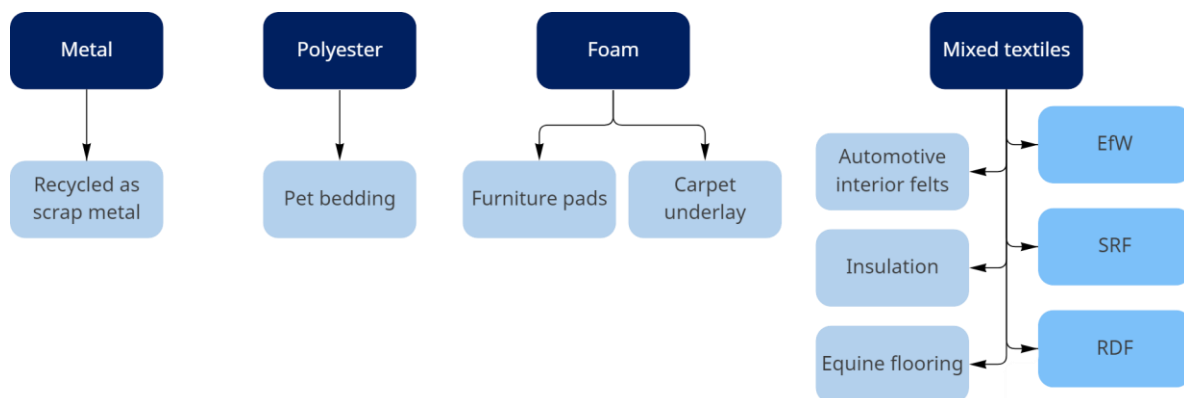
infrastructure. A further example of this can be seen in the Netherlands, where on top of landfill bans, there are limitations on the incineration capacity of its government-owned facilities, so to prevent competition with recycling. Recyclers have reported that EfW is oversubscribed in the UK, so the only route for these mattresses could be exportation to EfW/other facilities in Europe/rest of world where we cannot easily track their end fates – demonstrating the need for these further supporting measures.

6 Goal 1c: High utilisation of products/materials

Many smaller recyclers have felt unable to achieve a higher material recovery rate because of limited access to end markets. Due to the economies of scale, larger recyclers have the quantities of recyclable materials (including steel, polyester, foam, textiles etc) that enable trading. The smaller recyclers do not have the ‘critical mass’ of individual materials to trade and hence are more likely to recover and trade in a narrower range of materials. In this section, we discuss the potential outlets for recovered mattress materials and solutions to overcome limitations in reaching these, and how to increase utilisation of the whole mattress (before and after disposal).

6.1 Outward markets for secondary materials

Figure 12: Examples of end markets for mattress materials



6.1.1 Steel

Of the materials in a mattress, steel is reported as one of the most valuable. With the average volume by weight as the highest overall, and with steel being the easiest to recover through shredding or manual deconstruction, there are clear reasons to why this is the case. Steel is most often sent for scrap metal recycling, either baled or sent as spring sets. Some mattress recyclers export their steel.

In general, recyclers can achieve up to a 50% recycling rate by focussing on steel recovery alone, as the spring sets can account for up to 50% of the material in mattresses. Many smaller mattress recyclers focus on steel recovery as they are not able to accumulate enough material from the rest of the mattresses to trade with.

Further to this, recyclers are reporting that steel springs, especially those found in pocket spring mattresses, are difficult to clean. Whilst there is automated pocket spring mattress recycling technology out there, some recyclers are shredding these types of mattresses twice and others, mainly smaller recyclers, are manually removing the individual springs from their pockets (respectively, a cost-heavy and time-consuming process). Failure to provide clean, fabric-free springs can result in recyclers not being able to sell on their spring sets. As pocket springs account for a large percentage of the market in the UK, most recyclers cannot afford to reject these types of mattresses, despite the time and financial burden to recycle them.

