PackFlow Covid-19 Phase I: Plastic

A review of the quantity of plastic packaging placed on the market (POM) and recycled in 2019

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PackFlow COVID-19: Project Remit

This project seeks to estimate the impact of Covid-19 and the subsequent lockdown measures (in isolation) have on the compliance landscape for UK packaging recycling in 2020 and projecting forward to 2022.

This is achieved by:

1. Calculating UK packaging POM (placed on the market) and recycling by material and by industry sector in 2019 to provide a baseline for future scenarios

2. Using relevant data sources and industry insight to estimate and provide a narrative, by packaging material type, regarding the impact of Covid-19 and the subsequent lockdown has in 2020-2022 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 by sector
    - The changes to the level of obligated tonnage
        - Including an indicative assessment of the potential impact of the recession on the proportion of POM that is recoded within the obligated tonnage each year

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

Where requested by stakeholders, further scenarios have been developed to expand on aspects of recycling that may only in-part be attributed to the Covid-19 situation but were not included in the initial project brief.

Valpak, the project funders and the stakeholders acknowledge that there are a myriad of factors that can affect the packaging waste system inside and outside of the current Covid-19 situation. This project seeks to isolate the impacts of the change of consumption patterns, recycling and direct impact on businesses of the Covid-19 situation. All stakeholders acknowledge that the continued evolution of the wider recycling system will also impact on the overall UK compliance position.

J729 Plastic Version 2

Executive Summary

Introduction

The PackFlow Covid-19 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 potential implications of lockdown and the ensuing recession on packaging materials flows, packaging materials collection & recycling, and to assess potential compliance risks versus the packaging targets.

The PackFlow Covid-19 project has two phases:

Phase I

- Updates the baseline year to 2019 for estimates of packaging materials POM collections, recycling and end markets (from 2017 in the previous flow reports[1]).

Phase II

- Collates data and market intel on impact of the Covid-19 lockdown (materials flow, collections, recycling and end markets)
- Develops scenarios for packaging materials flow and recycling from 2020 to 2022
- Assesses potential compliance risks versus recycling targets for packaging materials.

Defra is keen to ensure that the estimates being used for its packaging policy work are as accurate as possible. To support Defra and other industry stakeholders, this work focuses on generating the most robust estimates of UK plastic packaging placed on the market (POM)[2] and possible compliance implications. The report also considers the levels of UK plastics packaging recycling, both in the UK and abroad, and provides some insight into the end markets and products that UK recycled plastic packaging is used in.

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

Plastic Packaging POM

This project estimates UK plastic POM for 2019 to be 2,290k tonnes +/- 6%.

This represents a potential small decrease of 71k tonnes[3] from the estimated current flow figure of 2,361k tonnes (2017). It is likely that increased product sales have been offset by packaging material light-weighting.

Plastic packaging POM in the consumer retail sector is estimated to be 1,447k tonnes +/- 7% in 2019.

Plastic packaging POM in the non-consumer sector is estimated to be 843k tonnes +/- 12% in 2019.

