PackFlow Refresh 2023: Wood

A review of the quantity of packaging placed on the market and recycled in 2022 with compliance projections to 2028.

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Packflow Refresh 2023: Project Remit

This project seeks to estimate packaging POM and recycling figures, observe changes in packaging flow trends, and assess the UK's compliance position in 2022, and projecting forward to 2028.

This has been achieved by:

- Calculating UK packaging POM (placed on the market) and recycling by material and by industry sector in 2022 to provide a baseline for future scenarios.
- Using relevant data sources and industry insight to estimate by packaging material type on:
    - The total amount of material that is likely to be placed on the market (POM) by sector
    - The impact of the change in POM on the UK recycling rate
    - The changes to the level of obligated tonnage
    - The scenarios for packaging materials flow and recycling up to 2028

Scenarios, assumptions and data sources have been agreed with the steering committee made up of key industry stakeholders representing individual materials and sectors.

J959 Wood Version 2.0

Executive Summary

Introduction

The PackFlow Refresh 2023 reports (https://www.valpak.co.uk/more/material-flow-reports) cover all packaging materials and have been produced to provide industry, governments, and other stakeholders with evidence to better understand the packaging materials flows, packaging materials collection & recycling, and to assess likely future recycling performance.

The PackFlow Refresh 2023 project has two phases:

Phase 1

- Update baseline year to 2022 for estimates of packaging materials POM collections, recycling and end markets (from 2019 in the previous flow reports[1]).

Phase 2

- Develop scenarios for packaging materials flow and recycling from 2022 to 2028
- Assess likely future recycling performance.

To support Defra and Governments in their packaging policy work and assist other industry stakeholders, this Phase 1 report focuses on generating robust estimates of UK wood packaging placed on the market (POM)[2] that are as accurate as is reasonably possible. The report also considers the quantities of wood packaging recycling, both in the UK and abroad, and provides insights into the end markets and products that are manufactured by packaging wood recyclers in the UK.

Data robustness assessments have been conducted and error margins are calculated and provided wherever possible throughout report.

Wood Packaging POM

This report estimates wood packaging POM in 2022 at 1,385k tonnes (+/- 10%)[3,4]. This estimate represents an increase by less than 1% from the revised wood POM figure of 1,383k tonnes (2019 revised data).

The wood POM estimate is established from a bottom-up approach (Table 1) as the weight of wood packaging produced in the UK plus the weight of net imported wood packaging into the UK (i.e. the weight of imported wood packaging less the weight of wood packaging exported).

Table 1: UK Wood Packaging POM, 2022 (k tonnes)[5]

UK production of wood packaging	914
plus Wood packaging imported[6]	740
less Wood packaging exported	268
= Wood Packaging POM	**1,385**

[1] *The previous packaging materials flow reports can found at https://www.valpak.co.uk/more/material-flow-reports.*
[2] *Wood packaging placed on the market means all household and non-household wood packaging used around products sold and transported within the UK.*
[3] *The error margins are assumed estimates based on the robustness assessment and are not the outputs of statistical calculation.*
[4] *The error margin indicates that the two wood packaging POM figures are not substantially different.*
[5] *Figures may not sum up due to rounding.*
[6] *It is assumed that these figures exclude fastenings etc.*

A total of 914k tonnes (66% of wood packaging POM) of new wood packaging is estimated to have been produced in the UK in 2022, of which 777k tonnes is estimated to be new wood used in new/refurbished wooden pallets and 137k tonnes is wood used in UK production of non-pallet wood packaging.

Total imports of wood packaging are estimated to be 740k tonnes in 2022, of which 624k tonnes is import of wood packaging declared by obligated producers who are registered, and 114k tonnes is estimated to be wood packaging imported by unregistered producers.

Total exports of wood packaging are estimated to be 268k tonnes in 2022, of which 235k tonnes is wood packaging exports declared by obligated producers who are registered, and 34k tonnes is estimated to be wood packaging exported by unregistered producers.

Figure 1: Wood Packaging POM by Sector, 2022, k tonnes[7]

Consumer wood packaging POM is estimated at around 11k tonnes in 2022 (+/- 15%).

The vast majority - 11 tonnes (+/- 15%) - is estimated to be wood packaging in the consumer non-grocery sector.

Consumer grocery wood packaging is estimated to be 870 tonnes (+/- 6%).

Wood packaging POM in the non-consumer sector is 1,374k tonnes in 2022 (+/- 11%).

The vast majority (99%) of wood packaging POM is in the non-consumer sector.

Wood packaging POM handled by obligated producers in 2022 is estimated to be 1,128k tonnes (or 81% of total POM).

This represents a slight decrease on the estimated 83% of wood packaging POM obligated in 2019.

Wood packaging POM handled by unregistered producers in 2022 is estimated to be 257k tonnes (or 19% of total POM).

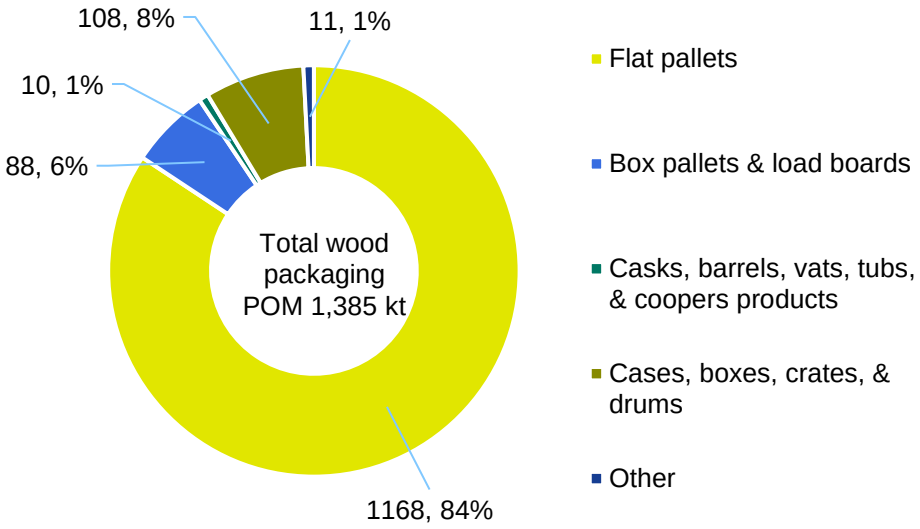
This represents a slight increase on the estimated 17% of wood packaging POM that was unregistered in 2019.

By format, flat wooden pallets are estimated to account for 84% of wood packaging POM (including imports) in 2022.

Cases, boxes, crates and drums are the next largest product format for wood packaging, representing 8% of wood POM. Wooden casks, barrels, vats, tubs & coopers products represent around 1% of total wood POM.

[7] *Figures may not sum due to rounding.*

Figure 2: UK Wood Packaging POM by format, 2022 (k tonnes, %)



The majority (85%) of wood packaging POM in the non-consumer sector is estimated to be flat wooden pallets.

The vast majority (92%) of consumer wood packaging is in the non-grocery retail sector, with wooden trays (50%) being the predominant format category.

While the quantity of wood packaging in consumer grocery retail is small, wood packaging uses remain similar to 2019 for products such as fruits, ready meals and cheeses.

Wood packaging collection and recycling

The WRA estimates 4.5m tonnes of wood waste arising (wood packaging and non-packaging wood) in the UK in 2022.

The WRA estimates[8] that ~1m tonnes of wood waste (wood packaging and non-packaging wood) is collected each year by local authorities at HWRC/CA sites.

WasteDataFlow figures for 2021/22 indicate that local authorities collected 731k tonnes of wood waste (wood packaging and non-packaging wood).

The vast majority (99%) of wood waste collected by local authorities is via HWRC/CA sites and is non-packaging wood. Less than 10k tonnes of wood waste collected by local authorities is wood packaging.

Accredited waste wood packaging recycling is estimated to be 635k tonnes in 2022.

The accredited recycling rate for wood packaging is ~46% in 2022 when comparing against the wood packaging POM of 1,385k tonnes.

In 2022, panel board manufacturers recycled of 334k tonnes of waste wood packaging, of which 318k tonnes is accredited. Wood recyclers manufacturing animal bedding, equine surfaces etc. used 290k tonnes of wood packaging in 2022. The WRA believes that 275k tonnes or approximately 95% of this tonnage was recorded as accredited recycling.

The total quantity of wood packaging recycled in the UK is estimated to be 666k tonnes, and the unaccredited wood packaging recycled is estimated at 31k tonnes.

However, there are some uncertainties around these figures due to the total accredited wood packaging recycling obtained through end-market figures not being consistent with the accredited wood packaging recycling by NPWD,

[8] *Based on the WRA estimate that ~23% of annual wood waste is collected via HWRC/CA sites*

such that the accredited wood packaging recycling obtained through end-market does not account for 40k tonnes of wood compared to the NPWD figure.

Wood packaging End Markets

A total of ~4.3 million tonnes of waste wood was recovered/recycled in 2022.

Waste wood recovery by UK energy facilities (large and small scale biomass) was ~2.8 million tonnes. Around 1.4 million tonnes of waste wood was recycled into panel board, animal bedding and equine surfacing.

The quantity of wood packaging waste recovered or recycled is estimated to be 844k tonnes in 2022.

In 2022, the panel board manufacturers recycled 334k tonnes of waste wood packaging.

Wood recyclers manufacturing animal bedding, equine surfaces etc. used 290k tonnes of wood packaging in 2022, and the WRA believes that 275k tonnes or approximately 95% of this tonnage was recorded as accredited recycling.

A full market estimate of the quantity of wood packaging being re-used is unknown.

The steering group commented that the fate of substantial quantities of wooden pallets is unknown (these are wooden pallets that are not of the size typically used by the various pallet pools, but are pallets that could be re-used).

In terms of recovery of wood packaging, 136k tonnes of wood packaging waste is estimated to have gone to large scale biomass (Biomass - Chapter IV) in 2022, with small scale biomass using 81k tonnes of wood packaging waste.

There is limited information to determine the amount of wood packaging that ends up being disposed of via landfill or used for EfW and its split by sector (consumer/ non-consumer).

It is estimated that at most 9.1 kt of consumer wood packaging waste ends up used for EfW, and at most 2.3kt of consumer wood packaging waste ends up in landfill. There is not enough information to quantify non-consumer wood packaging sent for disposal, and there is no available information on the breakdown of the end-of-life processing (landfill/ EfW) of non-consumer wood packaging for disposal.

Packaging Future Trends and Scenarios

Wood POM tonnage is projected to reduce in 2023 compared to 2022, and decline further in 2024. While growth resumes from 2026 it remains below its 2022 level in 2028. Business targets are projected as constant at 2024 level of 42%. The POM projection is reflected in the projection of obligated tonnage for wood packaging, and (with assumed constant collection rates) the projection of accredited recycling. Based on this a surplus relative to the business target 2024 to 2028 is projected for wood packaging.

Wood packaging is not an in-scope DRS material and its projection is not impacted by the removal of DRS drinks containers from recycling obligations under EPR.

Recommendations for Further Work

There are uncertainties around estimates of the fates of wood packaging.

This is highlighted by the fact that 2022 accredited wood packaging recycling is greater than accredited wood packaging recycling obtained by using figures from wood packaging end-markets in 2022.

Further research is recommended to provide an updated comprehensive assessment of wood packaging waste arising, re-use, recycling and informal/formal recovery routes for wood packaging.

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Glossary

bn - Billion

CA – Civic amenity

C&I – Commercial and Industrial

CPI – Confederation of Paper Industries

C&D – Construction and demolition

EA – Environment Agency

EfW – Energy from Waste

EPIC – Environmental Product Information Centre

GDP – Gross Domestic Product

HWRC – Household waste recycling centre

k – Thousand

kt – Thousand tonnes

LA – Local authority

NPWD – National Packaging Waste Database

POM – Placed on the market

Primary Packaging – Any packaging that the customer will take home, remove and throw away e.g. aluminium can, plastic bottle

PRN – Packaging Recovery Note

PERN – Packaging Export Recovery Note

RDF – Refuse Derived Fuel

Secondary Packaging – Inner packaging used to transport or display goods to/in store, usually cardboard boxes or shelf-ready packaging

Transit/Tertiary Packaging – Any transit packaging e.g. pallets, shrink wrap, staples or strapping

WDF – Waste Data Flow

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- Wood Recyclers Association (WRA)
- Wood Panel Industries Federation (WPIF)
- Advisory Committee on Packaging (ACP)
- Timber Packaging and Pallet Confederation (TIMCON)
- Environment Agency (EA)
- Department for Environment, Food & Rural Affairs (DEFRA)
- Scottish Government
- Zero Waste Scotland (ZWS)
- Department of Agriculture, Environment and Rural Affairs (DAERA)
- Natural Resources Wales
- Scottish Environment Protection Agency (SEPA)
- Packaging Federation
- Industry Council for Packaging and the Environment (INCPEN)

1. Introduction

1.1. Background

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1.2. Phase 1 Objectives

The PackFlow Refresh 2023 project for wood packaging has the following key objectives for Phase 1:

- Provide an updated (and cross-checked) baseline estimate of wood packaging placed on the UK market in 2022, by sector and format:
    - Format (e.g. pallets, barrels, casks etc)
    - Sector (e.g. consumer, non-consumer)
    - Source (handled by obligated producers who are registered, non-obligated wood packaging)
- Identify household (HH) and household-like (HH-like) categories.
- Identify commonly littered items
- Estimate the quantities of wood packaging collected through HWRC/CA sites, kerbside and other collection types, and by sector;
- Estimate the quantities of wood packaging recovered and recycled, sent for incineration with energy recovery, and sent to landfill for both UK and overseas end destinations; and
- Provide estimates of the quantities of wood packaging that is recycled (i.e. is recorded as accredited recycling) and wood packaging that is recycled but does not generate a PRN/PERN (i.e. is unrecorded or unaccredited).

[9] The previous packaging materials flow reports can found at https://www.valpak.co.uk/more/material-flow-reports.

[10] Wood packaging placed on the market means all household and non-household wood packaging used around products sold and transported within the UK.

1.3. Methodology

Alternative methodologies and data sources exist to calculate packaging recycling rates. One approach that is common practice and deemed an appropriate method, and indeed is accepted by the EU, is to establish packaging recycling rates based on packaging materials recycled relative to packaging materials POM.

An alternative is to calculate packaging recycling rates as the ratio of the quantity of packaging materials recycled and the quantity of packaging waste arising.

Other methodologies have been considered and discounted, such as waste composition analysis. Whilst this approach is valid, it has several significant limitations, relying on accurate and representative data for:

- The composition of household waste;
- The quantity of waste arisings from local authorities; and
- The quantity and composition of waste arisings in commercial and industrial streams.

The justification of the use of POM data over alternatives is provided in full in section 1.3.1 of Wood Flow 2025[11].

In the context of estimating recycling rates for wood packaging, estimates based on waste arising will likely be very different from POM estimates. Essentially, this is because the durability of wood packaging means it has a long life on the market and is extensively re-used and repaired. Therefore, there are long (and unknown) lags between wood packaging being POM and arising in the waste stream. Further, there are no comprehensive sources for waste wood statistics for the UK that include up-to-date and accurate data on waste wood and packaging wood waste arising. WasteDataFlow is of limited use for estimating wood packaging waste arising because the vast majority of wood packaging is non-consumer and there are only very small quantities of wood packaging waste collected by local authorities (for example at HWRC/CA sites).

1.3.1. POM

Wood packaging POM is estimated using a bottom-up approach that references a variety of data sources for wood packaging products placed on the market, combined with data and estimates provided by industry. The results of this method are cross-checked against wood packaging POM tonnages reported to NPWD by obligated (and registered) producers under the packaging regulations, and data provided by the project's industry Steering Group.

The baseline year is 2022; where 2022 data are not available, the most recent available data are used.

1.3.2. POM (Bottom Up Approach)

The bottom-up approach to estimating wood packaging POM references several data sources for wood packaging products placed on the market, combined with data and estimates provided by industry.

- TIMCON: UK pallet production and pallet refurbishment/repair
- PRODCOM: Non-pallets wood packaging
- NPWD: Imported and exported wood packaging[12]

Further details of the methodology to quantify wood packaging POM in 2022 and the results are provided in Section 2 of this report.

1.3.3. POM Cross-check (Net pack fill)

This cross-check collates data on the quantity of wood packaging data reported into NPWD by obligated producers who are registered. The net pack fill estimate is thought to capture the vast majority of obligated tonnage but it does

[11] https://www.valpak.co.uk/knowledge-hub-post/woodflow-2025/
[12] *The figures declared by obligated producers are scaled up to account for non-obligated flows.*

not include wood packaging handled by unregistered producers or packaging for internal company use (which is non-obligated packaging under the packaging regulations). Unregistered producers are ('de-minimis') businesses below the obligation threshold (which is an annual turnover of £2 million and 50 tonnes of packaging handled per year), and businesses with an obligation who are not registered with the relevant agency ('free-riders').

To estimate the amount of packaging placed on the UK market that is reported by obligated producers in NPWD, the net pack fill calculation set out below is applied. Details are reported in section 2.12 of this report.

Net Pack Fill	=	**Packing/ Filling** Table 1 - pack/filling	+	**Imports** Table 3A - imported for selling	+	**Imports** Table 3B - packaging removed from around imports	-	**Exports** Table 2A + Table 2B – pack/filling

1.3.4. 2019 POM data used for comparison

The 2019 POM data used for comparison with 2022 POM figures reflects the most up-to-date version of this data. This means that it uses revised data from TIMCON and PRODCOM for 2019, and the complete 2019 data from NPWD instead of projections to reflect the complete 2019 data. The POM figure for wood in the Covid-19 report is estimated at 1,358 kt, and the revised figure is 1,383 kt. The difference between the Covid-19 POM report figures and the revised POM 2019 figures for wood is therefore less than 2%.

1.3.5. NPWD data

The report uses NPWD data for 2023 submissions (extracted as at 30th January 2024) to reflect obligated packaging POM in 2022. The 2022 NPWD data is used for both the 2022 wood POM estimate and 2022 net pack fill calculations.

1.3.6. Recycling

NPWD was used as the source for accredited (recorded) recycling of wood packaging. The quantity of wood packaging reported as accredited recycling is that which is eligible to raise a PRN/PERN but can differ from the actual issuance of PRN/PERN evidence for wood packaging recycling.

Industry representatives were consulted, and alternative data sources were provided on the recycling of wood packaging that might not, for whatever reason, be reported (by accredited recyclers) on to NPWD. The output of these discussions, together with an estimate of wood packaging waste arising were used to assess total wood packaging recycling (accredited/recorded and non-accredited/unrecorded wood packaging recycling).

1.3.7. Data robustness

There are levels of uncertainty around the data used to establish the various elements that are combined to estimate total wood packaging POM. Therefore, total POM estimates and the splits for consumer and non-consumer are presented with error margins to provide an indicative range of uncertainty. The robustness scores established for each element of data are presented in Appendix II and these have been converted into a percentage and related to appropriate margins of error, as shown in Table 2. The respective margins of error are provided throughout the report.

Table 2: Relating Robustness Scores to Appropriate Margins of Error

Robustness			Error Margin	
96%	to	100%	+/-	3%
91%	to	95%	+/-	6%
86%	to	90%	+/-	9%
81%	to	85%	+/-	12%
76%	to	80%	+/-	15%
71%	to	75%	+/-	18%
66%	to	70%	+/-	21%

To calculate the margin of error for the total POM, the margins of error for the sub-elements that make up total POM are converted to tonnages and then expressed as an overall percentage using a Root of Sum of Squares calculation.

2. Phase 1: Wood Packaging POM

2.1. Introduction

This section of the report provides an overview of wood packaging flows onto the UK market. It provides details of the data sources used and presents an estimate of the quantity of wood packaging POM in 2022.