Symbiosis amongst recyclers is needed to facilitate an overall higher material recovery rate, removing the economies of scale barrier.

6.1.2 Polyester

Polyester is seen as another valuable material, with pet bedding cited as a key outlet, and with options for automotive felts and soft toy stuffing. Some recyclers and off-takers also adopt a circular approach and recycle the polyester from old mattresses into new polyester filling for other furniture items.

Example of best practice:
Bensons for Beds demonstrates circularity by collecting polyester and fabric offcuts and returning to their supplier, who recycles the material into mattress spring insulator pads.

Many recyclers cited the difficulties of generating the volumes needed to trade to secondary markets. To accumulate enough material to trade with requires storage space, and especially for non-ferrous materials, this is difficult to keep clean whilst being stored – and so potentially refused from the off-taker requiring an uncontaminated material source. This is confirmed by one off-taker requiring the mattress materials to be baled separately and stored in a clean and dry condition.

6.1.3 Foam

Carpet underlay is the main secondary market for polyurethane foam, with one recycler also citing that its foam is used for wall insulation as well. Unlike the onward markets for polyester, the markets for foam appear to be used by most recyclers; a reassuring find given the increase in popularity of foam mattresses and so tonnages of material entering the market.

6.1.4 Mixed textiles

Textiles from mattresses are seen as low quality and are often sent for EfW, SRF or RDF. As flock (woollen fibres) is too high in calorific value for EfW, it can be used as a coal replacement (RDF). One recycler sends all mixed textiles to use as feedstock for their on-site SRF facility, removing the need for lower quality textile recovery. For those recyclers who do recover the mixed textiles, their onward markets include the equine flooring industry, which is currently a topic of contention as this is seen as a delayed route to landfill and a source of large leakages of synthetic material to the environment.²¹

To encourage an overall increase in recycling rate of materials by increasing the accessibility of end markets, the industry must encourage collaboration/symbiosis amongst recyclers. This will enable all recyclers to invest in more efficient recycling processes/infrastructure and allow the scaling-up of their businesses. In turn this could potentially allow for greater storage capacity for mattresses (pre- and post-deconstruction), and so greater amounts and types of materials can be recovered, resulting in more opportunities to trade with a variety of off-takers. The scale up of these recyclers could also result in them recycling mattress materials for internal reprocessing towards manufacturing high value products - for the mattress sector (e.g. mixed textiles into mattress pads) and other industries. Therefore, highlighting the potential for increased circularity in the industry.

²¹ Guidance on using shredded waste carpet in equestrian surfacing: <https://www.gov.uk/government/publications/using-shredded-waste-carpet-in-equestrian-surfacing-rps-248/using-shredded-waste-carpet-in-equestrian-surfacing-rps-248>

Example of best practice: Reborn²³ (in conjunction with Bye Bye Bed) reuse, remanufacture and reprocess products from the components of used mattresses for use in mainly the furniture (including mattresses) industry (e.g. mattress toppers, gym mats, window seat pads and furniture cushions). They also use a cleaning machine which sterilises and provides flame retardant treatment for the recovered components.

Although the main focus of this report is on the UK mattress recycling sector, to support and align with the waste hierarchy, it is important to also give focus to reuse and product life extension.

NLWA's #LoveYourMattressCampaign shares **best practice** examples of buying, caring for and responsibly disposing of mattresses.

Campaigns to raise awareness of how to best care for mattresses can contribute to extending the life of mattresses. As well as North London Waste Authority's campaign in the UK, these campaigns have run successfully in the USA and other countries. In an effort to more directly extend the life of their mattresses, some retailers provide mattress protectors with the purchase of a mattress.

Many recyclers cite that they send any reusable mattresses to charity, with some setting targets for this e.g. Endurmeta, based in Merseyside, plans to send 9,000 mattresses to local children's charities this year. Beyond donating mattresses, some retailers (in partnerships with recyclers) rejuvenate used mattresses, the main source of these mattresses being comfort guarantee returns. Currently, around 75% of mattresses returned in the early stages of use are returned to the market (i.e. Amazon/eBay) as 'rejuvenated' mattresses, with the remaining 25% going to recycling due to poor material condition.