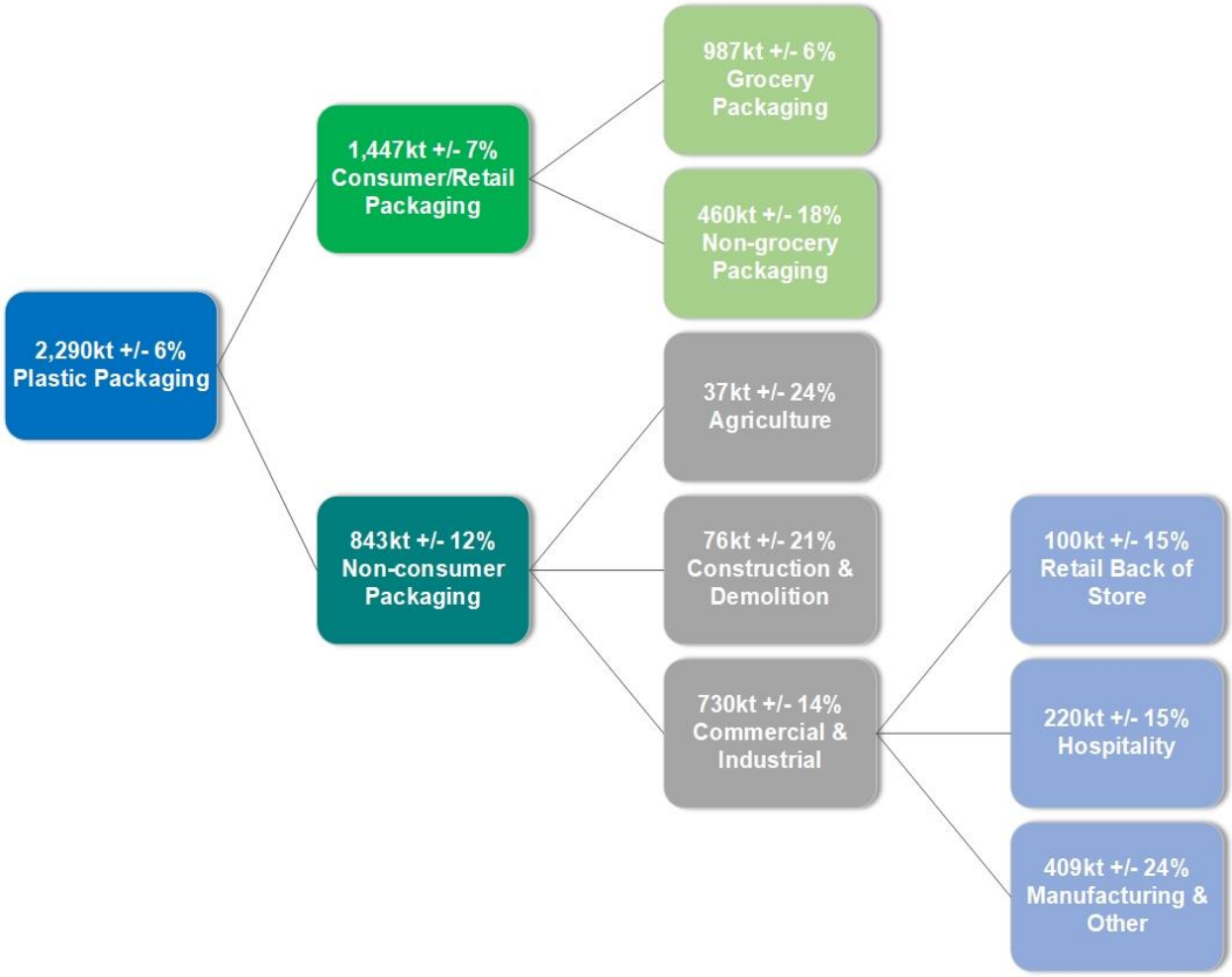
A further breakdown of plastic packaging POM in these sectors is shown in Figure 1 – Plastic Packaging POM by Sector

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

[2] Plastic packaging placed on the market means all household and non-household plastic packaging used around products within the UK.

[3] 71k tonnes is an increase of 3%. As the error margin around the total plastic POM figure is 6%, it is possible that there has been no real increase in POM.

Figure 1 – Plastic Packaging POM by Sector, 2019



The plastic POM figure is built up using a variety of components, based on the key sectors for plastic packaging, including:

- Plastic packaging around food/drinks/other groceries, including body care/clothing/DIY products etc., as sold by supermarkets and other non-grocery retailers, sourced from the Environment Agency and Valpak's EPIC database[4];
- Plastic packaging around food/drink as consumed in the hospitality sector, sourced from Valpak's EPIC database[5];
- Plastic packaging discarded by retailers back of store, obtained through a survey undertaken for the purposes of this study;
- Plastic packaging used by the construction industry, based on secondary research sources, such as the Green Construction Board and BRE, using the same approach as in Plastic Flow 2025;