2.2. Placed on the Market

Wood packaging typically enters the UK market in the following formats, which have been adopted for the purposes of this report:

- **Flat pallets** – extensively used as transit packaging by all industries requiring transport of large quantities of goods and bulky items. Pallets are typically made to standard sizes and managed operationally through large, leased pallet pools. Pallets are designed for multiple trips and are durable, reusable and repairable (often being repaired several times during their lifetime). However, flat pallets may also be single use pallets when required in specialist circumstances. It is only the quantity of new wood used in pallet manufacture and new wood added by repair/refurbishment activities that is included in the estimate of POM tonnage. Leased pallets are obligated on their first trip only;
- **Box pallets and load boards** – box pallets offer further protection to products on flat pallets and are often used in manufacturing industries to bulk transport components and parts. Load boards are planks of wood used to cushion heavy goods during transit;
- **Casks, barrels, vats, tubs & coopers' products** – used typically in the beverage industry to brew, store and transport drinks up to the bottling stage. Wooden coopers' products are used in the transportation of wiring;
- **Other** – all other forms of wood packaging such as wood shaving fillers, wood wool and specialist items not covered above.

An estimate of the total weight of UK wood packaging POM in 2022 is established as the weight of wood packaging produced in the UK plus the weight of net imported wood packaging into the UK (i.e. the weight of imported wood packaging less the weight of wood packaging exported).

To estimate the weight of wood packaging produced in the UK in 2022, industry data is used where possible. This is thought to provide a more complete coverage of the wood packaging supply chain compared to net pack fill (for example) which only covers the tonnage of wood packaging reported by registered obligated producers. Figure 3 provides an overview of the methodology used and the key data sources.

Figure 3: Key Data Sources for Wood Packaging POM, 2022

UK production, import/export* and de-minimis wood packaging		=	**UK Production** TIMCOM UK production of new/refurbished pallets PRODCOM UK non-pallet packaging production	+ +	**Imports** NPWD Table 3a imported for the purpose of pack/fill and selling + Table 3b packaging removed from imports De-minimis imports (estimate)	- -	**Exports** NPWD Table 2a direct exports pack/fill +Table 2b exports by 3rd party pack/fill De-minimis exports (estimate)
UK wood packaging POM		=	UK wood packaging production	+	UK imported wood packaging	-	UK exported wood packaging

2.3. Wood Packaging Production

This section reports estimates of wood packaging produced in the UK. Wood packaging production statistics are available by product category according to industry 1624 Manufacture of Wooden Containers in the Standard Industrial Classification of Economic Activities (SIC).

The two key data sources used in this report are:

- the Timber Packaging and Pallet Confederation & Forestry Commission (TIMCON), and
- the Office for National Statistics (ONS), UK Manufacturers' Sales by Product (PRODCOM).

A fundamental characteristic of wood is that it is hygroscopic, meaning that wood will gain or lose moisture based on the conditions of its surrounding environment. When a tree is first felled, it is considered to be in the green state, and contains a very large amount of moisture. Wood packaging products are made from both green and kiln dried materials and over the lifetime of wood packaging its moisture content can reduce from 50% to less than 10%. The moisture content of wooden pallets (imported into the UK or exported) will typically decrease over its lifetime and consequently its weight will vary at different points along the supply chain. In the estimates below a standard[13] density of 507kg per cubic metre is applied to wood volumes.

2.3.1. TIMCON Market data

In this report, 2022 data provided by TIMCON is used to estimate the weight of wood in UK new pallet production and the weight of wood used in pallet refurbishment and repair activities.

TIMCON market figures for the volume (m^3) of new wood purchased by TIMCON members who produce new/refurbished pallet was 1.65 million m3 in 2022. This is an increase by 2.48% compared to 2021 despite a decrease by 2.65% in the number of new and refurbished pallets produced. Between 2021 and 2022, the number of new pallets produced went down by 7% to 45.3 million pallets whereas refurbished pallets saw an increase of about 1.7% to 48.9 million pallets. Timcon senior executives believe that the reasons behind the increase in volume of wood purchased by TIMCON members compared to 2021 despite a decrease in the production of new/refurbished pallets include:

- Manufacturers increasing their stock holding following the severe difficulties in securing supplies in the previous year, to ensure continuity of pallet supplies for their customers.
- Manufactures having to "butcher" i.e., crosscut back timber sections during that period in order to meet their customers' requirements when the specific sizes were not available. This has created unwanted waste and ultimately a loss of timber volume.

Previously, the TIMCON figures for the volume m3 of new wood purchased by TIMCON members for use in the production of new pallets was assumed to be equal to the volume of new wood used in pallets annually. There has been limited data relating to stock of timber carried by members in the previous years and the behaviour of this trend.

However, due to an increase in stock by TIMCON members since 2021, it is believed that the 1.65 million m3 of timber purchased includes more than the usual fluctuations in stock. For this reason, TIMCON have provided estimates for the volume of wood used in new and refurbished pallets in 2022 to exclude this stock. These figures have been used to calculate the weight of wood used in new and refurbished pallets in the UK in 2022.

TIMCON figures for the volume (m^3) of new wood used in new pallet production is multiplied by the standard density of wood used in wood packaging (507 kg per cubic metre). The weight of new wood used in pallet repair was calculated using TIMCON figures for the volume (cubic metres) of new wood used in pallet repair multiplied by the standard density of 507 kg per cubic metre.

The figure obtained is 1.53 million m3 of timber used in 2022 compared to 1.65 million of timber purchased.

Estimates of the weight of wood in pallet manufacture and pallet refurbishment/repair are shown in Table 3 and Table 4.

[13] Environment Agency Agreed positions and technical interpretations – producer responsibility for packaging (14_08_26_Agreed_Positions_v8_5.pdf)

Table 3: Wood in Production of New Pallets

	Units	2019	2020	2021	2022
Number of new pallets manufactured	Items	44,900,000	44,900,000	48,600,000	45,300,000
Volume of new wood used	m^3	1,103,900	1,002,940	1,128,797	1,072,357
Volume of new wood per item	m^3	0.0246	0.0223	0.0232	0.0237
Weight of wood in new pallets @ 507kg/m3	Tonnes	559,677	508,491	572,300	543,685

Table 4: Wood in Pallet Refurbishment and Repair

	Units	2019	2020	2021	2022
Number of pallets repaired	Items	48,300,000	49,000,000	48,100,000	48,900,000
Volume of new wood used	m^3	473,100	429,832	483,770	459,582
Volume of new wood per item	m^3	0.0098	0.0088	0.0101	0.009
Weight of wood in pallet repairs @ 507kg/m3	Tonnes	239,862	217,925	245,271	233,008

2.3.2. PRODCOM Sales

The ONS PRODCOM dataset includes UK manufacturers' sales figures for wood packaging products. Sales for 'non-pallet' wood packaging products in are divided into key sections which are summarised in Table 5.

The quantity data for PRODCOM category 16241135 (box pallets and load boards) is reported as the number of items sold. This figure is converted to weight data for box pallets and load boards produced in the UK as described below in Table 5. The total weight of UK wood packaging production in 2022 for non-pallets is then the sum of the tonnages reported in PRODCOM for these categories.

Table 5: Conversion of PRODCOM Wood Production Data to Kg

PRODCOM	Product description	Unit	Conversion to Kg
16241135	Box pallets and load boards of wood EXCLUDING: - flat pallets	Number of items	Volume (cubic metres) of new wood per box pallet x 2 x number of items x 507
16241200	Casks, barrels, vats, tubs, and coopers' products and parts thereof of wood INCLUDING: - staves	kg	
16241320	Cases, boxes, crates, drums and similar packings of wood EXCLUDING: - cable drums	kg	
16241350	Cable-drums of wood	kg	

2.4. Summary of Wood Packaging Production

A summary of the estimates of the total weight of new wood used in UK production of wood packaging products in 2022 is reported in Table 6. The total quantity of new wood used in UK production of pallets and non-pallet wood packaging is estimated to be 914k tonnes in 2022 (down by 8k tonnes, or 1%, compared to 2019).

The total quantity of new wood used in the production and repair/refurbishment of pallets in the UK is estimated from TIMCON market data to be 777k tonnes in 2022 (down by 23k tonnes or 3% from 2019). The total quantity of new wood used in the production of non-pallet wood packaging products in the UK is estimated from PRODCOM data to be 137k tonnes in 2022 (up by ~15k tonnes or 10% compared to 2019 figures reported by PRODCOM).

Table 6: New Wood Used in UK Wood Packaging Production, 2022 (k tonnes)

New wood used in wood packaging production by product	2022
UK production of new pallets	544
UK refurb/repair of new pallets	233
TOTAL new wood used in pallet production & pallet refurb/repair	777
Box pallets and load boards of wood EXCLUDING: - flat pallets	60
Casks, barrels, vats, tubs, and coopers' products and parts thereof of wood INCLUDING: - staves	7
Cases, boxes, crates, drums and similar packings of wood EXCLUDING: - cable drums	71
Cable-drums of wood	2
Total non-pallet packaging (incl. fastenings)	139
Total new wood in non-pallet packaging (excl. fastenings[14])	137
Total new wood used in wood packaging production	**914**

2.5. Wood Packaging Imported into the UK

This section provides an estimate of the quantity of wood packaging imported into the UK by registered producers, and an estimate of the quantity of wood packaging imported into the UK by unregistered producers in 2022.

Producers handling wood packaging who are obligated (and registered) under the packaging regulations report data on the tonnages of imported wood packaging into NPWD (note that figures for the import of wood packaging are not covered by either the TIMCON or PRODCOM datasets). The quantities reported by producers in compliance year 2023 are actual 2022 sales/purchases data and include empty and filled wood packaging and wood packaging that is transit packaging.

The quantity of wood packaging imported by unregistered producers is estimated using the ratio of small business imports to total imports established by the methodology in the Wood Flow 2025 report[15]. It estimated that 15.4% of total imported wood packaging was imported by unregistered producers[16], and this proportion is used to scale up the estimate of wood packaging imported by registered producers to a total figure for import of wood packaging.

[14] *Industry data used in Wood Flow 2025 indicated that fastenings (non-wood items) represented no more than 2.3% of the weight of a finished pallet. No data was available for fastenings within non-pallet wood packaging. Therefore, it is assumed in this report that the proportional weight of fastenings in pallets and non-pallets packaging is unchanged from this figure.*

[15] *https://www.valpak.co.uk/more/material-flow-reports/woodflow-2025*

[16] *The dataset underlying this particular part of the analysis is for 2014. While this is outdated, it was discussed with the steering group and deemed a reasonable approximation. The project team believe it unlikely that this figure would have changed substantially, and that attempting to update the*

Table 7 shows that a total of 626k tonnes of wood packaging was imported into the UK by registered producers and 114k tonnes of wood packaging was imported into the UK by unregistered producers.

The total quantity of wood packaging imported into the UK by registered and unregistered producers in 2022 is therefore 740k tonnes.

Table 7: Wood Packaging Imported into the UK, 2022 (k tonnes)

Wood packaging imported by registered and unregistered producers[17]	2022
Registered producers	
Table 3a Packing/filling (imported empty packaging for pack/fill that remains in the UK)	23
Table 3a Selling (packed goods imported for onward selling in the UK)	235
Table 3b Packaging removed from direct imports	368
Wood packaging imported by registered producers	**626**
Unregistered producers	
Wood packaging imported by unregistered producers	**114**
Total wood packaging imported by registered and unregistered producers	**740**

% of unregistered producer would entail a lot of work without adding significant precision. It is acknowledged that this is an area of uncertainty for the wood POM estimate.

[17] *It is assumed that these figures exclude fastenings etc.*

2.6. Wood Packaging Exported from the UK

This section provides estimates of the quantity of wood packaging exported by registered and unregistered producers in 2022.

Producers with an obligation for wood packaging under the packaging regulations (and who are registered) report their data on the tonnages of exported wood packaging into NPWD (note that figures for export of wood packaging are not covered by either the TIMCON or the PRODCOM datasets). The quantities reported by producers in compliance year 2023 are actual 2022 sales data which include empty and filled wood packaging, and wooden transit packaging.

The quantity of wood packaging exported from the UK by unregistered producers is estimated using the export ratio for small businesses (to total exports) established by the methodology in the Wood Flow 2020 report[15]. It estimated that 12.5% of total exports of wood packaging was exported by unregistered producers[18], and this ratio is used to scale up the estimate of wood packaging exported by registered producers to a total figure for export of wood packaging.

Table 8 shows that a total of 235k tonnes of wood packaging was exported from the UK by registered producers in 2022, and a total of 34k tonnes of wood packaging was exported from the UK by unregistered producers in 2022.

The total quantity of wood packaging exported from the UK by registered and unregistered producers in 2022 is therefore estimated to be 268k tonnes.

Table 8: Wood Packaging Exported from the UK, 2022 (k tonnes)

Wood packaging exported by registered and unregistered producers[19]	2022
Registered producers	
Table 2a Packing/filling (direct exports)	223
Table 2b Packing/filling (third party exports)	12
Total Wood Packaging Exported By Registered Producers	**235**
Unregistered Producers	
Total Wood Packaging Exported By Unregistered Producers	**34**
Total Wood Packaging Exported By Registered And Unregistered Producers	**268**

2.7. Scheme Administrator Submissions (formally referred to as 'household/household-like')

Through the course of the Packflow projects, the definition of that subset of the total packaging POM which will attract additional fees to meet the costs of collecting packaging from households has evolved. Previously through the development of the UKs EPR system this had been referred to as 'household/household-like' packaging placed on the market.

This section of the report details the latest interpretation of this requirement, referred to here as *Scheme Administrator Submissions* (that is to say, the total tonnage of packaging POM that is like to be declared by obligated business to the scheme administrator as meeting the criteria of being for public/consumer use. Within this analysis, the packaging that should be included in the scheme administrator submissions is that around products which are 'consumed' by

[18] *The dataset underlying this particular part of the analysis is for 2014. While this is outdated, it was discussed with the steering group and deemed a reasonable approximation. The project team believe it unlikely that this figure would have changed substantially, and that attempting to update the % of unregistered producer would entail a lot of work without adding significant precision. It is acknowledged that this is an area of uncertainty for the wood POM estimate.*

[19] *It is assumed that these figures exclude fastenings etc.*

citizens as a part of their daily lives, as opposed that which goes to businesses for use part of their commercial operations. With this in mind, the way citizens buy products (and therefore get packaging) within the packaging flow breakdown identified in the PackFlow reports is through retail (only, be that online or bricks and mortar) or from takeaway hospitality.

In most instances, it is fairly clear as to whether products are provided for public/consumers or not. One such specific nuance is around some products that are bought within a hospitality setting but that could be consumed within premises or could be taken away. Particularly prevalent to the final tonnage of material that could (or could not) fall within Scheme Administrator Submissions is products within the HORECA sector, such as wine bottles in restaurants and beer bottles or cans in pubs. These packs are intended for public/consumers and may or may not be sold in a hospitality setting, and when they are, may or may not leave the business setting and corresponding private waste stream. As such these packs have been included in Scheme Administrator Submissions within this analysis.

Table 9: Total Expected Scheme Administrator Submissions

Material / Situation	Total POM	Total Consumer	Total Non-Consumer	Total Hospitality	Total Hospitality - Takeaway Only	Estimate of total scheme administrator submissions (consumer in scope)
Wood - All	**1,385**	11	1,374	0	0	**11**

2.8. Summary of Wood Packaging POM

This section reports a summary of this project's final estimates of wood packaging POM in 2022. Detailed figures on the key components of wood packaging POM are presented in Figure 4 where the arrows indicate the direction of change and the tonnage difference compared to 2019.

Wood packaging POM is estimated to be 1,385k tonnes (+/- 10%) in 2022, an increase by 2k tonnes[20] or less than 1% from the previous estimate of 1,383k tonnes[21] in 2019.

The wood POM estimate is established from a bottom-up approach as the weight of wood packaging produced in the UK plus the weight of net imported wood packaging into the UK (i.e. the weight of imported wood packaging less the weight of wood packaging exported).

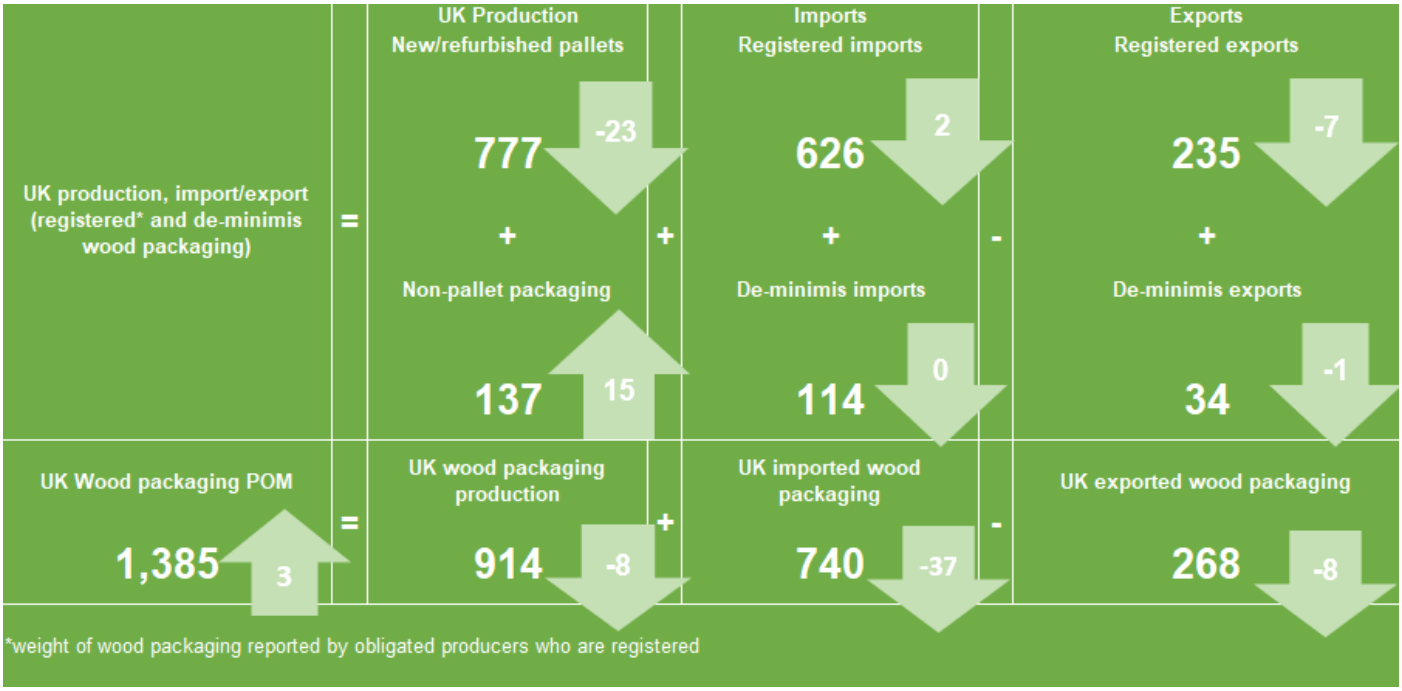
A total of 914k tonnes (66% of wood packaging POM) of new wood packaging is estimated to have been produced in the UK in 2022, of which 777k tonnes is estimated to be new wood used in new/refurbished wooden pallets and 136k tonnes is wood used in UK production of non-pallet wood packaging.

Total imports of wood packaging are estimated to be 740k tonnes in 2022, of which 626k tonnes is import of wood packaging declared by obligated producers who are registered, and 114k tonnes is estimated to be wood packaging imported by unregistered producers.

Total exports of wood packaging are estimated to be 268k tonnes in 2022, of which 235k tonnes is wood packaging exports declared by obligated producers who are registered, and 34k tonnes is estimated to be wood packaging exported by unregistered producers.

[20] *The error margin indicates that the two wood packaging POM figures are not substantially different.*
[21] *Revised 2019 data.*

Figure 4: Total UK Wood Packaging POM, 2022, and changes versus revised 2019 figures (k tonnes)



2.9. Consumer

Wood packaging POM in the consumer sector is broken down into consumer grocery POM and consumer non-grocery POM. The addition of these two sub-sectors equates to the total wood packaging POM in the consumer sector.

Total retail or consumer wood packaging POM in 2022 is therefore estimated at 0.87k tonnes + 10.5k tonnes = 11.37k[22] tonnes (+/-15%).

Details of the calculations for consumer grocery POM and consumer non-grocery POM are as follows.