Example of best practice: Bulky Bob's have a partnership with Liverpool County Council to collect, clean and donate/resell high quality, used mattresses at a lower price in an effort to end furniture poverty.

Given the current consumer trends towards sustainable choices, reuse and rejuvenation of mattresses has the potential to grow exponentially in the coming years. The introduction of a mattress EPR scheme could also drive this, with the opportunity to introduce and mandate a threshold for reuse. By encouraging more partnerships with manufacturers and retailers, more mattresses can be diverted from landfill.

²² Reborn sustainable manufacturing website: <https://reborn-products.com/>

7 Goal 2: Overall circularity of the sector can increase through design improvements

The design phase is essential when considering the EoL of mattresses. To understand how to improve the recycling rate and longevity of mattresses whilst still ensuring ample consumer choice, we need to look into the types of mattresses currently placed on market and how they can be designed to be better treated at EoL.

7.1 What types of mattresses are placed on the market?

As well as by size, mattresses can be categorised based on their core composition, such as open coil spring, pocket spring, PU foam or latex foam (hybrid). Traditionally, spring mattresses (namely innerspring) represent a significant proportion of mattress production and consumption in the UK. Pocket spring mattresses are considered the top end of the market (with increasing popularity), whilst foam mattresses are primarily found in the lower to middle market range²³.

Recently, there has been a surge in popularity of ‘bed in a box’ mattresses from online retailers, significantly propelled by the lockdowns caused by the COVID-19 pandemic, and a surge in online shopping. This has caused a rise in the sale of foam mattresses (both PU and latex) and, as mentioned in previous sections, an increase in mattresses returned during the comfort guarantee period. Such a high rate of returns is not seen from high street retailers, where you can ‘try before buying’ - although they were somewhat affected by the restrictions imposed by the government during the pandemic, resulting in consumers buying cheaper and lower quality mattresses online, and subsequently more were returned.

Retailers have also reported an increase in consumer demand for more sustainable mattresses. These include mattresses made from recyclable and/or more natural materials, and so retailers are working with manufacturers to find the most suitable materials (e.g. cotton, hemp, wool; recycled PET etc), shifting from more traditional synthetic foam mattresses to these ‘natural’ products. Overall, consumers are reportedly more interested in where their products come from, demanding material traceability from the mattress supply chain.

7.2 Problems faced by recyclers

Although in an ideal world for mattress recyclers there would be large amounts of few materials in mattresses, this is of course not the case. Currently, the mattresses being manufactured and sold hardly correspond at all to the mattresses the recyclers would prefer to receive.

In contrast to consumer popularity, pocket spring and natural fibre mattresses prove problematic for recyclers.

As mentioned in the previous reports, the popularity of pocket spring mattresses results in a burden on mattress recyclers due to the time and effort needed to remove the steel springs from their individual pockets. Whilst the machinery exists which can cope with dismantling pocket spring mattresses, this is still a problem amongst some recyclers, and the consumer preference for pocket springs is unlikely to diminish. More recently, the popularity of natural fibres in mattresses may boost

²³ World mattress report, IBIS, Csil, 2020

sales amongst eco-conscious consumers, but provides problems for mattress recyclers. Natural fibres can decompose in wet/damp conditions, thereby becoming unrecyclable and potentially affecting the rest of the mattress material. Until collection processes become more efficient and can ensure sheltered mattress storage, this will negatively affect mattress recycling rates, and leads to recyclers preferring synthetic foam mattresses.

7.3 Design for end-of-life

To encourage a more circular mattress industry and understand the true impacts of mattress design on the environment, a full life-cycle assessment should be undertaken on all materials. This is in contrast to focusing on one stage of the supply chain, namely EoL.