[4] *The database is based on information collected direct from suppliers as well as information sourced internally, meaning that it holds a wide coverage of information across multiple product ranges. Product specific data collection is completed through site visits, supplier mailings and weighing in-house (purchasing product and collecting used product from staff). All data goes through a comprehensive checking process on receipt and is stored in Valpak's bespoke software Environmental Product Information Centre (EPIC).*

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- Plastic packaging used in the manufacturing industry, using the POM calculated in Plastic Flow 2025, which was sourced from Steering Group member data and that collected in a survey as part of the Valpak/WRAP 2015 C&I Plastic Packaging[6] project; and
- Plastic packaging used in agricultural sector, based on Valpak report, 'UK AWP Waste Arisings, Valpak 2007', based on 2006 data.

The total plastic POM estimate was cross-checked and found to be 308k tonnes higher than data reported by obligated companies under the Packaging Waste Regulations (using the UK net pack/fill calculation method). This suggests that non-obligated companies, handling fewer than 50 tonnes of packaging or with lower than £2 million turnover, account for 13% of plastic packaging in the UK. This has decreased from the 17% non-obligated POM identified in 2017. It is important to stress that the net pack/fill estimates are themselves subject to a degree of error because they rely on the robustness of the data submitted to NPWD. In addition, due to the impacts of Covid-19 and the lockdown, there has been an unprecedented number of late registrants in 2020. Valpak therefore undertook two methods to adjust the aggregated data tables provided by the Environment Agency under FOI. 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 reasonably possible, which is then audited by the regulating body. This data is used by policy makers and their agencies.

Polymer/ Format Composition of Plastic POM

The estimated composition of consumer plastic packaging in the UK in 2019 is shown in Figure 2. The category 'Other' includes elements of packaging such as caps & lids, toothpaste tubes, chocolate/sweet wrappers, egg boxes, blister packs and clothing hangers.

Figure 2 – Consumer Plastic Packaging by Format and Polymer, 2019 (k tonnes)

	HDPE	LDPE	PE	PET	PP	PS	PVC	Other	Grand Total	
Bottle	274	0	2	348	17	0	0	1	643	*44%*
Film	16	103	17	43	80	4	3	46	311	*22%*
Other	43	21	3	44	77	2	1	2	194	*13%*
PTT	5	0	3	164	92	28	3	4	300	*21%*
Grand Total	338	125	24	599	267	35	7	53	1,447	
	23%	*9%*	*2%*	*41%*	*18%*	*2.4%*	*0.5%*	*4%*		

To provide a breakdown by format and polymer of consumer plastic packaging, supermarket packaging composition was used as a proxy for grocery packaging, but only the non-grocery categories of supermarket packaging (around toys, electrical, clothing, etc.) were used as a proxy for non-grocery packaging. In addition to non-grocery items, a certain quantity of drinks are sold through non-grocery retailers and so allowances have been made for these non-grocery drinks sales in the non-grocery composition. This follows the same methodology as Plastic Flow 2025.

There are much fewer data sources to estimate non-consumer POM than consumer POM and the levels of uncertainty around the data are greater. This is even more true of format and polymer composition data and therefore the splits in the below summary table should be regarded as indicative, with a high level of uncertainty.

[6] http://www.wrap.org.uk/sites/files/wrap/Rigid_Plastic_Packaging_report_0.pdf

Figure 3 – Summary of Indicative Total Non-consumer POM Composition, 2019 (k tonnes)

	HDPE	LDPE	PE	PET	PP	PS	PVC	Other	Grand Total	
Bottle	238	0	0	99	0	0		0	338	*40%*
Film	8	228	91	1	20	1	0	6	354	*42%*
Other	7	0	0	0	3	0	0	0	11	*1%*
PTT	33	1	1	11	70	23	1	0	139	*17%*
Grand Total	286	229	92	11t	94	23	1	7	843	
	34%	*27%*	*11%*	*13%*	*11%*	*3%*	*0%*	*1%*		