2.9.1. Grocery Retail

The quantity of wood packaging POM by grocery retailers is estimated from aggregated NPWD data provided by the Environment Agency (EA). The grocery market dataset provided by the EA is the 2022 sales quantities of wood packaging reported in the table 1 selling activity from NPWD. The aggregated 2022 sales for the 12 UK supermarkets in the dataset represents 92% of UK grocery retail sales.

Scaling up the aggregated NPWD figures for supermarkets to 100% of UK grocery market sales provides an estimate of consumer grocery wood packaging POM for 2022 of 867 tonnes (+/- 6%).

2.9.2. Non-grocery

To scale up the grocery retail sales figure to represent total UK retail sales, including non-grocery retail, the Office of National Statistics (ONS) retail sales figures are used. The ONS retail sales figures show grocery retail sales accounted for 42% of total UK retail sales in 2022.

However, simply scaling up using market shares is not considered robust, since it is likely that wood packaging usage in the grocery and non-grocery sectors is very different. The difference in usage of wood packaging in the grocery sector and the non-grocery retail sector is analysed using Valpak memberships' reported wood packaging data and reported turnover, total grocery packaging POM (calculated using existing PackFlow methodology) and ONS retail sales data.

[22] *sum of unrounded consumer grocery and non-grocery figures.*

The analysis involved the following key stages:

- Calculation of non-grocery packaging POM (tonnes) per billion-pound retail sales by:
    - Identification of non-grocery retail members within Valpak's membership and extraction of data from the 2023 packaging submission detailing per business:
        - Retail sales data (turnover) and
        - Total (non-grocery) packaging POM
- Calculation of total grocery packaging POM (tonnes) per billion-pound retail sales from:
    - existing PackFlow methodology (as detailed previously in this report), and
    - ONS data detailing T*otal Sales made by Predominantly Food Stores* from *All Retailing Excluding Automotive Fuel*
    - In previous iterations of PackFlow, data provided by Valpak's grocery retailer members has been used alongside stated turnover in their packaging returns.

This was deemed an improved methodology due to concerns about stated turnover as it is not a compulsory field in a packing submission (a long as the turnover is over £2m, a business meets the relevant threshold for participation). Some of the issues include:

- Use of historic or estimated turnover values.
- Use of rounding
    - for example, input in thousands of pounds.
- Sometimes turnover is included twice.
    - for example, where a supermarket completes a GB registration and an NI registration and includes total UK turnover on both submissions (double counting).
- Inclusion of non-packaging related turnover, such as
    - fuel (petrol stations).
    - and, potentially, sale of assets like land.

Instead, this iteration of PackFlow calculates the Grocery tonnes per £bn of turnover using total Grocery POM from existing PackFlow methodology (relating to 92% of the grocery market) and the ONS total sales in stores specialising in food, derived by taking *Total Sales made by Predominantly Food Stores* from *All Retailing Excluding Automotive Fuel.*

Non-Grocery tonnes per £bn of turnover is calculated in the same way as in previous iterations of PackFlow, using checked and cleansed data submissions from non-grocery retailers within the Valpak membership base (excluding petrol retailers from the sample).

- Total consumer grocery wood packaging flow in 2022 is 867 tonnes (see section 2.9.1);
- The proportion of grocery retail sales to total retail sales in the UK is ~42% in 2022[23];
- Total non-consumer retail wood packaging flow, assuming a like-for-like packaging composition is 1,191 tonnes in 2022,
- Wood packaging usage is estimated to be 5 tonnes/£bn total retail sales and 41 tonnes/£bn turnover in non-grocery retail (this is because non-grocery retail covers sectors such as DIY stores and garden centres),

[23] *https://www.ons.gov.uk/businessindustryandtrade/retailindustry/datasets/poundsdatatotalretailsales In 2017 this was 43%, and although there is less than 1% change (from 43.2% in 2017 to 42.5% in 2019), this indicates some reduction in non-grocery sales.*

- Non-grocery wood packaging tonnes/£bn turnover[24] is circa 8.8 times that of grocery wood packaging tonnes/£bn turnover, and
- Multiply the difference between the like-for-like total retail (1,191 tonnes) and grocery retail (867 tonnes) by 8.8 which equates to ~11k tonnes of consumer non-grocery wood packaging

The estimate of consumer non-grocery wood packaging POM is ~11 tonnes (+/-15%).

2.10. Non-Consumer

The quantity of non-consumer wood packaging POM is estimated as the total POM estimate (1,385k tonnes) *minus* the estimate of consumer wood packaging POM (~11k tonnes).

This provides an estimate of 1,374k tonnes (+/- 11%) of non-consumer wood packaging POM in the UK in 2022. Based on this estimate non-consumer wood packaging accounts for ~99% of total wood packaging POM in the UK.

2.11. Wood Packaging Formats

2.11.1. Total POM formats

Figure 5 shows estimates of total wood packaging POM in 2022 by type of format. The estimates for 2022 are derived from a combination of sources: TIMCON market data for pallets, PRODCOM for non-pallet packaging, and Valpak's EPIC database for grocery retail primary packaging supplied to consumers in the UK.

Wood packaging in the form of pallets accounts for the largest proportion of total wood packaging POM at 84% in 2022.

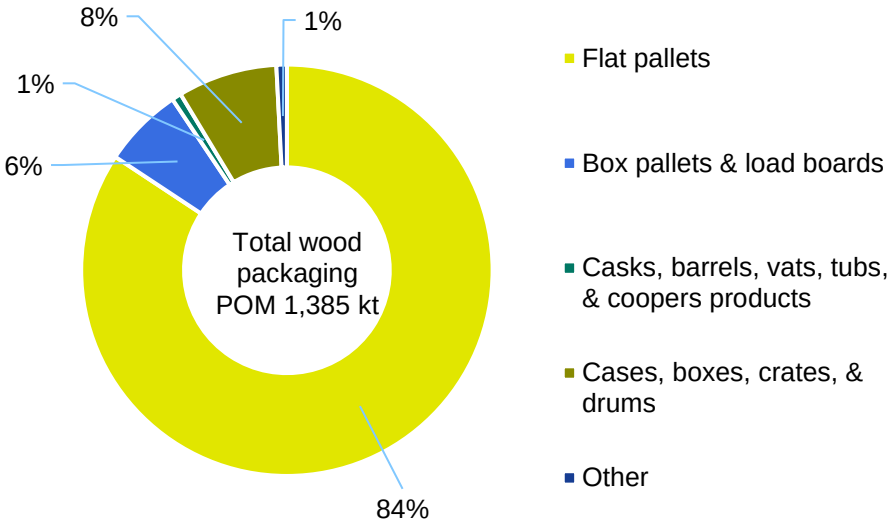
Cases, boxes, crates and drums are the next largest product format for wood packaging and represent 8% of total wood packaging POM in 2022.

Wooden casks, barrels, vats, tubs and coopers products represent around 1% of total wood packaging POM in 2022.

The majority (99%) of wood packaging POM is non-consumer, of which 84% is estimated to be flat wooden pallets. For the consumer sector the vast majority (92%) of wood packaging is in non-grocery retail.

[24] *The methodology for the calculation of consumer non-grocery has changed to exclude builders merchants in 2022, as opposed to 2019 data which included them in non-grocery due to them labelling themselves as retailers. This means that the tonnage used by these builder merchants would have been moved to the non-consumer figures in 2022. This change explains a decrease in consumer figure between 2019 and 2022 by 91%.*

Figure 5: UK Wood Packaging POM by format, 2022 (k tonnes, %)



The table below breaks down the total packaging tonnage by format.

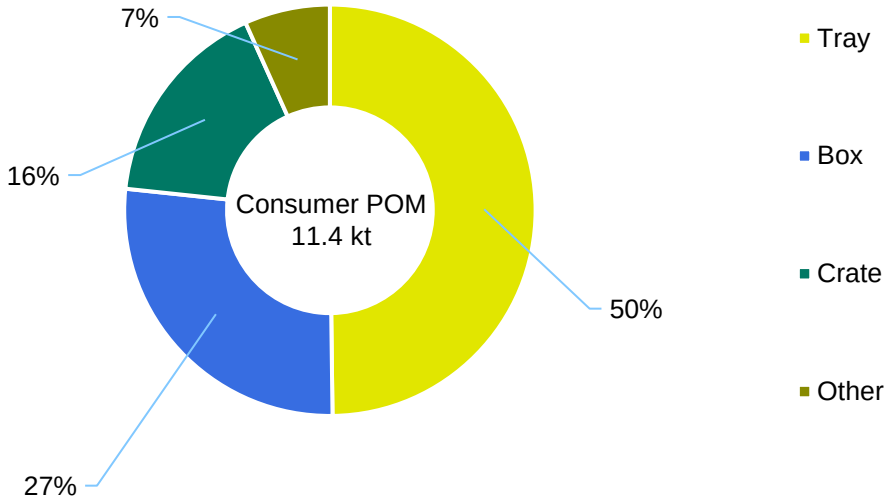
Table 10: UK total wood packaging POM by format, 2022 (k tonnes)

	Flat Pallets	Box pallets & load boards	Casks, barrels, vats, tubs, & coopers products	Cases, boxes, crates & drums	Other
Total wood packaging (in k tonnes)	1,168	88	10	108	11

2.11.2. Consumer formats

A breakdown of wood packaging POM in the consumer sector by format is estimated from analysis of the wood packaging composition data from the supermarkets within Valpak's EPIC database as a proxy for grocery packaging, and a sample of non-grocery retailers used as a proxy for non-grocery packaging within Valpak's EPIC database. The results of this analysis are shown in Figure 6.

Figure 6: UK Consumer wood packaging POM by format, 2022 (k tonnes, %)



The vast majority (99%) of consumer wood packaging is in the non-grocery retail sector, with wooden boxes (50%) being the biggest packaging format category. While the quantity of wood packaging in consumer grocery retail is small, wood packaging uses remain similar to 2019 for products such as fruits, ready meals and cheeses.

The table below breaks down the consumer packaging tonnage by format.

Table 11: UK consumer wood packaging POM by format, 2022 (k tonnes)

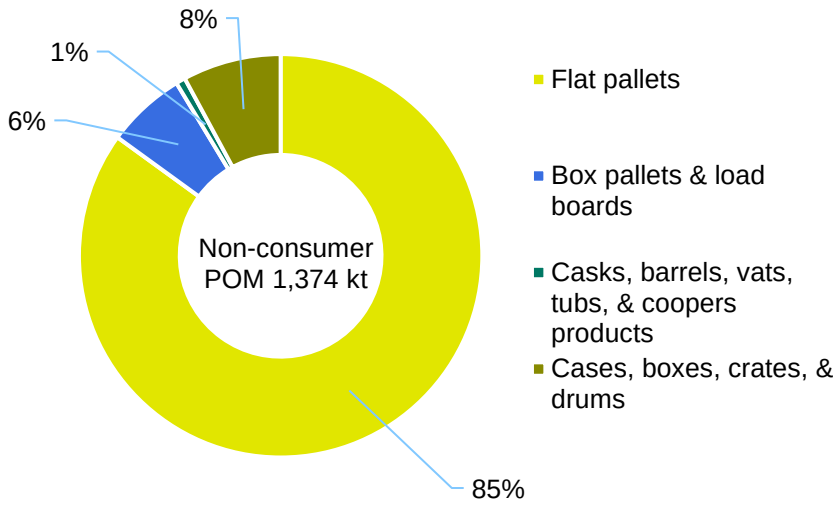
	Tray	Box	Crate	Other
Consumer wood packaging (in k tonnes)	6	3	2	1

2.11.3. Non-consumer formats

To break down the non-consumer packaging by format, the data was initially separated into pallets and non-pallets wood packaging. The PRODCOM data then allowed for a further breakdown of non-pallet packaging products. Figure 7 shows the breakdown of non-consumer wood packaging POM in 2022.

The vast majority (99%) of wood packaging POM is non-consumer, of which 85% is estimated to be flat wooden pallets.

Figure 7: UK Non-consumer wood packaging POM by format, 2022 (k tonnes, %)



The table below breaks down the non-consumer packaging tonnage by format.

Table 12:UK non-consumer wood packaging POM by format, 2022 (k tonnes)

	Flat Pallets	Box pallets & load boards	Casks, barrels, vats, tubs, & coopers products	Cases, boxes, crates & drums
Non-consumer wood packaging (in k tonnes)	1,168	88	10	108

2.12. Wood Packaging POM Cross-check: Net Pack Fill

This section of the report presents estimates of the total weight of wood packaging POM in 2022 that is handled by producers obligated (and registered) under the packaging regulations.

The tonnages for obligated wood packaging are those reported into NPWD by registered businesses with an obligation under the packaging regulations i.e. businesses with a turnover of more than £2 million (in the previous year) and who handle more than 50 tonnes of packaging per year.

Net Pack Fill	=	**Packing/Filling** Table 1 - pack/filling	+	**Imports** Table 3A - imported for selling	+	**Imports** Table 3B - packaging removed from around imports	-	**Exports** Table 2A + Table 2B – pack/filling

The net pack fill calculation (outlined above) for wood packaging takes the weight of packaging reported at the packing/filling stage of the supply chain as opposed to the selling stage of the supply chain. It is believed by stakeholders that because of the likely size of businesses who are packer/fillers there are fewer unobligated packer/filler businesses in comparison to unobligated sellers. Also, other activities such as raw material manufacturing will include process losses which means that not all material manufactured will be converted or pack/filled, so it is expected that declared tonnage will reduce as it moves further down the supply chain.

Using the net pack fill calculation as the best proxy for obligated wood packaging, the total tonnage of obligated wood packaging POM in 2022 is 1,128k tonnes, as shown in Table 13.

Table 13: Obligated Wood Packaging POM, 2022 (Net pack fill, k tonnes)[25]

Table 1: Pack/fill (UK packing/filling)	**759**
Imports:	
Table 3a: Selling (imported for selling)	235
Table 3b: Packaging removed from imports	368
Total UK Pack/Fill + Imported	**1,363**
Exports:	
Table 2a: Packer/filling (direct exports)	223
Table 2b: Packer/filling (third party exports)	12
Total Exported	**235**
Net Pack/Fill	**1,128**

It is important to note that the net pack fill estimate is open to the possibility of a degree of error because it relies on the accuracy of the data that is submitted by registered producers to NPWD. The NPWD data is widely recognised as being the best available as there is a legal obligation for companies to submit data that is as accurate as is reasonably possible, which is then audited by the regulating body. This data is used by policy makers and their agencies.

The net pack fill calculation does not account for the tonnage of wood packaging handled by unregistered producers which are:

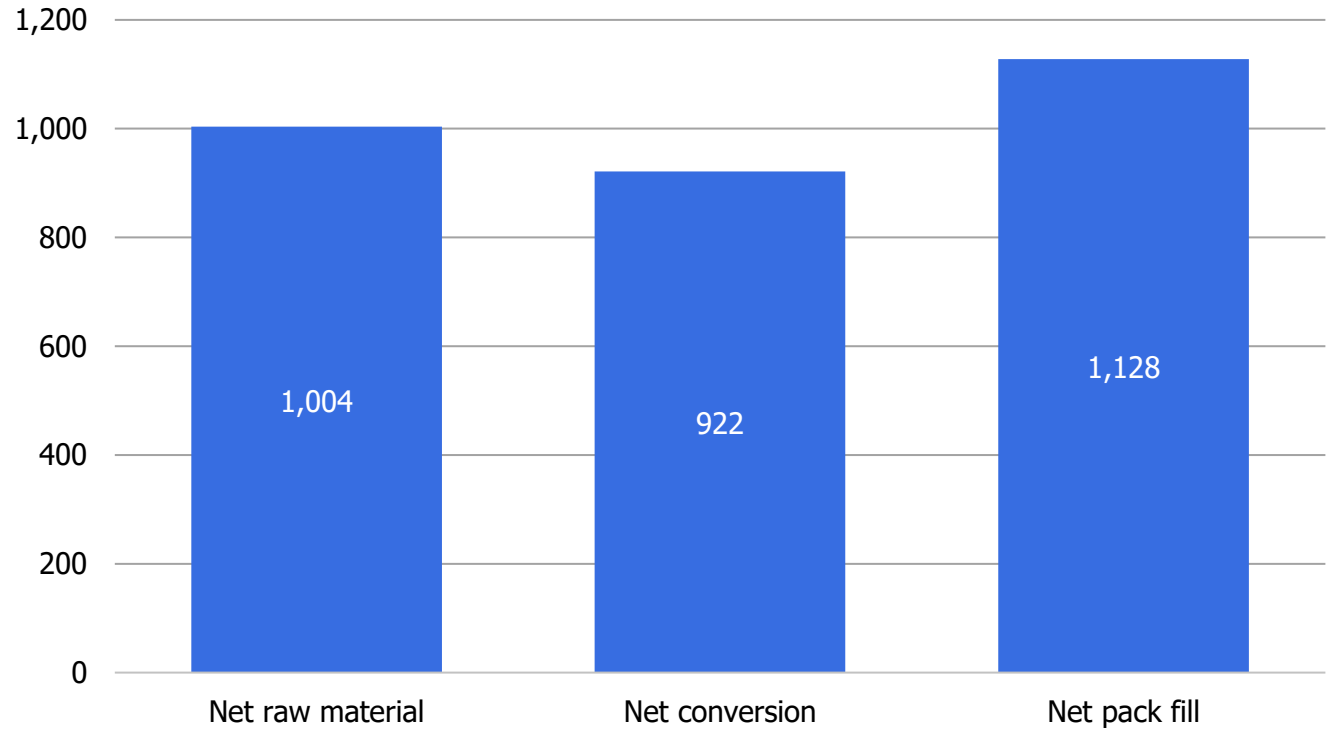
- De-minimis producers – businesses handling fewer than 50 tonnes of packaging or with a turnover (in the previous year) below £2 million;
- Free-riders – businesses that are obligated but are not registered; and
- Illegal importers

There is no available dataset to accurately quantify the quantity of wood packaging handled by unregistered producers. Here, unregistered wood packaging POM is calculated as the wood packaging POM estimate of 1,385k tonnes less the net pack fill figure of 1,128k tonnes. This provides an estimate of the unregistered tonnage for wood packaging of 257k tonnes (or 19% of wood packaging POM). This compares to a figure of 242k tonnes (or 17% of wood POM) for the unregistered tonnage for wood packaging POM in 2019 (revised data).

As a sense check of the obligated tonnage established by the net pack fill calculation, net UK tonnages declared by registered producers in other activities along the supply chain are calculated. Net UK tonnages are established for raw material manufacturing and conversion, in addition to pack/filling. The aim was to identify the obligated tonnage at other stages of the supply chain to see how they differ. The results are shown in Figure 8.

[25] Figures may not sum up due to rounding

Figure 8: Net pack/fill, net raw material and net conversion, 2022 (k tonnes)

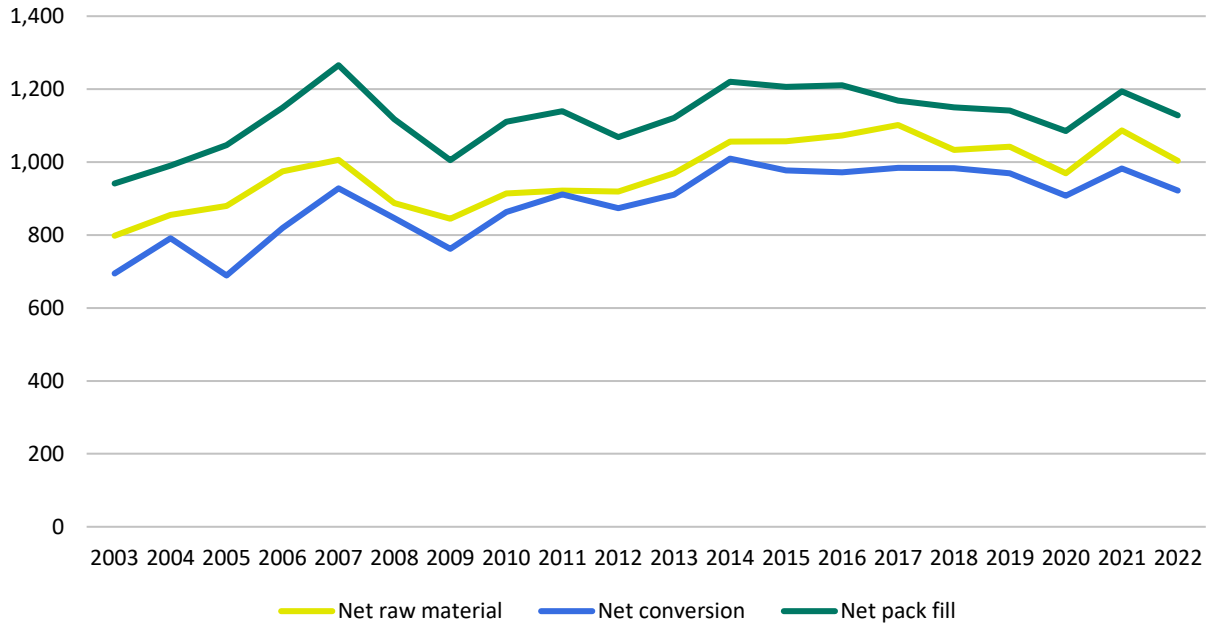


For wood packaging, the tonnages of net raw material production and net conversion are below net pack fill. The comparison across supply chain activities for wood packaging shows a different pattern to that of other packaging materials (where manufacturing and conversion tonnages are comparable or higher than the net pack fill tonnage).