To aid the shift to a more circular mattress industry, many manufacturers and retailers are already demonstrating willingness and/or action to change their mattress designs. They are doing so with EoL in mind, but with a dual focus on keeping consumer options open, with examples such as:

- Designing for recyclability/disassembly (e.g. restrictions on mattress components being glued together, new pocket spring mattress designs etc).
- Retailers working closely with suppliers to understand the source of materials going into mattresses, requiring detailed breakdowns of products.
- Actively searching out innovative developments in mattress design.
- Sourcing recycled materials such as polyester from plastic (PET) bottles.
- Enforcing standardization of mattress materials across ranges.
- Introducing QR codes on mattresses to advise consumers on how best to recycle their mattresses, and to inform recyclers on material content.
- Retailers and manufacturers following the Eco-Design principles laid out by the NBF.²⁴

What must be considered is that the trend of mattress imports is looking to increase. This may limit the effect that UK manufacturers will have on increasing the circularity of the sector through mattress design, because recyclers will have to process imported mattresses which do not consider the EoL. A mattress EPR scheme could introduce requirements for mattress recyclability, but would also need to consider these imports.

²⁴ <https://www.bedfed.org.uk/nbf-green/ecodesign-principles/>

8 Conclusions

With the COVID-19 pandemic, most industries - including the mattress sector - have experienced new challenges and opportunities. Overall, despite hygiene restrictions and closures due to government lockdowns, the industry has remained stable, with a supply chain looking to prepare for other unforeseen challenges in coming years and future-proof the industry.

This report highlights the current ad hoc nature of the recycling of EoL mattresses, and confirms the need for action from wider stakeholders in the industry. For the NBF to achieve its 2028 target of 75% diversion from landfill, a harmonised approach to management of mattresses must be adopted across the supply chain. This can be facilitated in no small way by the introduction of an EPR scheme.

Manufacturers and retailers are reporting heightened demand in take-back schemes, driven by their convenience in tandem with the public's increasing awareness of the need for responsible disposal. Whilst this is positive news, collection, storage and recycling infrastructure need to have the capacity to accommodate this influx of mattresses. Currently, the scale of infrastructure does not provide suitable capacity to effectively manage the increase in mattress disposal. Due to the growth in purchases of lower quality mattresses during the pandemic, the number of mattresses hitting the waste stream is likely to rise relatively sharply in the years to follow. In contrast to the positive rising demand for take-back schemes, ineffective collection has been reported as the main cause of mattresses being sent to landfill.

The introduction of an EPR would nominally provide the necessary revenue and incentives to develop the collection and recycling infrastructure needed to meet the recycling targets. This is effectively demonstrated in Connecticut (USA) where, in the first year following the introduction of a mattress EPR scheme, the mattress recycling rate (inferred as sent for recycling) rose from 8.7% to 63.5%.²⁵

While there are industry stakeholders (notably, recyclers) proactively pushing for a more sustainable, circular model for mattresses, they require further collaboration from the wider supply chain in order to effect substantial change and map the holistic impact that any changes will have on the industry. An EPR scheme will support those seeking better practices and encourage the whole life cycle of a mattress to be considered.

As the voice of the UK bed industry, the NBF can encourage the uptake of an EPR for mattresses and facilitate an aligned approach to developing a national recycling strategy. This will support the ambitions of UK mattress manufacturers and retailers, ongoing operations of recyclers, and bolster UK collection and recycling capacity. The alternative case would likely see the UK mattress industry reaching a troublesome bottleneck.

²⁵ <https://www.productstewardship.us/page/Mattresses>

9 Appendix

9.1 Appendix 1. Trade and production analysis

Combining the trade and production data required mapping between different classification codes (see Table 10). Also, the trade statistics required a conversion from value to volume (number of units) for which we used the average values from the production data (see Table 11).