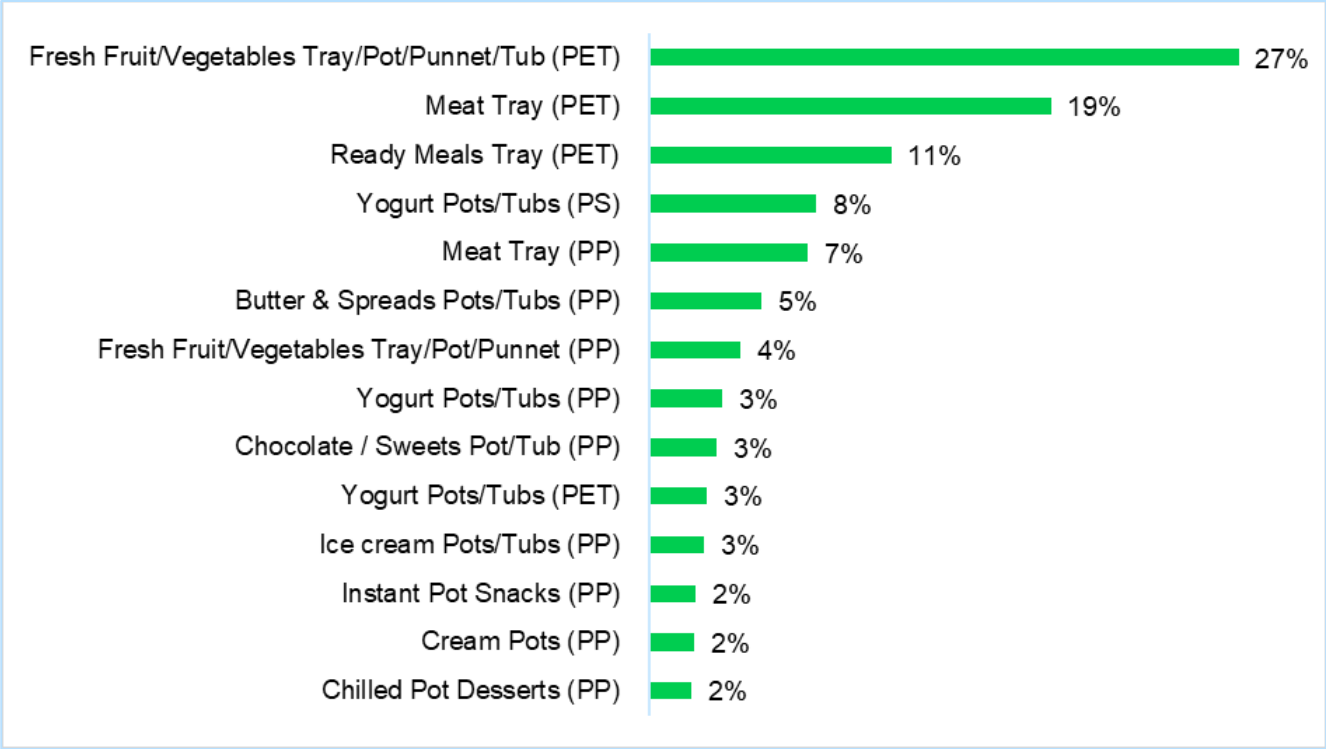
Although this non-consumer POM composition is indicative, the format and polymer splits are consistent with those identified in 2017.

Due to the quantity of packaging data available in Valpak's EPIC database, further analysis was undertaken on consumer POM as part of PackFlow Covid-19. This included an assessment by format and polymer type of consumer pots, tubs and trays (PTTs) and of consumer drinks packaging.