A possible reason for this in the case of wood packaging could be the nature of the wood production industry. For example, producers at the manufacturing stage may not be aware of the extent to which their wooden products are made into packaging further along the supply chain. Also, due to the high quantity of re-use pallets in circulation there could potentially be producers entering these tonnages incorrectly into their annual packaging returns for NPWD (multi-trip pallets should only be declared when entering the UK market for their first trip).

Other potential contributory factors could be that there are differing levels of de-minimis and/or free-riders at each stage of the supply chain. Note this pattern for wood packaging is not unique to 2022 and can be seen in data from 2003 onwards, as shown in Figure 9.

Figure 9: Producer data net pack/fill, net raw material and net conversion, 2003 to 2022 (k tonnes)



3. Scheme Administrator Submissions (formally referred to as 'household/household-like')

Through the course of the Packflow projects, the definition of that subset of the total packaging POM which will attract additional fees to meet the costs of collecting packaging from households has evolved. Previously through the development of the UKs EPR system this had been referred to as 'household/household-like' packaging placed on the market.

This section of the report details the latest interpretation of this requirement, referred to here as *Scheme Administrator Submissions* (that is to say, the total tonnage of packaging POM that is like to be declared by obligated business to the scheme administrator as meeting the criteria of being for public/consumer use. Within this analysis, the packaging that should be included in the scheme administrator submissions is that around products which are 'consumed' by citizens as a part of their daily lives, as opposed that which goes to businesses for use part of their commercial operations. With this in mind, the way citizens buy products (and therefore get packaging) within the packaging flow breakdown identified in the PackFlow reports is through retail (only, be that online or bricks and mortar) or from takeaway hospitality.

In most instances, it is fairly clear as to whether products are provided for public/consumers or not. One such specific nuance is around some products that are bought within a hospitality setting but that could be consumed within premises or could be taken away. Particularly prevalent to the final tonnage of material that could (or could not) fall within Scheme Administrator Submissions is products within the HORECA sector, such as wine bottles in restaurants and beer bottles or cans in pubs. These packs are intended for public/consumers and may or may not be sold in a hospitality setting, and when they are, may or may not leave the business setting and corresponding private waste stream. As such these packs have been included in Scheme Administrator Submissions within this analysis, albeit the total quantity for wood that falls within this category is still negligible.

Due to the unique nature of wood within the packaging sector, it is envisaged that only the grocery fraction (0.87kt) and non-grocery fraction (<11kt), including wood packaging to provide rigidity in the delivery of white goods and some pallets and boards supplied specifically to households for large items) will be included within the scheme administrator submissions. it is of course not impossible that pallets (supplied with products) purchased by builders working on house projects (or, for that matter, keen DIY practitioners) from the building wholesale channel may arise in the household waste stream, but it is not anticipated that these will be included in scheme administrator submissions.

Table 14: Total Expected Scheme Administrator Submissions

Material / Situation	Total POM	Total Consumer	Total Non-Consumer	Total Hospitality	Total Hospitality - Takeaway Only	Estimate of total scheme administrator submissions (consumer in scope)
Wood - All	**1,385**	11	1,374	0	0	**11**

4. Consumer Packaging in the Household Waste Stream

In July 2022, Valpak delivered a report to WRAP and Defra entitled 'Producer Reporting of Household Vs Household-Like Packaging' (POS101-030). Within this project, Valpak developed a methodology for estimating the quantity of consumer packaging that entered the household waste stream.

4.1. Methodology

The process of mapping retail packaging POM to household waste streams was to first assign a ruleset based on likely disposal location against each of the 2,655 EPIC product categories. The end goal was to assign each EPIC category a robust percentage 'likelihood of being disposed of in a household bin'.

For consumer packaging, it was assumed that consumer packaging that was not disposed of within the household waste stream would instead be disposed of within a household-like waste stream, such as 'on the go' litter bins, mixed recycling in business premises such as work, leisure venues, hospitality / HORECA settings (including hotels) or other destination locations.

4.2. Specific applications to wood packaging

Due to the unique nature of wood within the packaging sector, it is envisaged that only the grocery fraction (0.87kt) and non-grocery fraction (<11kt, including wood packaging to provide rigidity in the delivery of white goods and some pallets and boards supplied specifically to households for large items) will be included within the scheme administrator submissions. it is of course not impossible that pallets (supplied with products) purchased by builders working on house projects (or, for that matter, keen DIY practitioners) from the building wholesale channel may arise in the household waste stream, but this has not been included in this analysis as accurate data is not available.

Typically wooden grocery packaging (0.87kt) is extremely specialist, for example a very small proportion of the ready meals market and presentation boxes for high end wines and spirits. As such, accurate data is not available as to the disposal route for such items, however based on public survey results for packaging around other products, including ready meals, it would be expected that the vast majority of this packaging would arise in the household waste stream. Similarly, wood packaging in the consumer non-grocery sector (11kt) is likely to be repurposed (including use in wood burners, barbeques etc) or disposed of in the household waste from home. As such, it is estimated that c.10-11kt of wood packaging enters the household waste stream or is repurposed. This may well be supplemented by pallets (supplied with products) purchased by builders working on house projects (or, for that matter, keen DIY practitioners) from the building wholesale channel, although in these cases they are more likely to be taken to an HWRC, repurposed or form part of a bulky collection.

5. Consumer Packaging in the 'Litterable' Categories

In the project entitled Producer Reporting of Household Vs Household-Like Packaging (POS101-030), delivered to WRAP and Defra in July 2022, Valpak developed a methodology for estimating the total quantity of consumer packaging that fell within the 'litterable' categories as defined by WRAP using analysis outlined in a corresponding report[1] produced by Keep Britain Tidy (KBT). Despite there being some wooden items that may be associated with littering, such as lolly sticks and wooden single use cutlery, there are no items identified within the consumer segment of the POM analysis that are both defined as packaging and included in the KBT analysis.

[1] *www.keepbritaintidy.org/sites/default/files/resources/20200330%20KBT%20Litter%20Composition%20Report%20-%20FINAL.pdf*

6. By nations reporting

6.1. Introduction

The section of the PackFlow reports separates the total amount of packaging placed on the market (POM) by the four nations of the UK (England, Northern Ireland, Scotland and Wales). These indices are intended to be indicative of the total amount of packaging placed on the market each of the nations and consider each sector identified as a source of packaging for each material in isolation. Appropriate economic indicators are then applied to each of the sectors. At this time, neither Valpak nor Government have access to data from obligated businesses which describes accurately the total POM by nation (although 'by nation reporting' from 2024 will provide such insight) and as such this is proposed to be an appropriate method of estimating such a split by apportioning total POM by sector to each nation by a suitable scaling factor.

6.2. Scaling factors - background

An appropriate scaling factor for each of the sectors identified in the reports are detailed below, along with alternative factors which were also considered where appropriate.

Factors were found and applied to the sectors identified in the PackFlow reports by material. The sectors identified and the associated factors are detailed below.

6.2.1. Agriculture

Valpak considered national statistics for agriculture relating to employment[26], income, the number of holdings and the total hectares[27] in each of the nations as follows.

Table 15 – Metrics relating to Agriculture in the nations of the UK in 2022

	Employment	No of Holdings	income / farm 21/22	Total income	Hectares
England	297,400	104,476	448,500	£46,857,486,000	9,098,253
Northern Ireland	52,200	25,952	83,500	£2,166,992,000	1,035,642
Scotland	67,400	23,345	332,000	£7,750,540,000	5,012,957
Wales	50,400	37,116	113,000	£4,194,108,000	1,765,566

Note, that in this instance, the total income was calculated using the total income per farm multiplied by the number of holdings.

These metrics were then calculated as proportions of the UK packaging sector to be assigned to each nation as follows.

Table 16 – Proportion of key metrics relating to Agriculture in the nations of the UK

	Employment	No of Holdings	Total income	Hectares
England	64%	55%	77%	54%
Northern Ireland	11%	19%	7%	10%
Scotland	14%	12%	13%	30%
Wales	11%	14%	4%	6%

In this instance, it was decided that the proportion of total holdings and total hectares were an inappropriate factors to use because these are likely to be skewed by very large farms for grazing livestock (for which the packaging may not be proportional to the size or number of farms). As such employment and total income were then considered. Whilst neither is likely to be entirely accurate, employment was chosen as the reasonable metric on the basis that total

26 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1106562/AUK_Evidence_Pack_2021_Sept22.pdf

27 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1088518/AUK-Chapter2-14jul22.ods

income again could be skewed by the relative value of the output of the farm itself. Instead, the assumption is that a farm worker is equally likely to open packaged product as any other as a farm work on their or any other farm during the course of their day-to-day duties. As such, it was decided that the most appropriate figure for this calculation was to use employment.

6.2.2. Population

Population statistics were obtained from ONS from census data in 2021. Whilst there are some estimates of 2022 populations, it was decided that actual numbers in 2021 would be a reasonable proxy for working our the proportion of residents across the UK that live in each country in 2022 (when applied and reported in kt).

Table 17 – Proportion of the population living in each of the nations of the UK

	Population mid-2021	Population proportion
England	56,536,000	84%
Northern Ireland	1,905,000	3%
Scotland	5,480,000	8%
Wales	3,105,000	5%

6.2.3 Construction

Various factors were considered within construction sector, however as is the case in agriculture, the total employment[28] [29] was deemed to be a suitable factor for defining the relative size of the corresponding sector in each the nations. This removes issues such as the relative size of the individual business, cost and availability of materials and value of the building, any discrepancies over land value that may exist and any other issues around other cost complexities or differences in the sizes of building.

Table 18 – Proportion of the employees within the construction sector in each of the nations of the UK

	Employment in construction	Employment proportion
England	1,213,614	85%
Northern Ireland	35,135	2%
Scotland	123,000	9%
Wales	54,500	4%

6.2.4. GDP

Those aspects of POM in the Non-Consumer (manufacturing) sectors were scaled by GDP[30] to represent manufacturing output.

Table 19 – Proportion of total UK GDP by UK nation

	GDP (£ bn)	GDP Proportion
England	1,961,238	87%
Northern Ireland	51,717	2%

[28] GB data: https://www.ons.gov.uk/file?uri=/businessindustryandtrade/constructionindustry/datasets/constructionstatisticsannualtables/2021/constructionsannualtables2021.xlsx

[29] Northern Ireland Data: https://www.nisra.gov.uk/system/files/statistics/2022q2soti.xlsx

[30] https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/gdpukregionsandcountries/januarytomarch2022, https://www.gov.scot/publications/gdp-quarterly-national-accounts-2022-q2/, https://www.nisra.gov.uk/statistics/economic-output-statistics/ni-composite-economic-index

Scotland	169,162	7%
Wales	79,699	4%

6.2.5. Hospitality

Data as to the relative size of the hospitality sector in each of the regions is available from Government statistics in terms of the number of establishments in 2017[31]. This data was used as a proxy for the size of the relative markets in 2022. Number of establishments was used instead of other metrics such as sales due to the potential for the outcome to be skewed by high cost establishments.

Table 20 – Proportion of total UK hospitality by UK nation

	Number of establishments (From 2017)	Proportion of hospitality
England	71,527	82%
Northern Ireland	3,973	5%
Scotland	6,017	7%
Wales	5,913	7%

6.3. Sector scaling factors used

The scaling factors used for each sector in the by nation 2022 POM reporting is shown below in Table 21.

Table 21 – Scaling Factors Used for Each Sector in the By-Nation 2022 POM Reporting

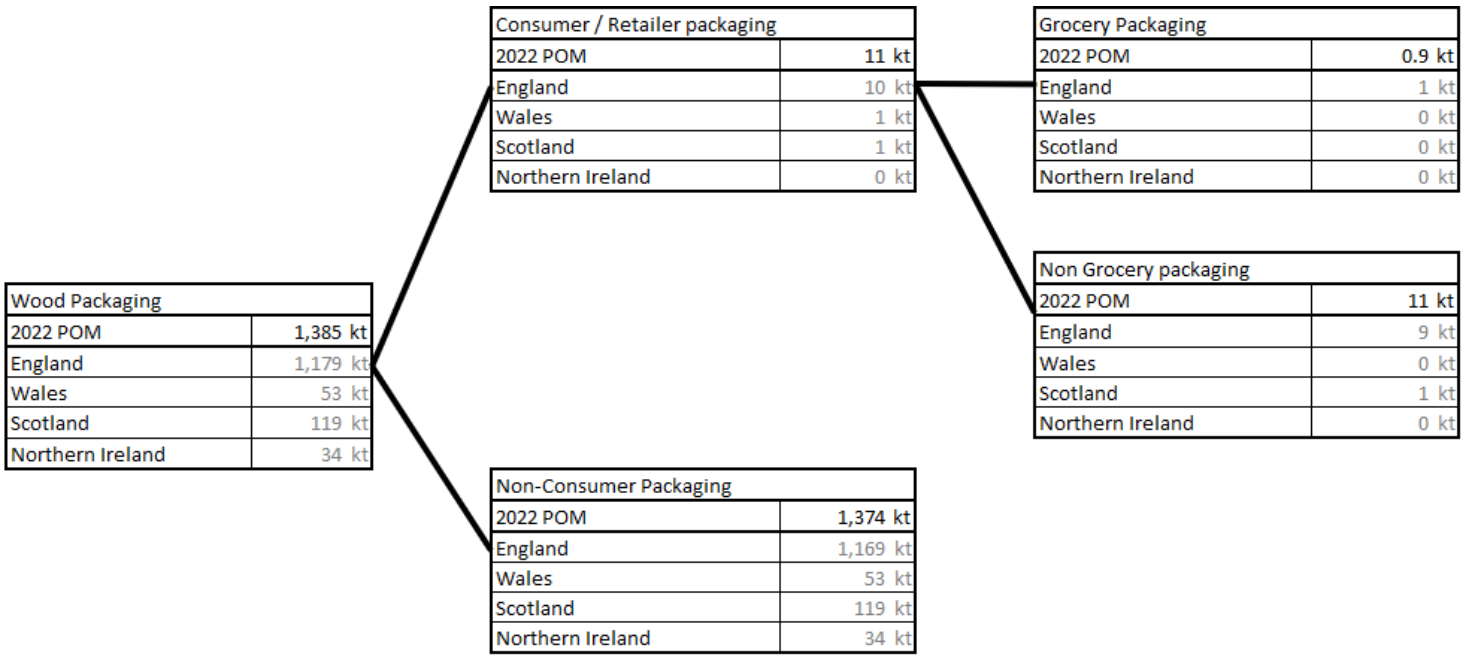
Sector	**Scaling Factor**
Grocery	Population
Non-Grocery	Population
Shipment	Population
Agriculture	Agriculture
Construction and demolition	Construction
Retail Back of Store	Population
hospitality	Hospitality
Manufacturing and Other / Other C&I	GDP
Non consumer Packaging (glass)	Hospitality
Non consumer Packaging (wood)	Construction

[31] https://assets.publishing.service.gov.uk/media/5d67a363ed915d53b4904899/Hospitality_and_Tourism_Workforce_Landscape.pdf

6.4. POM by Nation – Wood

Applying the scaling factors detailed above, the total POM in 2022 broken down by nation for Wood is as follows:

Figure 10: POM by Nation – Wood



7. Phase 1: Collection & Recycling of Wood Waste

This section of the report examines the quantities of wood and wood packaging waste arising, collected, and recycled/reprocessed within the UK or exported in 2022.

7.1. Wood Waste Arising

As noted above estimates of the quantity of wood waste arising are likely be very different from POM estimates, particularly for wood packaging. Essentially, this is because the durability of wood packaging means it has a long life on the market and is extensively re-used and repaired. Therefore, there are long (and unknown) lags between wood packaging being POM and arising in the waste stream.

Wood waste arising (wood packaging and non-packaging wood) in the UK is estimated to be 4.5m tonnes in 2022[32] . Accurate and up to date estimates of the quantity of waste wood packaging are not available, but studies now around 10 years old[33] indicated around 1 million tonnes of wood packaging waste arising per year.

7.2. Collection of Wood Waste

Estimates of the collection of wood packaging waste sourced from local authorities (LAs) and from commercial and industrial (C&I) businesses are provided.

These estimates are based on assumptions made in previous Wood Flow projects, namely;

- The quantity of wood waste collected is assumed to be equivalent to the quantity of waste wood recycled
- Household data on LA recycling collections taken from Waste Data Flow (WDF)[34] is used as a proxy for household recycling.
- The quantity of wood packaging waste accepted by accredited reprocessors / exporters for generation of PRN/PERNs (as reported on NPWD) equates to accredited recycling of wood packaging waste. These figures do not account for any unaccredited[35] recycling of wood packaging waste.

Where wood waste is collected by LAs and/or by private collectors on behalf of LAs, it is generally collected from:

- Kerbside
- Bring sites
- Household waste recycling centres (HWRCs) or civic amenity (CA) sites.

Collection tonnage data is reported into WDF by LAs as: wood for composting; wood, chipboard and MDF; and composite wood materials. Collections of wood in the C&I sector are usually carried out by private waste management companies or wood recyclers.

7.2.1. Local Authority Collection

LA household collections of wood packaging waste in the UK can be represented as follows:

[32] *https://woodrecyclers.org/record-amount-of-waste-wood-processed-in-2022/*
[33] *These are referenced in the wood flow 2025 report https://www.valpak.co.uk/more/material-flow-reports/woodflow-2025 and indicate a range from 998k tonnes per year to 1,170 tonnes per year for wood packaging waste arising.*
[34] *It should be noted that WDF is based on the collection of data from all LAs in the UK and that as such, due to the number of those reporting data, there is the risk of inconsistencies in the way LAs interpret the questionnaire and/or report data. WDF is used as it is considered the best available dataset for LA collected wood.*
[35] Wood packaging that is recycled or exported for recycling by a company that is not accredited/registered with the Environment Agencies to raise PRN/PERNs on wood packaging reprocessed or exported.

Total UK Wood Packaging Collected by Local Authorities	=	Kerbside Collection[27]	+	Bring Site Collection	+	HWRC/CA Site Collection

The WRA estimates[36] that ~1m tonnes of wood waste (wood packaging and non-packaging wood) is collected each year by local authorities at HWRC/CA sites.

WDF also includes figures for collection of waste wood, with the figures for the financial year 2021/22[37] reported below. Collection tonnage data for wood waste reported into WDF refers to all wood waste and does not separately identify waste wood that is packaging wood. It is estimated that around 1% of wood waste collected by local authorities is wood packaging[38].

A summary of the UK local authority wood waste and wood packaging waste collection is shown in Table 22.

Table 22: Local Authority Wood Waste Collection, 2021/22 (k tonnes)

LA collected waste wood	Kerbside	Bring	HWRC/CA	Commingled	**Total**
Waste wood (non-packaging)	3	1	717	3	**724**
Waste wood (packaging)	0	0	7	0	**7**
Total waste wood	**3**	**1**	**724**	**3**	**731**

Table 22 shows a total of 731k tonnes of wood waste (wood packaging and non-packaging wood) is reported as collected by local authorities in 2021/22, of which it is estimated that just 7k tonnes is wood packaging. The majority (99%) of wood waste collected by LAs is collected at HWRC/CA sites. However, some may be collected at kerbside, although this is likely to be part of bulky item collections. It is important to note that the LA collected waste wood packaging tonnage cannot all be assumed to come from the consumer sector.