Table 10: Different product classification codes used in the analysis of trade and production data related to mattresses

SITC code (used in import export data)	SIC code (used in production data)	CN code (for reporting in EU)
82123 – Mattresses of cellular rubber and plastics	31031230 - Mattresses of cellular rubber	94042110
	31031250 - Mattresses of cellular plastic	94042190
82125 – Mattresses of other materials	31031270 - Mattresses with spring interiors	94042910
	31031290 - Mattresses EXCLUDING: - with spring interiors - of cellular rubber or plastics	94042990

Table 11: Average value per unit assumed for import and export flows into the UK

	Production volume weighted average £/unit of mattresses cellular rubber and plastic (SITC 82123)	Production volume weighted average £/unit of mattresses of other materials (SITC 82125)
2009	30.2	69.2
2010	29.6	73.0
2011	29.0	76.9
2012	34.3	87.4
2013	40.5	95.0
2014	37.1	99.0
2015	32.2	99.7
2016	36.7	102.8
2017	33.6	108.1
2018	37.6	111.9
2019	42.2	120.4
2020	56.2	110.8

This methodology differs to that used in previous reports as the UK no longer publishes its production and trade data in Prodcom, which is part of the EU's Eurostat database. Slightly less granularity (only SITC code not SIC code) was available for 2020 data, meaning that the £/unit conversion factors needed to convert the trade flows from value to volume are different to that used previously. The agreement between the old and new methodologies is within 5%, with the apparent consumption calculated using the new methodology being systematically lower.

Table 12: Summary of major trade flows of mattresses into and out of the UK during the 2010-2020 period

Top export destinations of UK mattresses	Value (£) of UK mattress exports (total 2010-2020)	% value (£) of UK mattress exports (total 2010-2020)	Top import sources of UK mattresses	Value (£) of UK mattress imports (total 2010-2020)	% value (£) of UK mattress imports (total 2010-2020)
Ireland	113,942,423	30%	Poland	244,051,824	24%
France	40,097,183	11%	Denmark	221,401,181	22%
United States	34,904,957	9%	China	218,192,310	21%
Belgium	33,751,945	9%	Ireland	79,413,192	8%
Germany	19,623,789	5%	Germany	51,798,870	5%
China	15,005,570	4%	Italy	43,048,636	4%
Netherlands	12,239,469	3%	Turkey	41,996,968	4%
Australia	10,929,610	3%	Belgium	31,564,512	3%
Hong Kong	10,806,414	3%	Romania	18,700,357	2%
Poland	9,756,260	3%	Taiwan	18,239,920	2%
Other	80,024,528	21%	Other	55,804,388	5%
EU	252,082,261	66%	EU	719,219,099	70%
Non-EU	128,999,887	34%	Non-EU	304,993,059	30%

9.2 Appendix 2. Derivation of the replacement rate

9.2.1 Estimate based on population and household composition statistics

Family and household statistics as well as overall UK population statistics were downloaded from the Office of National Statistics (ONS).²⁶ These were then combined along with the following assumptions to estimate the total number of 'in-use' (i.e. not guest or spare beds) mattresses in the UK. Relevant assumptions were:

- All non-dependent children still have beds in the dwelling the family lives in
- Families with no children were all cohabiting couples sharing a bed
- Adults co-sleep in households with 2 parents
- Non-family households, e.g. young people in shared accommodation, have an average of 2.5 people per household, each with their own mattress
- Homeless people have no mattresses allocated to them
- Approximately 3% of population not covered in the household estimates have one mattress each.

Between 2010 and 2020 the average growth in the number of mattresses in-use was 0.6% per year, or 6% over the whole period. This is equivalent to an average of approximately 300,000 new mattresses per year required to accommodate population growth and changing household composition in the UK. This is equivalent to 4% of all the mattresses bought in the UK, corresponding to a mattress replacement rate of 96%.