The dominant polymer in consumer PTTs remains PET, with just over half (56%) of PTTs being made of PET. The second most popular polymer is PP, constituting around one third of PTTs in the UK[7]. In terms of usage, the most common category of PTTs (PET) is fresh fruit and vegetable packaging, by a considerable margin. This is illustrated in Figure 4 – Key PTT Applications, 2019below. Fruit and vegetable punnets, butter and spread tubs and meat trays account for just over half of PP PTTs.

[7] *Polymer composition of PTTs as given in this analysis vary slightly from those provided in the overall POM composition table. This is due to the film element of PTTs (closures, lids, etc) being included as part of PTTs in this analysis, being included within the film category of the overall POM composition table. Including the film element of PTTs in this analysis allowed for comparison with previous work undertaken.*

Figure 4 – Key PTT Applications, 2019



As a Deposit Return Scheme (DRS) in both Scotland and England is being developed, it was considered of interest to present the plastic primary packaging data relating to the drinks market. This is shown in Figure 5 – Plastic Drinks Packaging POM, 2019 (k tonnes)below.

Figure 5 – Plastic Drinks Packaging POM, 2019 (k tonnes)

Drinks	Consumer	Non-consumer	Total
HDPE	76	37	113
PET	215	71	286
Other	2	0.4	2
Total	293	109	401

The analysis indicates that in 2019 there was 401k tonnes of plastic drinks packaging placed onto the UK market[8]. In order to verify this data, Dairy UK data relating to the milk market was assessed, with total milk sales for the UK in litres and by each key market, such as retail and hospitality, being identified[9].

[8] *Bottled drinks only, including all caps and labels.*

[9] *http://www.dairyuk.org/images/documents/publications/THE-WHITE-PAPER-2017.pdf*

Plastic Packaging Recycling

PackFlow Covid-19 estimates the quantity of accredited UK plastic packaging recycled to have been between 1,037k tonnes and 1,172k tonnes in 2019. A range is used to express recycling levels as the point at which recycling is measured can vary, and therefore the quantities are shown as a maximum (recovered plastic in[10]) and a minimum (recycled polymer out[11]). The estimates shown in Figure 6, include a breakdown of consumer (465-549k tonnes[12]) and non-consumer (572-623k tonnes) recycling, and UK recycling (345-480k tonnes) and exports (692k tonnes), taken as a proxy from NPWD PERN data).

Figure 6 –UK Domestic Plastic Packaging Recycling & Export, 2019 (k tonnes)

Stream	2019	
	Recovered Plastic (IN)	Recycled Polymer (OUT)
Consumer UK Recycling	250	166
Consumer Export	299	299
Non-consumer UK Recycling (films)	170	136
Non-consumer UK Recycling (rigids)	60	43
Non-consumer Export (films)	292	292
Non-consumer Export (rigids)	102	102
TOTAL Recycled or Exported	1,172 – 1,037	

UK recycling estimates were made primarily from in-house knowledge of changes in recycling since the 2017 survey and discussions with UK reprocessors and exporters. This industry information was used in combination with NPWD PERN data and RECOUP's UK Household Plastics Collection Survey 2019[13].

The total quantity of plastic packaging recycled in the UK was cross-checked with the number of PRNs that were raised on plastic packaging according to the NPWD. For 2019, NPWD reports accredited UK recycling to have been 449k tonnes (PackFlow Covid-19 estimates 345-480k tonnes).

The number of PERNs issued in 2019 was used as a proxy for the tonnage of plastic packaging exported for recycling at 692k tonnes. However, it should be noted that in principal exporters are required to disregard any non-target plastic packaging waste (including contamination) from export tonnages prior to issuing PERNs.

Accredited reprocessing is likely to be an underestimation as it is related to the level of PRNs raised and additional recycling (unaccredited) may be carried out without a PRN being raised. The unaccredited reprocessing was estimated by using the subtracting accredited recycling from the volume of total recycling identified through several discussions with UK reprocessors and exporters. Based on this, unaccredited recycling was estimated to be 31k tonnes. Valpak market knowledge was then used to crosscheck the total recycling tonnage and provide a second estimate of unaccredited recycling of 14k tonnes. The first estimate of 31k tonnes is believed to be the most robust estimate, however a range has been used because it is incredibly difficult to accurately quantify unaccredited recycling.