7.2.2. C&I Collection

C&I collection of wood packaging waste is estimated as follows:

Total UK wood packaging recycled	-	Local authority collected wood packaging waste	=	Commercial & Industrial collected wood packaging waste

The total quantity of wood packaging recycled is the tonnage of accredited wood packaging recycling from NPWD. Local authority collected tonnages of wood packaging are based on WDF. C&I collected tonnages of wood packaging waste are estimated as the difference between the total quantity recycled and local authority collected wood packaging waste.

[36] *Based on WRA estimate of ~23% of annual wood waste is collected via HWRC/CA sites*
[37] *At the time of writing 2021/22 data was the most recent full set of WDF data available.*
[38] *Adopting the same assumption for the share of wood packaging in total wood collected as that in the Wood Flow 2020 report. This is supported by waste compositional analysis of mixed waste collected by LAs published by Defra in 2009[29], which concluded that 4% of all LA collected waste (at kerbside, HWRCs and bring sites) is estimated to be wood, of which only 1.48% is untreated wood and is therefore likely to include an element of packaging wood waste.*

C&I wood packaging waste collected is estimated at 628k tonnes in 2021/22 as shown in Table 23.

Table 23: Wood packaging waste collected, 2021/22 (k tonnes)

Collected wood waste packaging	Quantity
Total collected	635
LA collected	7
C&I Collected	628

It is important to highlight that the quantity of wood packaging collected for recycling is not equal to the quantity that is ultimately recycled. The WDF collection figures will not equal the amount recycled, as many local authorities do not robustly account for material rejected by the materials recycling facilities (MRFs) during the sorting process. Therefore, for simplicity, by assuming that the total collected for recycling equals the total actually recycled, this calculation distorts the representation of contamination and non-target material, accounting for them all upfront (in this case, by default, within the C&I collections estimate).

This means that C&I collections as reported here are implicitly underestimated by the combined, unknown level of contamination and non-target material.

It is also important to note that the NPWD figures only cover wood packaging waste recycled by accredited reprocessors/exporters and does not include tonnages recycled without a packaging recovery note/ packaging exported recovery note (PRN/PERN) being generated.

7.3. Recycling of Wood Packaging

This section of the report examines the quantity of wood packaging recycling in the UK and that which is exported. In contrast to collection it specifically focuses on wood packaging that is successfully recycled (i.e. where wood packaging waste is used to manufacture products derived from waste packaging wood).

To estimate the total quantity of wood packaging recycling that is taking place, recycling activities are split into two categories:

- Accredited recycling, meaning recycling of wood packaging waste recycling reported by accredited wood recyclers and accepted as being eligible for issuing PRN/PERNs
- Unaccredited recycling, meaning recycling of wood packaging waste that is not recorded by an accredited wood recycler.

7.3.1. Accredited wood packaging recycling

Accredited recycling and recovery are that undertaken by a reprocessor/exporter whose activities are eligible for registration as an accredited reprocessor/exporter and to issue PRN/PERNs. Only the activities of wood recyclers who are registered as accredited are considered here.

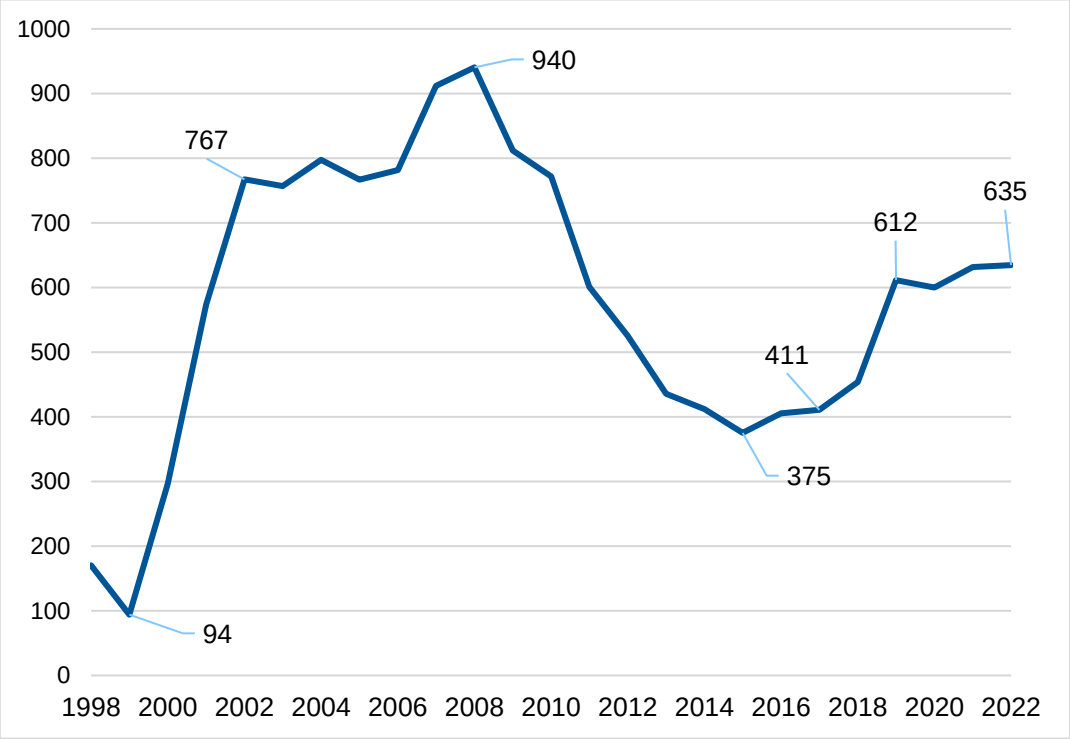
Eligible markets for the recycling/recovery of waste wood packaging include:

- Manufacture of wood board, for example, chipboard or orientated strand board (OSB);
- Decorative woodchip;
- Utility chip (including that used in riding arenas etc.); and
- Animal bedding.

Previously, there were certain conditions under which recovery PRNs could be issued for wood packaging waste destined for combustion in energy recover facilities. However, recovery PRNs stopped being issued in the start of 2021.

The total quantity of accredited wood packaging waste recycled (reprocessed in the UK or exported by accredited exporters) from 1998 to 2022 is shown in Figure 11.

Figure 11: Accredited Wood Packaging Recycling, 1998 to 2022 (k tonnes)

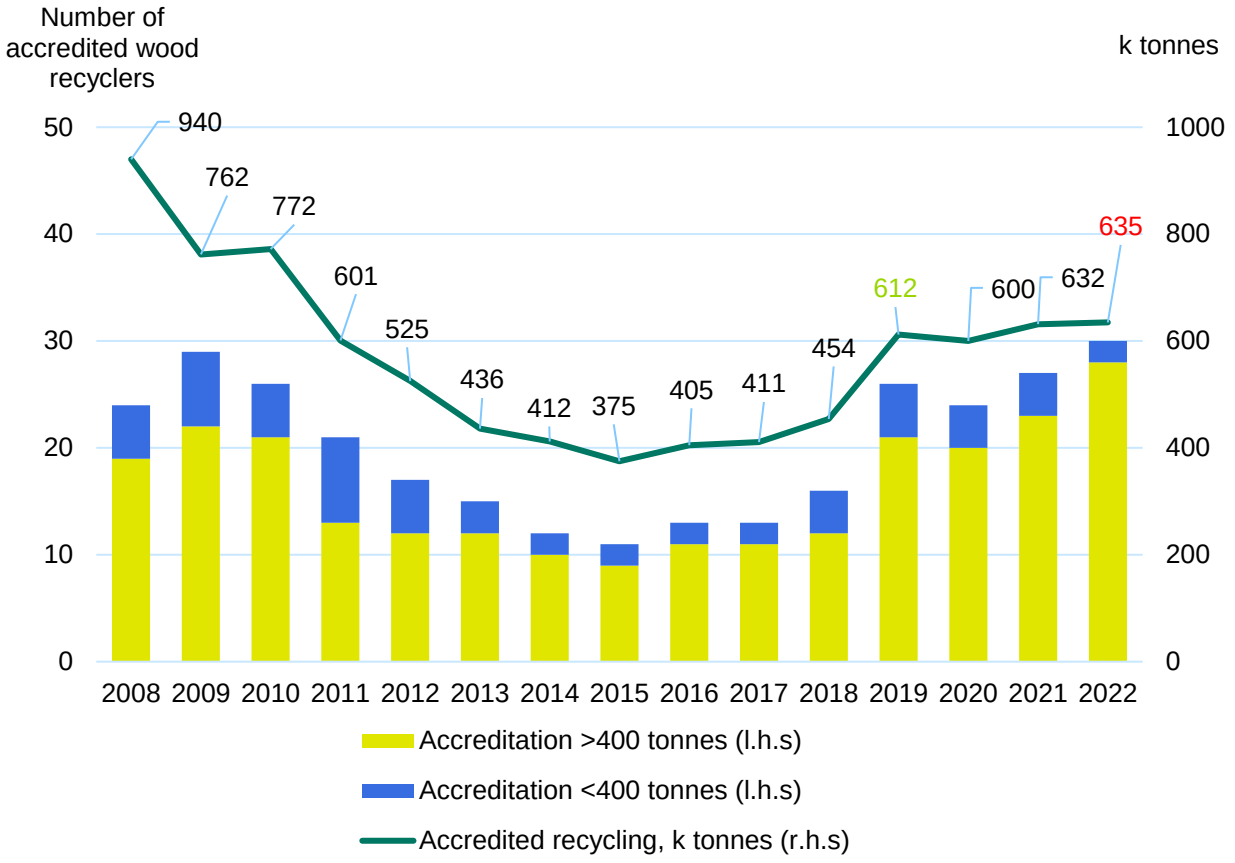


Since 1998 the quantity of accredited wood packaging recycling has followed two distinct trends: an increase from 2000 up to 2008 when it peaked at 940k tonnes; followed by a decline that continued to a low point in 2015. Since 2015, accredited wood packaging recycling has increased. In 2019 it increased by 154k tonnes to 612k tonnes (compared to 454k tonnes in 2018) and continued increasing to 635k tonnes in 2022.

It is believed the decrease from 2009 is due to an increase in wood packaging being used in end markets such as biomass energy (which is classified as a recovery activity rather than a recycling activity). In addition, there was a decline in the number of wood reprocessors who were accredited with agencies for wood packaging, notably from 2010 to 2015, and for sites with large accreditations (>400 tonnes per year) (See).

Figure 12).

Figure 12: Wood Recycler Accreditation and Accredited Wood Packaging Recycling, 2008 to 2022



7.3.2. End Markets

This section presents analysis to determine the quantity of packaging wood waste recovered and used in different end markets in 2022.

The project Steering Group commented that it seems likely there are notable quantities of waste wood packaging that is being recycled/recovered but it is taking place without any recycling or recovery evidence being issued and as such is considered unaccredited (or unrecorded) recycling.

There is no fully comprehensive source of waste wood statistics for the UK that includes up-to-date and accurate data on waste wood arisings and markets. There is uncertainty around the amounts of wood and wood packaging going to re-use, recycling or recovery but it is believed that the quantity of wood wastes going to landfill disposal is small.

The available data sources were reviewed, and the information drawn from them updated using information on current markets for wood waste from the Wood Recyclers Association and the Wood Panel Industries Federation.

The major end markets for waste wood (including packaging) are:

- Panel board manufacture;
- Biomass energy generation;
- Other recycling (animal bedding, equine surfaces and mulches etc.)

To understand how wood waste packaging may be used in different markets, it is first necessary to understand the quality requirements of each market. Wood waste comes from a variety of sources that dictate the level of contamination in the waste wood. The source and level of contamination is used by wood recyclers to grade the quality of the wood waste, providing an indication of the need for processing and potential end markets. This

classification has been standardised by the WRA and is used in the Publicly Available Standard 111[39]. The grades and typical uses of waste wood are summarised in Appendix I.

Table 24: UK Waste Wood End Markets, 2022

Sector	k tonnes
Panel board	1,041
Animal bedding, equine surfaces and other recycling	322
Biomass - Chapter IV	2,729
Reuse[40]	n/a
Export	130
Small Scale Biomass	90
Total	**4,312**

Table 24 reports the estimated quantities of waste wood going to various UK wood waste markets in 2022 according to the WRA. It should be emphasised that these figures are for all types of waste wood, not just wood packaging waste.

A total of ~4.3 million tonnes of waste wood was recovered/recycled in 2022. Waste wood recovery by UK energy facilities (large and small scale biomass) was ~2.8 million tonnes. Around 1.4 million tonnes of waste wood was recycled into panel board, animal bedding and equine surfacing.

Recycling end markets for packaging wood waste are predominantly in applications that require grade A wood, i.e., animal bedding, equine surfaces, but also in Grade B applications such as panel board. These grades consist predominantly of packaging waste but may also contain waste wood from other sources, such as from manufacturing and joinery offcuts.

The panel board industry used 1,041k tonnes of waste wood in 2022. 322k tonnes of waste wood was used by UK manufacturers of animal bedding, mulches and equines surfaces, and 130k tonnes of waste wood was exported.

Having identified the total quantity of wood waste utilised by each market, the next stage in the analysis is to estimate tonnages of wood packaging waste used by each end market. Estimates of waste wood packaging are summarised in Table 25. This includes information on the quantities of wood recycling reported by members of the WRA and estimates made by the WRA of the quantities of wood waste managed by non-members to provide a full market figure.

[39] https://www.wrap.org.uk/content/bsi-pas-111-processing-wood-waste
[40] The WRA's membership reported ~25kt of waste wood going to reuse in 2019 but the full market estimate is uncertain and this figure should be interpreted as such.

Table 25: UK Waste Wood Packaging End Markets, 2022

	Wood packaging share of total wood waste	UK Wood Packaging Market Estimates
Sector	%	k tonnes
Panel board		334
Animal bedding, equine surfaces and other recycling	90%	290
Biomass - Chapter IV	5%	136
Reuse	N/A	N/A
Export		2
Small Scale Biomass	90%	81
Total		**844**

The quantity of wood packaging waste recovered or recycled is estimated to be 844k tonnes in 2022, of which 626k tonnes (or 74%) of this being accredited and unaccredited recycling of wood packaging.

In 2022, the panel board manufacturers recycled of 334k tonnes of waste wood packaging. It is estimated that 318k of waste wood packaging is accredited, and the remaining 5% (16k tonnes) would be unaccredited. Note that while UK panel board producers are accredited, the quantity of wood packaging going into board mills is not necessarily the same as that reported as accredited recycling.

The WRA estimates that ~90% of the wood waste used in the manufacture of animal bedding, equine surfaces and mulches is waste wood packaging. Wood recyclers manufacturing animal bedding, equine surfaces etc. used 290k tonnes of wood packaging in 2022, and the WRA believes that 275k tonnes or approximately 95% of this tonnage was recorded as accredited recycling. The WRA estimates that the remaining 15k tonnes of waste wood packaging used by the animal bedding, equines surfaces and mulches and other recycling is unaccredited recycling.

A full market estimate of the quantity of wood packaging being re-used is unknown. The steering group commented that the fate of substantial quantities of wooden pallets is unknown. These are wooden pallets that are not of the size typically used by the various pallet pools, but are pallets that could be re-used.

The 2k tonnes of wood packaging exported is based on the 2022 figure for PERNs, but the actual figure for wood packaging exported is unknown.

In terms of recovery of wood packaging, 136k tonnes of wood packaging waste is estimated to have gone to large scale biomass (Biomass - Chapter IV) in 2022, with small scale biomass using 81k tonnes of wood packaging waste. Small scale biomass feedstock has to be clean, untreated grade A material, which will predominantly be wood packaging but may also contain pre-consumer waste wood such as joinery offcuts. For Chapter IV biomass, the feedstock is varied according to the specific requirements of the operator, but all will be able to use treated/non-hazardous waste wood (Grades B and C) as well as clean, untreated (Grade A) and virgin wood. However, both economically and environmentally, it makes more sense for biomass operators to use more of the treated/non-hazardous material.

7.3.2.1. Summary of End Markets

A total of ~4.3 million tonnes of waste wood was recovered/recycled in 2022. Waste wood recovery by UK energy facilities (large and small scale biomass) was ~2.8 million tonnes. Around 1.4 million tonnes of waste wood was recycled into panel board, animal bedding and equine surfacing.

The quantity of wood packaging waste recovered or recycled is estimated to be 844k tonnes in 2022, of which 626k tonnes (or 74%) is recycled.

In 2022, the panel board manufacturers recycled 334k tonnes of waste wood packaging, of which 318k tonnes is accredited.

Wood recyclers manufacturing animal bedding, equine surfaces etc. used 290k tonnes of wood packaging in 2022, and the WRA believes that 275k tonnes or approximately 95% of this tonnage was recorded as accredited recycling.

In terms of recovery of wood packaging, 136k tonnes is estimated to have gone to large scale biomass (Biomass - Chapter IV) in 2022, with small scale biomass using 81k tonnes.

A full market estimate of the quantity of wood packaging being re-used is unknown. The steering group commented that the fate of substantial quantities of wooden pallets is unknown. These are wooden pallets that are not of the size typically used by the various pallet pools, but are pallets that could be re-used.

7.3.3. Unaccredited Wood Packaging Recycling

The total quantity of unaccredited and accredited wood packaging waste recycled in 2022 using end-market figures is estimated to be 626k tonnes.

Previously, the accredited recycling figure (from NPWD) was subtracted from the total quantity of wood packaging waste obtained by using end-market figures, to obtain the unaccredited wood packaging recycling estimate. The accredited recycling figure of 635k tonnes (as extracted from the NPWD) is greater than the total quantity of wood packaging waste recycled obtained using end-market figures. This means that the previous methodology for calculating unaccredited wood packaging recycling cannot be used for 2022 data.

In 2019, the total wood packaging recycling was estimated at 614k tonnes (as presented in the PackFlow Covid-19 wood report). Subtracting the 2019 accredited wood packaging recycling of 612k tonnes (as presented in the PackFlow Covid-19 wood report) gives an unaccredited figure of 2k tonnes for 2019 (0.1% of 2019 POM).

In 2022, we estimate that unaccredited recycling is equal to the estimate of the unaccredited wood packaging used by the wood panel industry plus the estimate of the unaccredited wood packaging used by the animal bedding, equine surfaces and other recycling industry. This equates to 31k tonnes, of which 16k tonnes is attributed to unaccredited wood used by the panel board industry and 15k tonnes to unaccredited wood used by the animal bedding, equines surfaces and other recycling industry. The unaccredited wood packaging recycling is equivalent to 5% of the accredited packaging recycling tonnage reported by the NPWD (635k tonnes).

This also means that there is a difference of about 40k tonnes between accredited wood packaging recycling (NPWD) and total wood packaging recycling by end-market. It is believed by stakeholders that some of this difference may be due to time lags between time of accreditation and the use phase of recycled wood in end-markets.

Due to the difference between accredited wood packaging recycling (NPWD) and total wood packaging recycling by end-market, there are some uncertainties around the total wood packaging waste recycled in 2022. It is estimated that total wood packaging recycling is equal to accredited wood packaging recycling (NPWD) plus unaccredited wood packaging recycling. The total wood packaging recycling is thereby estimated to be 666k tonnes.

In 2022, accredited wood packaging recycling has seen an increase compared to 2019, despite lower average PRN prices and lower business target recycling rates for wood packaging in 2022 (35%) compared to 2019 (43%). In addition, there are 12 more accredited wood reprocessors in 2022 compared to 2019[41]. This may be due to the fact that in 2019, wood prices were decreasing by the end of the year, whereas in 2022 the wood prices continued to increase by the end of the year, creating a continuous incentive for wood packaging recycling accreditation in 2022.

7.4. Wood Packaging Waste not Recycled

There is limited information to determine the amount of wood packaging that ends up being disposed of via landfill or used for EfW and its split by sector (consumer/ non-consumer). This is due to the fact that the life of wood packaging does not mostly end within a year of POM (see section 7.1).