²⁶<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/timeseries/ukpop/pop> and <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/families/datasets/familiesandhouseholds/familiesandhouseholds>

Table 13: Raw data on household composition that fed into the calculation of mattress replacement rate using this approach.²⁶

	People in lone parent households (1 'in-use' bed per person)	Number of 1 person households (1 'in-use' bed per person)	Families with no children (1 'in-use' bed between 2)	Aver no. 'in-use' beds in families with children	Other 'in-use' beds	Total no. 'in-use' mattresses
2009	7,518,000	7,534,000	7,612,000	20,813,000	3,452,500	46,929,500
2010	7,589,000	7,591,000	7,686,000	20,906,000	3,575,500	47,347,500
2011	7,587,000	7,660,000	7,730,000	20,976,000	3,859,100	47,812,100
2012	7,829,000	7,729,000	7,724,000	21,204,000	3,621,000	48,107,000
2013	7,650,000	7,761,000	7,605,000	21,723,000	3,725,700	48,464,700
2014	7,745,000	7,599,000	7,878,000	21,715,000	3,765,800	48,702,800
2015	7,774,000	7,743,000	7,898,000	21,911,000	3,787,000	49,113,000
2016	7,489,000	7,660,000	8,064,000	22,226,000	3,926,100	49,365,100
2017	7,252,000	7,715,000	8,080,000	22,686,000	3,846,200	49,579,200
2018	7,390,000	8,007,000	8,173,000	22,579,000	3,783,600	49,932,600
2019	7,427,000	8,197,000	8,247,000	22,779,000	3,564,800	50,214,800
2020	7,553,000	7,898,000	8,318,000	23,177,000	3,299,000	50,245,000

9.2.2 Estimate based on mattresses used in new dwellings

UK wide housebuilding statistics were used to estimate the number of new bedrooms built every year.²⁷ Relevant assumptions used in this estimate were:

- The measure of net additional dwellings (as opposed to number of completions) was the appropriate metric for total additions to the UK housing stock as it takes into account changes in building use (i.e. office to flat conversions), renovations and demolitions.
- The number of bedrooms in completed permanent dwellings reflects that in the net additional dwellings.

²⁷<https://app.powerbi.com/view?r=eyJrIjoiMzg1MDczZDAyYjRmYy00OGI3LTlmNzEtZGNlMGU0ZWVmYTU2liwidCI6ImJmMzQ2ODEwLTljN2QtdNDkZS1hODcyLTl0YTJlZjM5OTVhOCJ9&pageName=ReportSectionabd88355d2a923eaeab50> and <https://www.gov.uk/government/statistical-data-sets/live-tables-on-house-building>

- Houses with 4 or more bedrooms have on average 4.25 bedrooms.
- There is one new mattress bought to fill each new bedroom.

There's been a marked increase in net additional dwellings in the UK between 2000-2014, when the average was 142,000, and 2015-2020, when the average was 222,000. There's also been a shift from building smaller dwellings to larger dwellings: 1 and 2 bedroom dwellings averaged at 45% of all completed dwellings between 2000 and 2014, but only 36% between 2015 and 2020. As such estimates of the mattress replacement rate using this method shifts from approximately 94%, between 2000 and 2014, to 91%, between 2015 and 2020.

Nevertheless, when the replacement rate using the new dwelling statistics is averaged with that based on household composition and population statistics, it is relatively consistent at 94% (+/- 1%) across the whole 2010 to 2020 period.

Table 14: Raw data on new dwellings used in deriving the mattress replacement rate using this method.²⁷

	Net additional dwellings	% of permanent dwellings completed (in England)				Number of mattresses (assuming 1 per bedroom, and 4.25 bedrooms in the 4 or more category)
		1 bedroom	2 bedrooms	3 bedrooms	4 or more bedrooms	
2009	144,870	13	40	27	20	375,213
2010	137,394	8	38	32	22	375,773
2011	134,896	9	38	32	21	364,556
2012	124,722	9	35	33	23	343,921
2013	136,605	8	33	33	26	387,275
2014	170,693	7	31	35	27	492,876
2015	189,645	7	29	34	30	558,505
2016	217,345	8	29	34	29	633,017
2017	222,281	8	28	34	30	652,395
2018	241,877	8	28	34	30	709,909
2019	242,702	7	28	35	29	706,870
2020	216,489	8	27	36	30	644,055

Table 15: Mattress replacement rate estimated using both approaches over the period 2010 to 2020.