It is believed that it is more likely for consumer wood packaging to be disposed of via landfill or EfW than non-consumer packaging, which has more formal routes to recycling end-markets. Much wood packaging in the consumer sector is small format and likely to be disposed of in residual bin waste at end of life rather than recycled.

[41] *As at September 2023 from NPWD*

An analysis of municipal waste data from the Department for Environment, Food & Rural Affairs (Defra, for England), the Scottish Environment Protection Agency (SEPA), StatsWales and the Department of Agriculture, Environment and Rural Affairs (DAERA, for Northern Ireland) was used to estimate the percentage of residual household waste that was sent to Energy from Waste (EfW) and landfill. This showed that in 2022 approximately 80% of consumer waste was disposed using EfW and 20% to landfill. The 80% to EfW includes refuse derived fuel (RDF) that is exported to EfW plants in mainland Europe.

Although an assumption could be made for consumer wood packaging that is disposed of, that 80% ends up going to EfW and 20% to landfill, there is not information to quantify consumer wood packaging sent for disposal rather than recycling, although recycling is considered small. It is estimated that 7k tonnes of wood packaging is collected by LAs from HWRC/CA sites, however this cannot all be assumed to come from the consumer sector (see section 7.2). For this reason, it is assumed that at most the total amount of consumer packaging placed-on-the-market, 11.4k tonnes ends up disposed of via landfill or used for EfW. The split between EfW (80%) and landfill (20%) is applied to the total amount of consumer packaging placed-on-the-market, providing an estimate that at most 9.1 kt of consumer wood packaging waste ends up used for EfW, and at most 2.3kt of consumer wood packaging waste ends up in landfill.

Table 26: Consumer wood packaging waste not recycled

	Consumer	Comments
Total not recycled	<11kt	No information on amount of consumer packaging that is not recycled. Less than consumer POM.
EfW (including RDF)	<9.1kt	Split between EfW (and RDF) (80%) and landfill (20%) based on official government-reported data on destination of residual municipal waste.
Landfill	<2.3kt	

There is not enough information to quantify non-consumer wood packaging sent for disposal, and there is no available information on the breakdown of the end-of-life processing (landfill/ EfW) of non-consumer wood packaging for disposal.

7.5. Summary of Collection and Recycling of Wood Waste

This section summarises the key findings for the collection and recycling of wood waste and wood packaging waste.

Wood waste arising (wood packaging and non-packaging wood) in the UK is estimated to be 4.5m tonnes in 2022[42].

The WRA estimates[43] that ~1m tonnes of wood waste (wood packaging and non-packaging wood) is collected each year by local authorities at HWRC/CA sites.

WasteDataFlow figures for 2021/22 indicate that local authorities collected 731k tonnes of wood waste (wood packaging and non-packaging wood).

The vast majority (99%) of wood waste collected by local authorities is via HWRC/CA sites and is non-packaging wood. Less than 10k tonnes of wood waste collected by local authorities is wood packaging.

Accredited waste wood packaging recycling is estimated to be 635k tonnes in 2022.

The accredited recycling rate for wood packaging is ~46% in 2022

(comparing against the wood packaging POM of 1,385k tonnes estimated in this report).

A total of ~4.3 million tonnes of waste wood was recovered/recycled in 2022.

[42] *https://woodrecyclers.org/record-amount-of-waste-wood-processed-in-2022/*
[43] *Based on WRA estimate of ~23% of annual wood waste is collected via HWRC/CA sites*

A total of ~4.3 million tonnes of waste wood was recovered/recycled in 2022. Waste wood recovery by UK energy facilities (large and small scale biomass) was ~2.8 million tonnes. Around 1.4 million tonnes of waste wood was recycled into panel board, animal bedding and equine surfacing.

In 2022, panel board manufacturers recycled of 334k tonnes of waste wood packaging. Wood recyclers manufacturing animal bedding, equine surfaces etc. used 290k tonnes of wood packaging in 2022, and the

The WRA believes that 275k tonnes or approximately 95% of this tonnage was recorded as accredited recycling.

In terms of recovery of wood packaging, 136k tonnes of wood packaging waste is estimated to have gone to large scale biomass (Biomass - Chapter IV) in 2022, with small scale biomass using 81k tonnes of wood packaging waste.

A full market estimate of the quantity of wood packaging being re-used is unknown.

The steering group commented that the fate of substantial quantities of wooden pallets is unknown. These are wooden pallets that are not of the size typically used by the various pallet pools, but are pallets that could be re-used.

The total quantity of wood packaging recycled in the UK is estimated to be 666k tonnes, and unaccredited wood packaging recycling is estimated at 31k tonnes.

However, there are some uncertainties around these figures due to the total accredited wood packaging recycling obtained through end-market figures not being consistent with the accredited wood packaging recycling by NPWD, such that the accredited wood packaging recycling obtained through end-market does not account for 40k tonnes of wood compared to the NPWD figure.

There is limited information to determine the amount of wood packaging that ends up being disposed of via landfill or used for EfW and its split by sector (consumer/ non-consumer).

It is estimated that at most 9.1 kt of consumer wood packaging waste ends up used for EfW, and at most 2.3kt of consumer wood packaging waste ends up in landfill. There is not enough information to quantify non-consumer wood packaging sent for disposal, and there is no available information on the breakdown of the end-of-life processing (landfill/ EfW) of non-consumer wood packaging for disposal.

8. Phase 2: Packaging Future Trends and Scenarios

8.1. Background

The PackFlow Refresh 2023 reports (https://www.valpak.co.uk/more/material-flow-reports) cover all packaging materials and have been produced to provide industry, governments, and other stakeholders with evidence to better understand the packaging materials flows, packaging materials collection & recycling, and to assess likely future recycling performance.

The PackFlow Refresh 2023 project has two phases:

Phase 1

- Update baseline year to 2022 for estimates of packaging materials POM collections, recycling and end markets (from 2019 in the previous flow reports[44]).

Phase 2

- Develop scenarios for packaging materials flow and recycling from 2022 to 2028
- Assess likely future recycling performance.

8.2. Phase 2 Objectives

The key objectives in Phase 2 are, for each of the packaging material types, to;

- Project packaging POM by year from 2022 to 2028[2] based on robust assumptions and techniques.
- Estimate packaging recycling rates for 2022 for various scenarios based on robust assumptions and techniques, and provide a narrative up to 2028 focusing on recycling capacity, end markets, key outlets, and recycling rate trends.

To complement the above a trend analysis is undertaken comparing packaging POM data, by packaging material type, with a range of a priori suitable economic/ industry activity indicator data (e.g. consumer spending, growth in home shopping deliveries). The indicator measures are material-specific and linked to appropriate growth projections to provide plausible indications of future developments in packaging POM tonnages.

Key outputs of the Phase 2 analysis are; an updated analytical Excel-based tool enabling its users to easily make/present estimates of, and future projections of packaging POM quantities for the UK, and a report discussing the methodologies, results and conclusions.

8.3. Methodology

An overview of the approach to assess trends in packaging materials POM for this project is provided below.

8.3.1 Net Pack Fill

This report uses historic NPWD[45] data - 'Packaging handled by activity' – from 1997 to 2023 submissions to represent trends in packaging materials POM by weight (more accurately this is trends in packaging materials POM reported by obligated producers).

[44] *The previous packaging materials flow reports can found at https://www.valpak.co.uk/more/material-flow-reports.*
[45] *www.npwd.environment-agency.gov.uk*

The net pack fill calculation applied in each year, to each packaging material type, is set out below:

Net Pack Fill	=	Packing/Filling Table 1 - pack/filling	+	Imports Table 3A - imported for selling	+	Imports Table 3B - packaging removed from around imports	-	Exports Table 2A + Table 2B – pack/filling

9. Trends in Packaging POM by Material

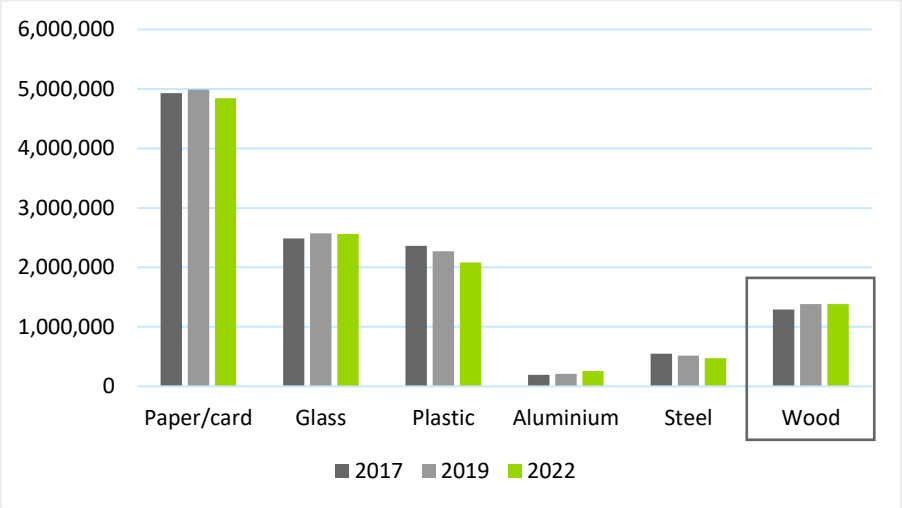
This section of the report uses NPWD time-series data on packaging handled by obligated producers, by type of packaging material, from 1998 to 2021 – this dataset represents the maximum number of annual observations available.

PackFlow's most recent quantifications of packaging POM are for 2017, 2019 and in the current project 2022 (Figure 1). The main takeaways from Figure 13 for packaging materials POM in 2022 compared to earlier years are;

- Paper and card has reduced compared to 2019 and 2017;
- Glass is down from 2019,
- Plastic is down from 2019 and 2017,
- Aluminium has increased compared to 2019 and 2017,
- Steel has reduced compared to 2019 and 2017, and
- Wood is stable between 2019 and 2022 but higher compared to 2017.

While these POM estimates are regarded by industry and Government as being the best available, they are not repeated on an annual basis, so there isn't a sufficiently long run of annual time-series observations available for a robust analysis of trends.

Figure 13: Packaging POM by material, 2017, 2019 and 2022 (k tonnes)



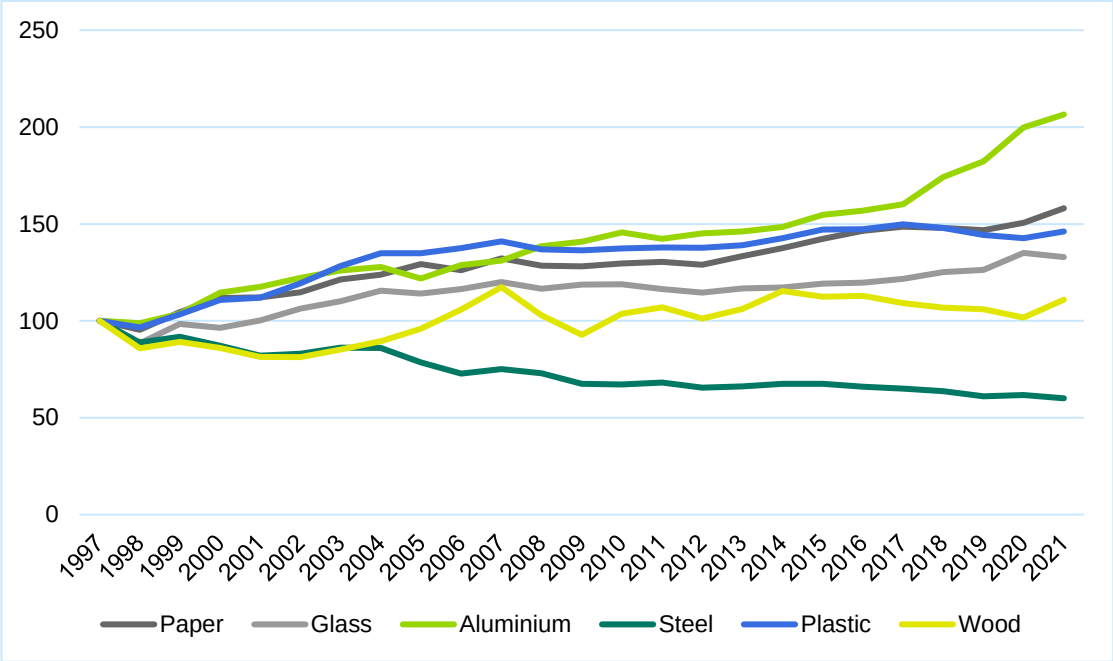
Instead, to inform trends by packaging material type the NPWD dataset is used to calculate the measure 'net pack fill' which is regarded as the best approximation or proxy to trends in POM by type of material.

Figure 14 shows the estimates of trend in packaging materials POM (by weight) by material type from 1997 to 2021. In general, POM[46] for all materials (apart from steel packaging) has increased though clearly there are year-to-year fluctuations. Aluminium packaging has grown the fastest, followed by paper, plastic and glass. Wood packaging has seen modest growth overall, and steel packaging has experienced year-on-year declines in most years over this period.

Since 2017 growth in aluminium and glass packaging POM has picked up relative to trend and plastic packaging POM has reduced. Since 2019, paper packaging POM has increased relative to plastic packaging POM.

[46] Strictly speaking this is obligated POM as represented by the net pack fill measure. The % of total POM as measured by the PackFlow reports varies by material and over time.

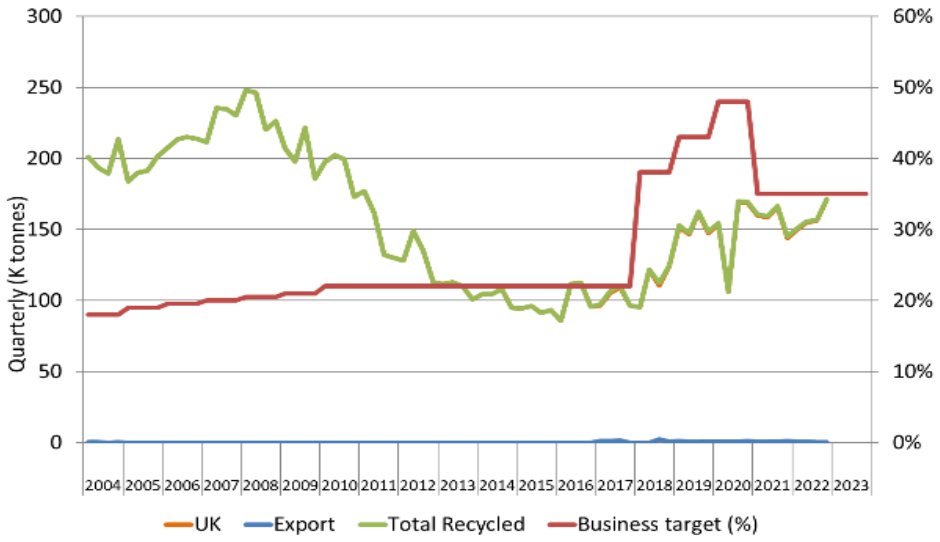
Figure 14: Packaging POM trends by material, 1997 - 2021 (indexed 1997=100)



10. Packaging Recycling

A key objective of this report is to provide an understanding of the trends in the recycling of packaging materials. To inform the recycling projections in the baseline scenario NPWD accredited recycling data (i.e.PRN/PERN) is used as a proxy for the assessment of recycling trends. Note that non-accredited recycling and export (i.e. tonnages not recorded by PRN/PERN) also takes place which has an impact on overall recycling performance. Figure 15 illustrates quarterly data on total accredited recycling, UK domestic accredited recycling and accredited exports for wood from 2004 to 2023. A key driver of packaging recycling is the material specific business targets, which are shown on the left-hand-scale of the charts.

Figure 15: Trends in accredited packaging recycling 2004 – 2023 (k tonnes)



Upward trend seen in total recycling between 2004 and 2008, which peaked at an annual tonnage of 940k tonnes; followed by a decline that continued to a low point in 2015. Since 2015, accredited wood packaging recycling has continued to increase despite a drop in 2020. Business targets saw a slow increase between 2004 and 2009, before stagnating until 2017. In 2018, targets saw a dramatic increase to 48% in 2020, before dropping to 35% in 2021 and stagnating.

11. Wood Market Trends

Legislation

Wood packaging is not an in-scope DRS material and the projection for wood will not be affected by this legislation. Similarly, the introduction of EPR will not affect wood flow.

UK POM

When asked about future trends of wood packaging POM, TIMCON revealed that they expect based on the current and forecasted market conditions, anything from a 10 to 20% reduction in 2023. With the forecasts that are being published by other trade associations, TIMCON members and major pallet users expect to see status quo for 2024 and increased activities in 2025. TIMCON have shared concerns relating to how the industry continues to be challenged due to the economy in 2023.

It is believed that the recent reports issued by the likes of the Construction Products Assoc (CPA) are not encouraging for 2024 and predicting no improvements until possibly 2025, as TIMCON have advised previously the construction and in particular the house building sector takes the largest volume of new manufactured pallets per annum circa 50% and the 2022 report confirms that the volumes has dropped to 44.4%.

The key points in the latest CPA report highlight a drop in construction output [47]:

- Construction output falls by 6.8% in 2023 and 0.3% in 2024
- Private housing output falls by 19.0% in 2023 and remains flat in 2024.
- Private housing repair, maintenance, and improvement to fall by 11.0% in 2023 before remaining flat in 2024.
- Infrastructure output to fall by 0.5% in 2023 and fall by 0.1% in 2024
- Industrial output to rise by 3.5% in 2023 before falling by 8.7% in 2024.

Waste Management

WRA projects the following evolution of UK waste wood.

[47] Cross-checked https://www.constructionproducts.org.uk/publications/economics/construction-industry-forecasts/construction-industry-forecasts-autumn-2023/

Whilst recycling rates seem to stabilise (mostly panel board and animal bedding), recovery rates seem to be more at risk (mostly biomass). ROC refers to renewable obligation certificate which is designed to encourage generation of electricity from eligible renewable sources in the United Kingdom. This includes biomass.

12. Projections and EPR scenarios

This section of the report discusses the projections for POM and recycling and three EPR scenarios for the quantity of packaging material which differ by the amount of packaging material *removed* from the POM quantity which is then available to be for recycling. The remaining POM material is assumed to be covered by EPR from 2025 and the quantity removed is assumed to be in scope of a DRS from 2027.

12.1. POM projections

The Phase 1 baseline data year for all packaging material POM tonnages is calendar year 2022. The scenario projection's tonnages from 2022 to 2040 are developed with the following considerations (note that the report tables show a summary of the scenarios to 2028);

1. Near term. Profile shaped based on market intelligence and datasets that are available for year to date in 2023. Typically, in the near term there's more information available on which to base projections, and make assumptions. For example, qualitative commentaries on current market conditions are used. The current cost of living crisis – energy bubble – is a key source of uncertainty distorting purchasing decisions and, to the extent that this is reflected in indicator data, it is built into the profile of the projections for packaging materials.
2. Medium term. The scenario projections link to growth projections to inform the scenario profiles 2024 to 2040 ('official' economic projections to 2028 are used, namely the OBR's forecast published in November 2023 that accompany the Chancellor's Autumn Statement).
3. Long term. As the projection horizon extends further out there's inevitably greater uncertainty. The scenario projections adopt a 'return to trend or steady state' growth approach.

The POM projections by material type are linked to indicators (and projections of these indicators). The indicators considered are selected through analysis of historical relationships with packaging materials POM. Therefore, they are (statistically) *a priori* deemed potentially useful in describing the evolution of packaging materials POM. The indicators shown in the Table 27 are grouped according to level/growth in; economic activity (GDP, GVA by sector, construction, imports), spending (consumer spending and retail sales), and population. Data for all indicators is sourced from the ONS and is adjusted by the ONS to remove the effects of changes in prices, so they are indicators of activity potentially related to the tonnage of packaging POM in real-terms.

Table 27: A Selection of Indicators

Indicator group	Indicator and data source
Consumer spending	Household final consumption expenditure : National concept CVM SA - £m
Consumer spending	Total goods :Total CVM NA Year SA £m
Gross Domestic Product	GDP
Retail sales	Retail in non-specialised stores IV2X
Retail sales	Retail in predominantly food stores IV3G
Retail sales	Retail in non-food stores IV3I
Retail sales	Retail in other stores IW6U
Retail sales	Retail in textile, clothing and footwear stores IW6X
Retail sales	Retail in household goods stores IW6Y
Retail sales	Non-store retailing J58P
Retail sales	All retail excl. automotive
GVA	G46: Wholesale trade, except of motor vehicles and motorcycles
GVA	G47: Retail trade, except of motor vehicles and motorcycles
GVA	G56: Food and beverage service activities
GVA	A: Agriculture

GVA	B: Mining and quarrying
GVA	C: Manufacturing
GVA	D: Electricity, gas, steam and air conditioning supply
GVA	F: Construction
GVA	G: Wholesale and retail trade and repair of motor vehicles and motorcycles
GVA	Total GVA
Construction	Public new housing
Construction	Private new housing
Construction	Total new housing
Imports	CPA 08:WW:IM:CVM:BOP:SA: C. Manufactured products
Imports	CPA 08:WW:IM:CVM:BOP:SA: 10. Food products
Population	POP

A chart-based correlation analysis for a selection of these indicators versus wood POM and a detailed statistical correlation analysis is reported in Appendix III. A summary is shown in Table 28 and Table 29. In each of these the top three correlations are ranked.

Table 28: Levels correlation analysis of wood packaging and indicator measures, 1997 – 2021

Material	Highest correlations	Suggested activity indicator to link to?
Wood	1. Wholesale trade, except motor vehicles and motorcycles 2. Wholesale/retail trade and repair of motor vehicles and motor cycles 3. Retail sales in textile, clothing and footwear stores	GVA

Table 29: Growth correlation analysis of wood packaging and indicator measures, 1998 – 2021

Material	Highest correlations	Suggested activity indicator to link to?
Wood	1. Private new housing construction 2. Public new housing construction 3. GVA, total	Construction

Growth in POM for wood packaging is most highly correlated with growth measures based on construction sector activity, so the projection for wood is linked to projections of construction sector activity. The POM was multiplied by the change over time in the selected correlated indicator to obtain the level for each subsequent year.

Table 30: Summary of linking packaging POM to indicator measures.

Material	Levels analysis	Growth analysis	Projection based on
Wood	GVA	Construction	Construction

Table 31: Projected growth in indicator measures, 2024 to 2028.

Indicator	2023	2024	2025	2026	2027	2028	Source	
Construction	-9.2%	-6.0%	0.0%	3.7%	3.5%	3.7%	ONS latest data: Jan - Sep 2023	OBR forecast Nov 2023 : Private housing starts

12.2. EPR Scenarios

Three EPR scenarios for each of the packaging materials covered in the Packflow Refresh 2023 where developed and are discussed in the following sections. Please note there are no EPR Scenarios 2 and 3 for wood packaging. Only scenario 1 is included from the list below.

The three scenarios are;

- EPR scenario 1: All packaging materials subject to recycling obligations under 2007 Regulations for 2024 and under new EPR regulations from 2025 onwards (all packaging is in scope of current producer responsibility obligations from 2022 to 2025)
- EPR scenario 2: DRS drinks containers *excluding* glass removed from recycling obligations under EPR in 2027 onwards
- EPR scenario 3: DRS drinks containers *including* glass containers for Scotland and Wales, and *excluding* glass drinks containers in England and Northern Ireland, are removed from EPR POM tonnages from 2027.

In the context of scenarios 2 and 3 'removing DRS drinks containers', (glass as above) from EPR' means removing these materials from EPR recycling obligations. The policy is that they are not subject to disposal cost fees in the period between the new EPR regulations coming into force (from 2025) and DRS 'going live' (from 2027). Note that glass packaging is the *only* material impacted in scenario *3*.

The scenarios provide an assessment of likely recycling performance, in each year, to 2028. In each scenario packaging materials are assumed to be under EPR from 2025 and the table below show (to 2028) the tonnages of packaging placed on the market which would be under EPR. Also shown are the business targets (%, k tonnes), obligated packaging tonnages, the level (%) of non-obligated packaging, accredited packaging recycling (k tonnes), the projected surplus/shortfall of recycling relative to the business target, and a summary of the recycling rate performance over the scenario horizon.

The scenarios calculate the tonnage of accredited recycling based on the amount of packaging POM and an assumed collection rate. The scenarios assume the collection of EPR packaging material is separated from the DRS collection system i.e. 100k tonnes of EPR packaging equates to 100k tonnes of EPR packaging collected for accredited recycling. In reality there will be DRS materials not captured by a DRS which could end up in the waste stream collected for accredited recycling.

Please note there is no EPR Scenario 2 and 3 for wood packaging. Only scenario 1 is included from the list above.

12.3. EPR Scenario 1

Wood POM tonnage is projected to reduce in 2023 compared to 2022, and decline further in 2024. While growth resumes from 2026 it remains below its 2022 level in 2028. Business targets are projected as constant at 2024 level of 42%. The POM projection is reflected in the projection of obligated tonnage for wood packaging, and (with assumed constant collection rates) the projection of accredited recycling. Based on this a surplus relative to the business target 2024 to 2028 is projected for wood packaging.

Table 32: Wood projections EPR Scenario 1

Wood	Units	2022	2023	2024	2025	2026	2027	2028
Business target	%	35%	35%	42%	42%	42%	42%	42%
POM	k tonnes	1,385	1,258	1,182	1,182	1,226	1,269	1,316
Obligated tonnage	k tonnes	1,063	1,024	963	963	998	1,033	1,071
Level of non-obligated tonnage	%	19%	19%	19%	19%	19%	19%	19%
Business target	k tonnes	372	358	404	404	419	434	450
Accredited recycling	k tonnes	635	704	532	532	552	571	592
Surplus (+) / shortfall (-)	k tonnes	263	345	128	128	132	137	142
Business recycling rate	%	60%	69%	55%	55%	55%	55%	55%
Recycling rate performance	%	46%	56%	45%	45%	45%	45%	45%
UK recycling rate	%	27%	28%	34%	34%	34%	34%	34%

12.4. EPR Scenario 2

In this scenario in-scope DRS drinks containers *excluding* glass drinks containers are removed from EPR POM quantities from 2027 onwards. In this context 'removing DRS drinks containers from EPR' means removing these materials from recycling obligations. The policy is that they are not subject to disposal cost fees in the period between the new EPR regulations coming into force (from 2025) and DRS 'going live' (from 2027).

Wood packaging is not an in-scope DRS material and the projection in this scenario is not impacted by the removal of DRS drinks containers (see section 12.3 for details of the projected scenario for wood packaging).

12.5. EPR Scenario 3

In this scenario in-scope DRS drinks containers *including* glass containers for Scotland and Wales, and *excluding* glass drinks containers in England and Northern Ireland, are removed from EPR POM tonnages from 2027. In this context 'removing DRS drinks containers', (glass as above) from EPR' means removing these materials from recycling obligations. The policy is that they are not subject to disposal cost fees in the period between the new EPR regulations coming into force (from 2025) and DRS 'going live' (from 2027). Compared to EPR scenario 2 glass packaging is the only material impacted in this scenario.

13. Conclusions for Wood Packaging

This section sets out the conclusions of the project and details the main areas recommended for further work.

13.1. Conclusions: POM

This report estimates wood packaging POM in 2022 at 1,385k tonnes (+/- 10%). This estimate represents less than a 1% increase from the revised wood POM figure of 1,383k tonnes (2019 revised data).

The wood POM estimate is established from a bottom-up approach, as the weight of wood packaging produced in the UK plus the weight of net imported wood packaging into the UK (i.e. the weight of imported wood packaging less the weight of wood packaging exported).

A total of 914k tonnes (66% of wood packaging POM) of new wood packaging in pallets is estimated to have been produced in the UK in 2022, of which 777k tonnes is estimated to be new wood used in new/refurbished wooden pallets and 137k tonnes is wood used in UK production of non-pallet wood packaging.

Total imports of wood packaging are estimated to be 740k tonnes in 2022, of which 626k tonnes is imported wood packaging declared by obligated producers who are registered, and 114k tonnes is estimated to be wood packaging imported by unregistered producers.

Total exports of wood packaging are estimated to be 268k tonnes in 2023, of which 235k tonnes is wood packaging exports declared by obligated producers who are registered, and 34k tonnes is estimated to be wood packaging exported by unregistered producers.

Consumer wood packaging POM is estimated at around 11k tonnes (+/- 15%) in 2022, the vast majority 10.5k tonnes (+/-15%) is estimated to be wood packaging in the consumer non-grocery sector.

Consumer grocery wood packaging is estimated to be ~870 tonnes (+/- 6%)

Wood packaging POM in the non-consumer sector is 1,374k tonnes (+/- 11%) in 2019.

The vast majority (99%) of wood packaging POM is in the non-consumer sector.

Wood packaging POM handled by obligated producers in 2022 is estimated to be 1,128k tonnes (or 81% of total POM).

A slight decrease on the estimated 83% of wood packaging POM obligated in 2019.

Wood packaging POM handled by unregistered producers in 2022 is estimated to be 257k tonnes (or 19% of total POM).

A slight increase on the estimated 17% of wood packaging POM that was unregistered in 2019.

By format, flat wooden pallets are estimated to account for 84% of wood packaging POM (including imports) in 2022.

Cases, boxes, crates and drums are the next largest product format for wood packaging, representing 8% of wood POM. Wooden casks, barrels, vats, tubs & coopers products represent around 1% of total wood POM.

The majority (85%) of wood packaging POM in the non-consumer sector is estimated to be flat wooden pallets.

The vast majority (92%) of consumer wood packaging is in the non-grocery retail sector, with wooden trays (50%) being the predominant format category.

While the quantity of wood packaging in consumer grocery retail is small, wood packaging uses remain similar to 2019 for products such as fruits, ready meals and cheeses.

13.2. Conclusions: Collection and Recycling

The WRA estimates 4.5m tonnes of wood waste arising (wood packaging and non-packaging wood) in the UK in 2022.

The WRA estimates[48] that ~1m tonnes of wood waste (wood packaging and non-packaging wood) is collected each year by local authorities at HWRC/CA sites.

WasteDataFlow figures for 2021/22 indicate that local authorities collected 731k tonnes of wood waste (wood packaging and non-packaging wood).

The vast majority (99%) of wood waste collected by local authorities is via HWRC/CA sites and is non-packaging wood. Less than 10k tonnes of wood waste collected by local authorities is wood packaging.

Accredited waste wood packaging recycling is estimated to be 635k tonnes in 2022.

The accredited recycling rate for wood packaging is ~46% in 2022. (comparing against the wood packaging POM of 1,385k tonnes estimated in this report).

In 2022, panel board manufacturers recycled of 334k tonnes of waste wood packaging. Wood recyclers manufacturing animal bedding, equine surfaces etc. used 290k[49] tonnes of wood packaging in 2022.

The WRA believes that 275k tonnes or approximately 95% of this tonnage was recorded as accredited recycling.

The total quantity of wood packaging recycled in the UK is estimated to be 666k tonnes, and the unaccredited wood packaging recycled is estimated at 31k tonnes.

However, there are some uncertainties around these figures due to the total accredited wood packaging recycling obtained through end-market figures not being consistent with the accredited wood packaging recycling by NPWD, such that the accredited wood packaging recycling obtained through end-market does not account for 40k tonnes of wood compared to the NPWD figure.

13.2.1. Conclusions: End Markets

A total of ~4.3 million tonnes of waste wood was recovered/recycled in 2022.

Waste wood recovery by UK energy facilities (large and small scale biomass) was ~2.8 million tonnes. Around 1.4 million tonnes of waste wood was recycled into panel board, animal bedding and equine surfacing.

The quantity of wood packaging waste recovered or recycled is estimated to be 844k tonnes in 2022.

In 2022, the panel board manufacturers recycled 334k tonnes of waste wood packaging.

Wood recyclers manufacturing animal bedding, equine surfaces etc. used 290k tonnes of wood packaging in 2022, and the WRA believes that 275k tonnes or approximately 95% of this tonnage was recorded as accredited recycling.

A full market estimate of the quantity of wood packaging being re-used is unknown. The steering group commented that the fate of substantial quantities of wooden pallets is unknown These are wooden pallets that are not of the size typically used by the various pallet pools, but are pallets that could be re-used.

In terms of recovery of wood packaging, 136k tonnes of wood packaging waste is estimated to have gone to large scale biomass (Biomass - Chapter IV) in 2022, with small scale biomass using 81k tonnes of wood packaging waste.

13.3 Packaging Future Trends and Scenarios

Wood POM tonnage is projected to reduce in 2023 compared to 2022, and decline further in 2024. While growth resumes from 2026 it remains below its 2022 level in 2028. Business targets are projected as constant at 2024 level of 42%. The POM projection is reflected in the projection of obligated tonnage for wood packaging, and (with assumed constant collection rates) the projection of accredited recycling. Based on this a surplus relative to the business target 2024 to 2028 is projected for wood packaging.

[48] *Based on WRA estimate of ~23% of annual wood waste is collected via HWRC/CA sites*

Wood packaging is not an in-scope DRS material and its projection is not impacted by the removal of DRS drinks containers from recycling obligations under EPR.

13.4. Recommendations for Further Work

There are uncertainties around estimates of the fate of wood packaging.

This is highlighted by the fact that 2022 accredited wood packing recycling is greater than accredited wood packaging recycling obtained by using figures by wood packaging end-markets in 2022.

Further research is recommended to provide an updated comprehensive assessment of wood packaging waste arising, re-use, recycling and informal/formal recovery routes for wood packaging.

Appendix I
Grades of Wood Waste and Typical End Markets

Table 33: Description of the various Grades of Waste Wood and Typical End Markets

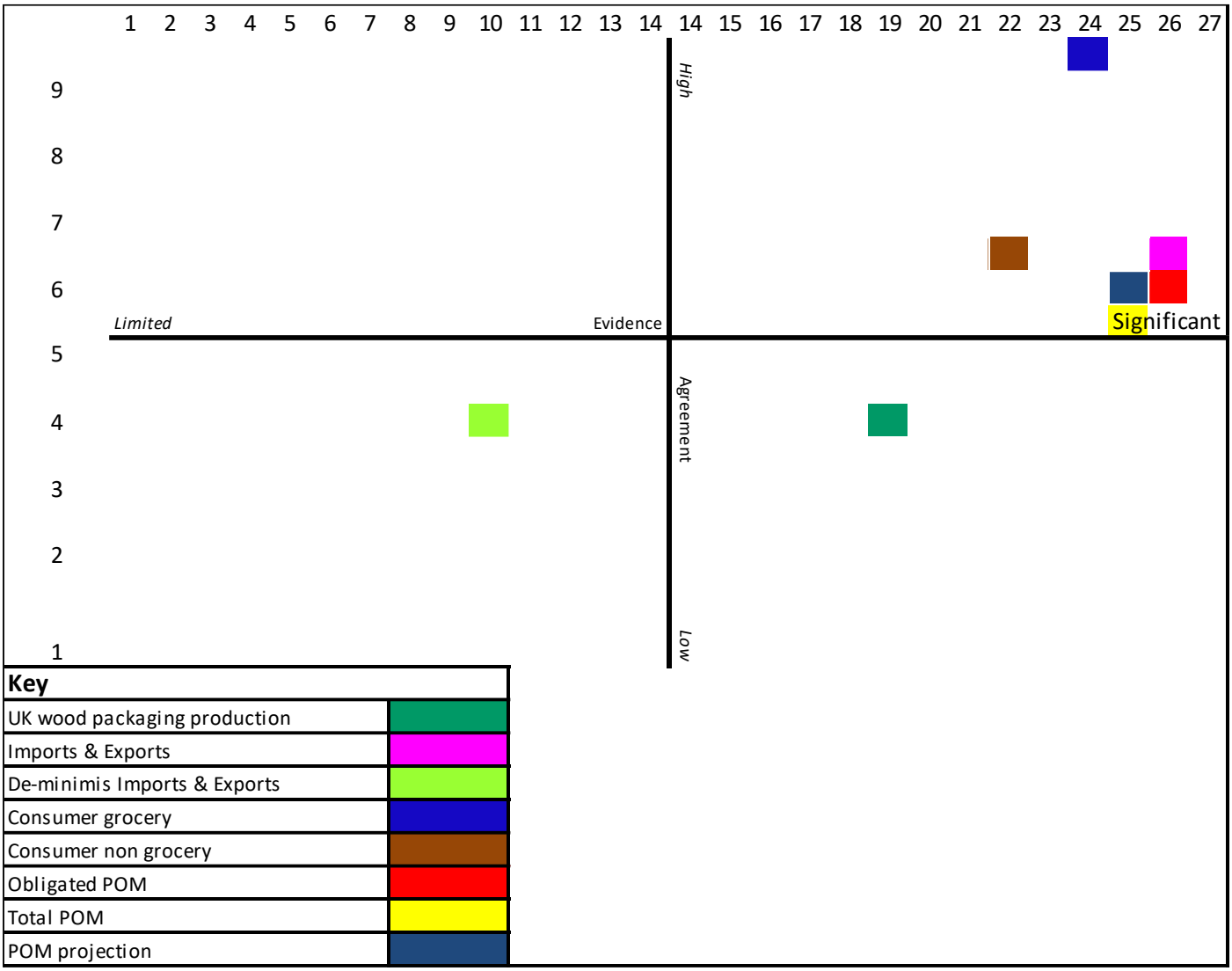
Grade	Definition	Typical markets
Grade A – Clean untreated wood	Relatively homogenous (hardwood/softwood), primary processed woods. Source: distribution, retailing, packaging and secondary manufacture e.g. joinery and pallet reclamation.	Manufacture of professional and consumer products, such as animal bedding, equine and landscaping surfaces. May also be used as a fuel in domestic and non-IED Chapter IV biomass installations and for the manufacture of pellets and briquettes.
	Materials: solid softwood and hardwood. Packaging waste, scrap pallets, packaging cases and cable drums. Process offcuts from the manufacture of untreated products.	
Grade B- Industrial waste wood	Source: Grade A plus construction and demolition operations, skip operators, transfer stations.	Industrial wood processing operations e.g. panel board manufacture.
	Materials: may contain up to 60% Grade A material as above plus building and demolition materials and domestic furniture made from solid wood.	
Grade C – Municipal waste wood	Source: As above plus municipal collections, transfer stations and HWRCs.	IED Chapter IV biomass installations and for panel board in controlled volumes.
	Materials: all of the above plus fencing products, flat pack furniture made from board products and DIY materials.	
Grade D - Hazardous waste wood	Source: All of the above plus agricultural fencing, trackwork and transmission pole contractors.	Must be disposed of at facilities licensed to accept hazardous waste.
	Materials: Agricultural fencing, transmission poles, railway sleepers, cooling towers.	

Appendix II
Data Robustness

A robustness analysis assessment was completed on the data sources used. This was developed to highlight the level of uncertainty for each data source by scoring the data sources on the evidence and agreement level from stakeholders. Questions were asked relating to the evidence and agreement levels of the data used (see the tables later in this section for details) and then the data were scored on each axis. The results are shown in Figure 16 (POM), Figure 17 (Recycling) and a summary in Figure 18, which has been constructed based on analysis completed for each project estimate.

The tables thereafter provide a full breakdown for each project estimate. If the question is answered 'Yes' then a score of 3 is given, if 'No' then a score of 0.

Figure 16: Data Robustness Assessment Results – POM



To convert scores to a percentage that could be used to relate to an appropriate error margin[50], the evidence and agreement levels scores were added and the percentage of the total possible score taken.