	Replacement rate		
	From population and household composition statistics	From statistics on new dwellings	Average
2010	95%	95%	95%
2011	93%	95%	94%
2012	95%	95%	95%
2013	94%	93%	93%
2014	96%	92%	94%
2015	94%	92%	93%
2016	97%	91%	94%
2017	97%	91%	94%
2018	96%	91%	94%
2019	96%	91%	93%
2020	100%	91%	95%

9.3 Appendix 3: Mattress recycling data reported by LAs (WasteDataFlow)

Table 16: Summary of the tonnage of mattress recycling and reuse, as reported by LAs in WasteDataFlow.

Region	Old analysis	New analysis			
	2016	2017	2018	2019	2020
East Midlands	635	635	431	1,096	892
Eastern	0	0	0	60	277
London	4,606	4,769	6,367	7,684	7,153
North East	247	205	650	1,155	690
North West	1,050	1,051	907	913	2,127
South East	476	421	366	567	666
South West	351	351	60	128	362
West Midlands	2,539	2,651	3,076	3,194	3,505
York and Humber	472	463	123	526	645
Scotland	0	-	706	1,160	1,421
Wales	3,094	2,749	3,049	2,537	2,090
Northern Ireland	1,258	444	726	1,004	754
Total (tonnes)	14,728	13,739	16,461	20,025	20,582

9.4 Appendix 4: Technical appendix

Table 17: Summary of all data sources and calculations, with their levels of uncertainty - where red is most uncertain/lowest level of confidence and green is most certain/highest level of confidence

Data	Source	Approach	Uncertainty (Red, Amber, Green)
Placed on market	Prodcom	See Section 3.1	Green
Replacement rate	ONS and UK Government Statistics	See Appendix 2	Amber
No. mattresses disposed	As above	See Section 3.3	Amber
No. mattresses collected by LAs (and sent to recyclers)	WDF		Green
No. mattresses collected by retailers/manufacturers	Surveys	See Section 2.3 for links to surveys.	Red
Throughput of mattresses at recyclers' sites – all end fates (quantities)	Recycler interviews	Average annual number of mattresses reportedly treated by recyclers (across the years 2019-2021). Where this data was not available, average annual figures from the previous report (2019) were used.	Red
Recycling yield rate	WDF (Steel recycling), Recycler interviews (PU and PE recycling)	See Section 5.1.1. Tonnages of material reported as recycled by WDF were used alongside the tonnages of steel recovery, also reported by WDF. Percentage recovery of PU and PE as reported by recyclers were calculated by weight.	Steel
			PU foam
			Polyester
Real recycling rate	WDF, Sent for recycling rate	See Section 5.2. Using percentages from WDF data on tonnages of mattress material actually recycled, this was applied to the sent for recycling rate (as explained above).	Red
Sector-wide recycling rate/sent for recycling rate	Recycler throughput of mattresses, No. mattresses disposed (2019)	No. mattresses recycled (using average number for mattress throughput reported by mattress recyclers in interviews/surveys) divided by no. mattresses disposed	Red
Size of outlet markets	N/A	Could not be reported on due to limitations on data sources.	N/A

Contents amendment record

This report has been amended and issued as follows:

Version	Date	Description	Author	Editor
1	06/09/22	Mattress report final version	EP et al.	KB
2			EP et al.	
3			EP et al.	

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From its offices in Aylesbury and Brussels, Oakdene Hollins provides research and consulting services to clients under three main themes:

- Circular Economy
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