[50] *These are assumed estimates of error margin and not the outputs of statistical calculation.*

Figure 17: Data Robustness Assessment Results – Recycling

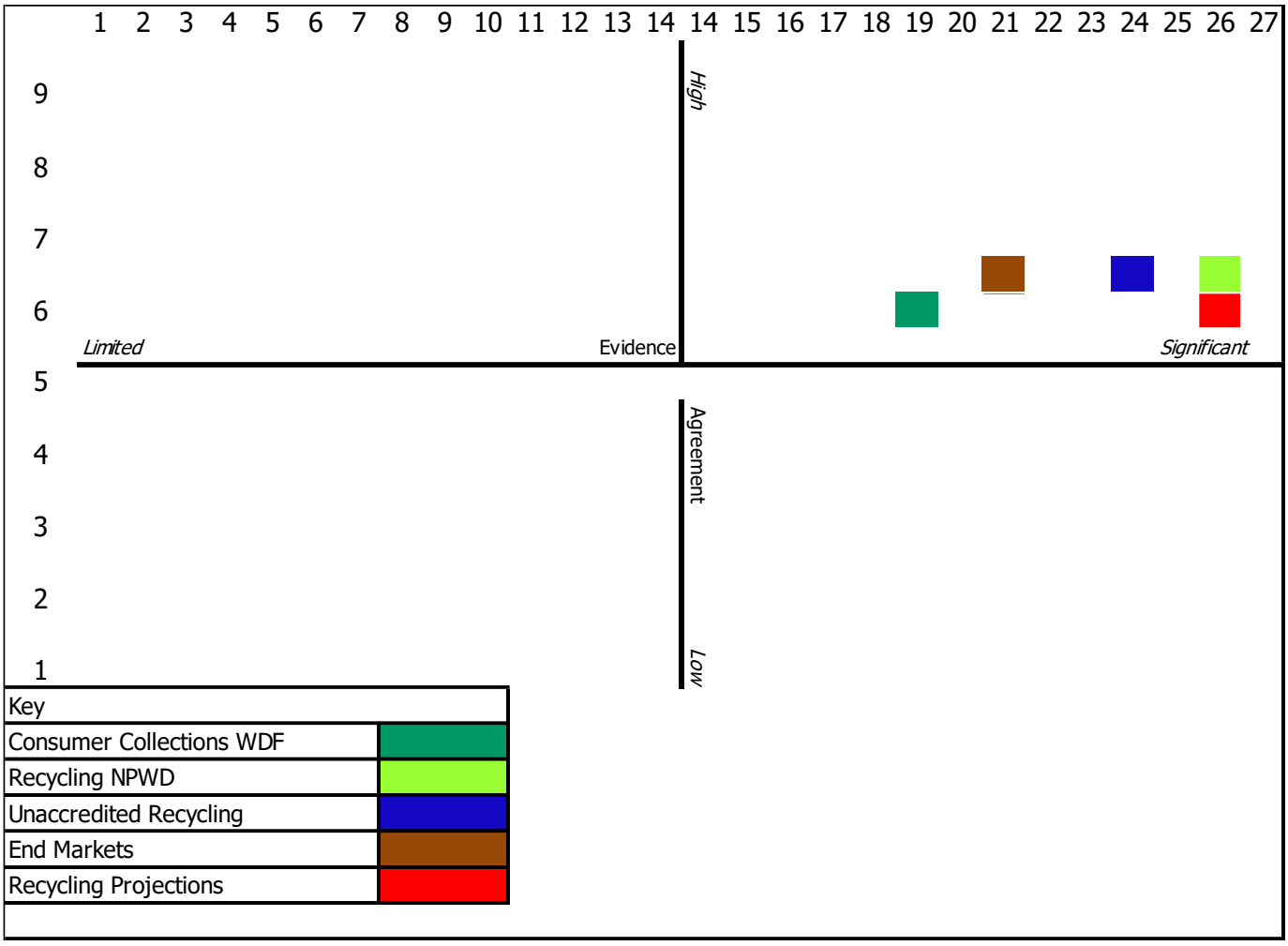


Figure 18: Data Robustness Assessment Results – Summary

Source & data	Robustness scores		Error margin
	Evidence robustness and completeness (max 27)	Degree of agreement around the findings (max 9)	
ONS PRODCOM	26	9	3%
TIMCON Markets data	27	9	3%
HMRC trade data	9	4	36%
EA grocery retail packaging handled	24	9	6%
Valpak EPIC data	22	6	15%
NPWD producer data 2022	26	6	9%
NPWD recycling data 2022	26	6	9%
WDF 2021/22	19	6	21%
WRA, WPIF data	24	6	12%

Figure 19: PRODCOM UK Manufacturers' Sales Data 2022

Data
PRODCOM
Source
ONS
Data Used In:
Wood packaging production (non-pallets)

Evidence (Robustness and completeness):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes	3
Does the data provide complete coverage?	Yes	3
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	No	0
Have the findings been independently peer-reviewed?	No	0
Is the methodology/calculation reasonably free from concerns?	No	0
Have the methodology/calculations been independently checked (internally or externally)?	No	0
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	No	0
Total		**12**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	No	0
Do the key stakeholders/experts actively agree with the findings?	No	0
Has feedback from the key stakeholders been incorporated in the reporting of findings?	No	0
Total		**0**

Figure 20: TIMCOM Pallet Markets Data 2022

Data
TIMCON Pallet Markets data
Source
TIMCON
Data Used In:
Wood packaging production (pallets inc refurb/repair)

Evidence (Robustness and completeness):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes	3
Does the data provide complete coverage?	Yes	3
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	Yes	3
Have the findings been independently peer-reviewed?	Yes	3
Is the methodology/calculation reasonably free from concerns?	Yes	3
Have the methodology/calculations been independently checked (internally or externally)?	Yes	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes	3
Total		**27**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	Yes	3
Do the key stakeholders/experts actively agree with the findings?	Yes	3
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes	3
Total		**9**

Figure 21: HMRC Trade Data 2022

Data
HMRC trade data
Source
HMRC
Data Used In:
Estimate of de-minimis imports and exports

Evidence (Robustness and completeness)	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes	3
Does the data provide complete coverage?	No	0
Has the data been sourced from credible, up-to-date sources?	Yes with some reservations	1
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	No	0
Have the findings been independently peer-reviewed?	More yes than no, but equivocal	1
Is the methodology/calculation reasonably free from concerns?	More yes than no, but equivocal	1
Have the methodology/calculations been independently checked (internally or externally)?	Yes	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes with some reservations	1
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	No	0
Total		**10**

Degree of agreement around the findings	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	No	0
Do the key stakeholders/experts actively agree with the findings?	Yes with some reservations	2
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes with some reservations	2
Total		**4**

Figure 22: Environment Agency Grocery Retailer Packaging Handled Data 2022

Data
Environment Agency Grocery Retailer Packaging Handled
Source
Environment Agency
Data Used In:
Consumer grocery POM

Evidence (Robustness and completeness):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes	3
Does the data provide complete coverage?	Yes, with some reservations	2
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	Yes	3
Have the findings been independently peer-reviewed?	Yes, with some reservations	2
Is the methodology/calculation reasonably free from concerns?	Yes, with some reservations	2
Have the methodology/calculations been independently checked (internally or externally)?	Yes	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes	3
Total		**24**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	Yes	3
Do the key stakeholders/experts actively agree with the findings?	Yes	3
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes	3
Total		**9**

Figure 23: Valpak EPIC Data 2022

Data
Valpak EPIC Data
Source
Valpak
Data Used In:
Composition of consumer packaging formats

Evidence (Robustness and completeness):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes	3
Does the data provide complete coverage?	Yes, with some reservations	2
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	Yes	3
Have the findings been independently peer-reviewed?	No	0
Is the methodology/calculation reasonably free from concerns?	Yes	3
Have the methodology/calculations been independently checked (internally or externally)?	Yes	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes, with some reservations	2
Total		**22**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	No	0
Do the key stakeholders/experts actively agree with the findings?	Yes	3
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes	3
Total		**6**

Figure 24: NPWD Producer Data 2022

Data
NPWD Producer Data 2022
Source
EA NPWD
Data Used In:
Net pack fill, net raw material manufacture, net conversion

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes	3
Does the data provide complete coverage?	Yes, with some reservations	2
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	Yes	3
Have the findings been independently peer-reviewed?	Yes	3
Is the methodology/calculation reasonably free from concerns?	Yes	3
Have the methodology/calculations been independently checked (internally or externally)?	Yes	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes	3
Total		**26**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	No	0
Do the key stakeholders/experts actively agree with the findings?	Yes	3
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes	3
Total		**6**

Figure 25: NPWD Accredited Recycling Data 2022

Data
NPWD Accredited Recycling Data 2022
Source
NPWD
Data Used In:
Recycling estimates

Evidence (Robustness and completeness):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes	3
Does the data provide complete coverage?	Yes, with some reservations	2
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	Yes	3
Have the findings been independently peer-reviewed?	Yes	3
Is the methodology/calculation reasonably free from concerns?	Yes	3
Have the methodology/calculations been independently checked (internally or externally)?	Yes	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes	3
Total		**26**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	No	0
Do the key stakeholders/experts actively agree with the findings?	Yes	3
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes	3
Total		**6**

Figure 26: Waste Data Flow 2021/22

Data
Waste Data Flow Local Authority Collection Data
Source
WDF 2021/22
Data Used In:
LA collection and consumer collection

Evidence (Robustness and completeness):	Scoring (Max 27)	
Does the data cover the correct time-frame?	No	0
Does the data provide complete coverage?	Yes, with some reservations	2
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	Yes, with some reservations	2
Have the findings been independently peer-reviewed?	No	0
Is the methodology/calculation reasonably free from concerns?	Yes, with some reservations	2
Have the methodology/calculations been independently checked (internally or externally)?	Yes, with some reservations	2
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes	3
Total		**17**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	No	0
Do the key stakeholders/experts actively agree with the findings?	Yes	3
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes	3
Total		**6**

Figure 27: Total Wood Recycling Data 2022

Data
Total Wood Recycling Data 2022
Source
WRA, WPIF
Data Used In:
Total Wood Recycling

Evidence (Robustness and completeness):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes	3
Does the data provide complete coverage?	No	0
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	Yes, with some reservations	2
Have the findings been independently peer-reviewed?	Yes	3
Is the methodology/calculation reasonably free from concerns?	Yes	3
Have the methodology/calculations been independently checked (internally or externally)?	Yes	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes, with some reservations	2
Total		**22**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	No	0
Do the key stakeholders/experts actively agree with the findings?	No	0
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes	3
Total		**3**

Figure 28: End Markets For Wood Recovery/Recycling 2022

Data
End markets for wood waste
Source
WRA
Data Used In:
Wood waste recovery/recycling

Evidence (Robustness and completeness):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes, with some reservations	2
Does the data provide complete coverage?	No	0
Has the data been sourced from credible, up-to-date sources?	Yes	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	More yes than no, but equivocal	1
Have the findings been independently peer-reviewed?	Yes	3
Is the methodology/calculation reasonably free from concerns?	Yes, with some reservations	2
Have the methodology/calculations been independently checked (internally or externally)?	Yes	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes, with some reservations	2
Total		**19**

Degree of agreement around the findings:	Scoring (Max 9)	
Does more than one data source confirm the findings (within +/- 5%)?	No	0
Do the key stakeholders/experts actively agree with the findings?	No	0
Has feedback from the key stakeholders been incorporated in the reporting of findings?	Yes	3
Total		**3**

Appendix III
Technical Appendix

Technical appendix

This short technical appendix details the methodology underlying the projections for packaging materials POM discussed in section 9 of the report, and recycling discussed in section 10 of the report.

POM projections

In this methodology, the POM projections by material type are linked to selected indicators, and to projections of these indicators. The indicators considered, through analysis of historical relationships with packaging materials POM, are (statistically) a priori deemed potentially useful in describing the evolution of POM quantities for each of the packaging materials. The list of potential indicators, as shown in the Figure 1, are grouped according to level/growth in; economic activity (GDP, GVA by sector, construction, imports), spending (consumer spending and retail sales), and population. Time series data for all indicators is sourced from the ONS and is adjusted by the ONS to remove the effects of changes in prices, so they are indicators of activity potentially related to the tonnage of packaging POM in real-terms.

Table 34: A Selection of Indicators

Indicator group	Indicator and data source
Consumer spending	Household final consumption expenditure : National concept CVM SA - £m
Consumer spending	Total goods :Total CVM NA Year SA £m
Gross Domestic Product	GDP
Retail sales	Retail in non-specialised stores IV2X
Retail sales	Retail in predominantly food stores IV3G
Retail sales	Retail in non-food stores IV3I
Retail sales	Retail in other stores IW6U
Retail sales	Retail in textile, clothing and footwear stores IW6X
Retail sales	Retail in household goods stores IW6Y
Retail sales	Non-store retailing J58P
Retail sales	All retail excl. automotive
GVA	G46: Wholesale trade, except of motor vehicles and motorcycles
GVA	G47: Retail trade, except of motor vehicles and motorcycles
GVA	G56: Food and beverage service activities
GVA	A: Agriculture
GVA	B: Mining and quarrying
GVA	C: Manufacturing
GVA	D: Electricity, gas, steam and air conditioning supply
GVA	F: Construction
GVA	G: Wholesale and retail trade and repair of motor vehicles and motorcycles
GVA	Total GVA
Construction	Public new housing
Construction	Private new housing
Construction	Total new housing
Imports	CPA 08:WW:IM:CVM:BOP:SA: C. Manufactured products

Imports	CPA 08:WW:IM:CVM:BOP:SA: 10. Food products
Population	POP

A chart-based correlation analysis for a selection of these indicators (GDP, population and retail sales) versus POM for each packaging material type is shown below. The figures illustrate from 1997/98 to 2022 the (univariate) relationship, separately for both the levels and growth (annual % change), between the net pack fill measure - which serves as the best approximation to POM by type of material - and GDP, population and retail sales.

Figure 29: Wood packaging

These charts only provide a visual assessment of the degree of association between POM and a selection of indicators. Therefore, the tables below summarise the results of a more detailed statistical (univariate) correlation analysis across a broader range of possible indicators including alternative measures of consumer spending, detailed market segments for retail sales, GVA measures by industry sector, and imports for goods.

The correlations between the trends in each of the activity measures and trends in packaging materials are shown and the strength of the correlation is denoted by the statistical significance of the t-statistic derived (Prob. t). in each case the top three correlations are highlighted.

Table 35: Correlation Analysis for Packaging Materials and Indicator Measures, Levels 1997 – 2021

Level		WOOD	Prob. t
Consumer spending	Household final consumption Expenditure CVM SA - £m	72.8%	0.00%
Consumer spending	Total goods :Total CVM NA Year SA £m	69.7%	0.01%
Gross Domestic Product	GDP	75.0%	0.00%
Retail sales	Retail in non-specialised stores IV2X	71.9%	0.01%
Retail sales	Retail in predominantly food stores IV3G	58.0%	0.24%
Retail sales	Retail in non-food stores IV3I	74.7%	0.00%
Retail sales	Retail in other stores IW6U	71.7%	0.01%
Retail sales	Retail in textile, clothing and footwear stores IW6X	79.8%	0.00%
Retail sales	Retail in household goods stores IW6Y	20.6%	32.39%
Retail sales	Non-store retailing J58P	47.6%	1.61%
Retail sales	All retail excl. automotive	67.9%	0.02%
GVA	G46: Wholesale trade, except of	87.1%	0.00%

	motor vehicles and motorcycles		
GVA	G47: Retail trade, Except of motor vehicles and motorcycles	52.3%	0.72%
GVA	G56: Food and beverage service activities	0.8%	97.05%
GVA	A: Agriculture	31.2%	12.92%
GVA	B: Mining and quarrying	-77.8%	0.00%
GVA	C: Manufacturing	67.9%	0.02%
GVA	D: Electricity, gas, steam and air conditioning supply	-60.0%	0.15%
GVA	F: Construction	-19.9%	33.96%
GVA	G: Wholesale and retail trade and repair of motor vehicles and motorcycles	81.2%	0.00%
GVA	Total GVA	75.2%	0.00%
Construction	Public new housing	79.5%	0.00%
Construction	Private new housing	60.0%	0.15%
Construction	Total new housing	67.5%	0.02%
Imports	CPA 08:WW:IM: CVM:BOP:SA: C. Manufactured products	77.2%	0.00%
Imports	CPA 08:WW:IM: CVM:BOP:SA:	78.8%	0.00%

	10. Food products		
Population	POP	73.1%	0.00%

Table 36: Correlation Analysis for Packaging Materials and Indicator Measures, Growth 1998 – 2021

Growth		**WOOD**	**Prob. t**
Consumer spending	Household final consumption Expenditure CVM SA - £m	0.303	15%
Consumer spending	Total goods :Total CVM NA Year SA £m	-0.297	16%
Gross Domestic Product	GDP	0.384	6%
Retail sales	Retail in non-specialised stores IV2X	0.277	19%
Retail sales	Retail in predominantly food stores IV3G	-0.251	24%
Retail sales	Retail in non-food stores IV3I	0.278	19%
Retail sales	Retail in other stores IW6U	0.229	28%
Retail sales	Retail in textile, clothing and footwear stores IW6X	0.326	12%
Retail sales	Retail in household goods stores IW6Y	-0.023	92%
Retail sales	Non-store retailing J58P	-0.133	54%
Retail sales	All retail excl. automotive	0.542	1%
GVA	G46: Wholesale trade,	0.476	2%

	except of motor vehicles and motorcycles		
GVA	G47: Retail trade, Except of motor vehicles and motorcycles	0.251	24%
GVA	G56: Food and beverage service activities	-0.123	57%
GVA	A: Agriculture	-0.250	24%
GVA	B: Mining and quarrying	0.206	33%
GVA	C: Manufacturing	-0.276	19%
GVA	D: Electricity, gas, steam and air conditioning supply	0.460	2%
GVA	F: Construction	0.546	1%
GVA	G: Wholesale and retail trade and repair of motor vehicles and motorcycles	0.389	6%
GVA	Total GVA	0.556	0%
Construction	Public new housing	0.589	0%
Construction	Private new housing	0.623	0%
Construction	Total new housing	0.360	8%
Imports	CPA 08:WW:IM: CVM:BOP:SA: C. Manufactured products	0.411	5%
Imports	CPA 08:WW:IM:	0.108	62%

	CVM:BOP:SA: 10. Food products		
Population	POP	0.011	96%

From the tables above Table 37 and

Table 38 list the top three correlations ranked in order from the highest correlation observed.

Table 37: Levels correlation analysis of wood packaging and indicator measures, 1997 – 2021

Material	Highest correlations	Suggested activity indicator to link to
Wood	4. Wholesale trade, except motor vehicles and motorcycles 5. Wholesale/retail trade and repair of motor vehicles and motor cycles 6. Retail sales in textile, clothing and footwear stores	GVA

Table 38: Growth correlation analysis of wood packaging and indicator measures, 1998 – 2021

Material	Highest correlations	Suggested activity indicator to link to?
Wood	4. Private new housing construction 5. Public new housing construction 6. GVA, total	Construction

Based on the statistical correlation analysis above Table 39 provides a summary of the choice of indicator measure to link to wood packaging. Growth in POM for wood packaging is most highly correlated with growth measures based on construction sector activity, so the projection for wood POM is linked to projections of construction sector activity.

Table 39: Summary of linking packaging POM to indicator measures

Material	Levels analysis	Growth analysis	Projection based on
Wood	GVA	Construction	Construction

Table 40 shows the projected growth rates for the indicators discussed above. The POM was multiplied by the change over time in the selected correlated indicator to obtain the level for each subsequent year.

Table 40: Projected growth in indicator measures, 2024 to 2028.

Indicator	2023	2024	2025	2026	2027	2028	Source	
Construction	-9.2%	-6.0%	0.0%	3.7%	3.5%	3.7%	2023 annual based on ONS latest data: Jan - Sep 2023	OBR forecast Nov 2023 : Private housing starts

Recycling projections

In this methodology, the projections for total accredited recycling depend on the POM projection and the projection of the collection rate (assumed to be constant), apart from 2023 where NPWD data for 2023Q1 to Q3 is used to approximate a full year figure for 2023.

UK domestic recycling

The projections for accredited UK domestic recycling are extrapolated from observed trends (or absence of trends) in historic NPWD data (see section 10 of the report for a discussion). For 2023 NPWD data for 2023Q1 to Q3 is used to approximate a full year figure for 2023.

- Accredited UK domestic recycling of wood packaging is calculated as total accredited recycling *less* accredited exports.

Export recycling

- Accredited exports of wood packaging is projected as constant at its 2023 level.