[10] *Plastic packaging waste accepted for recycling (input)*

[11] *Recycled polymer produced (output)*

[12] *Consumer Recycling (IN) calculated using RECOUP's 2019 plastic packaging collection survey and Recycled Polymer (OUT) estimated from survey research*

[13] *RECOUP's most recent survey based on 2019 data was not published at the time of writing this report and so the 2019 survey (based on 2018 data) was used*

PackFlow Covid-19 therefore estimates UK plastic packaging recycling rates to be between 45% and 51% for 2019. A consumer collection/recycling rate of 32%-38% is estimated for 2019 and a non-consumer recovery/recycling rate of 68%-74% is estimated for 2019.

Figure 7 – Summary of UK Plastic Packaging Recycling Rates, 2019 (k tonnes,%)

Stream	2019						
	POM	Collected	Recovered Plastic (IN)	Recycled Polymer (OUT)	Collection Rate	Recycling Rate (IN)	Recycling Rate (Out)
Consumer Total	1,447	549	549	465	38%	38%	32%
Consumer PTTs/Bottles	942	528	528	445	56%	56%	47%
Consumer Film	311	21	21	19	7%	7%	6%
Consumer Other	194						
Non-consumer Total	843		623	572		74%	68%
Non-consumer Rigids	477		162	145		34%	30%
Non-consumer Film	354		462	428		130%	121%
Non-consumer Other	11						
Grand Total	2,290		1,172	1,037		51%	45%

As can be seen from the above table, there is a discrepancy in the recycling rates of non-consumer film (121-130%). Based on a more feasible recycling rate of 70-80% recycling of non-consumer film, there remains 144-179k tonnes of non-consumer film recycling that cannot be identified. One explanation for this could be the incorrect allocation of PRN/PERNs against either non-packaging film or non-UK packaging. Alternatively, or in addition, it could suggest that the non-consumer film POM estimate is low.

It is suggested further research is required to fully understand why there is a mismatch of this size. Research is recommended both into non-consumer film POM and the incorrect issuing of PRNs.

End Markets for UK Plastic Packaging

Figure 8 provides a summary of key areas of usage of UK recycled polymer. The breakdown of how recycled polymer produced in the UK is used is based on in-house knowledge, and discussions with industry experts and recyclers. For PET, the recycled polymer is produced from bottles and trays (consumer and non-consumer from the hospitality sector). For HDPE the largest volume of recycled polymer comes from bottles/ household trays, but rigid C&I packaging also forms part of this stream. For PP there is a roughly equal split between recycled polymer produced from bottles/ trays and PP from rigid C&I packaging. Recycled LDPE is nearly all derived from C&I and manufacturing films.

Figure 8 – Summary of End Markets for UK Recycled Plastic Packaging

PET		
Application	**Examples**	**Indicative usage**
Sheet manufacture	Used to make packaging trays, etc.	55%
Bottles	Food contact applications, such as drinks bottles.	40%
Fibre	Polyester fibre for fill	5%

HDPE		
Application	**Examples**	**Indicative usage**
Packaging	Food and non-food bottles.	45%
Construction	Pipes, chambers, roof spacers, plumbing items.	35%
Horticultural & outdoors	Compost bins, water butts, wheel bins, garden furniture, watering cans.	15%
Other	Wide range of items including inclusion in plastic wood applications, garden furniture, household items such as boxes and buckets.	5%

PP		
Application	**Examples**	**Indicative usage**
Automotive	Interior design items, wheel arches, ducting, battery cases, mudguards.	40%
Packaging	Paint pots, pallets, crates, trays, boxes	40%
Horticulture	Plant pots, etc.	15%
Other	Wide range of items including inclusion in plastic wood items	5%

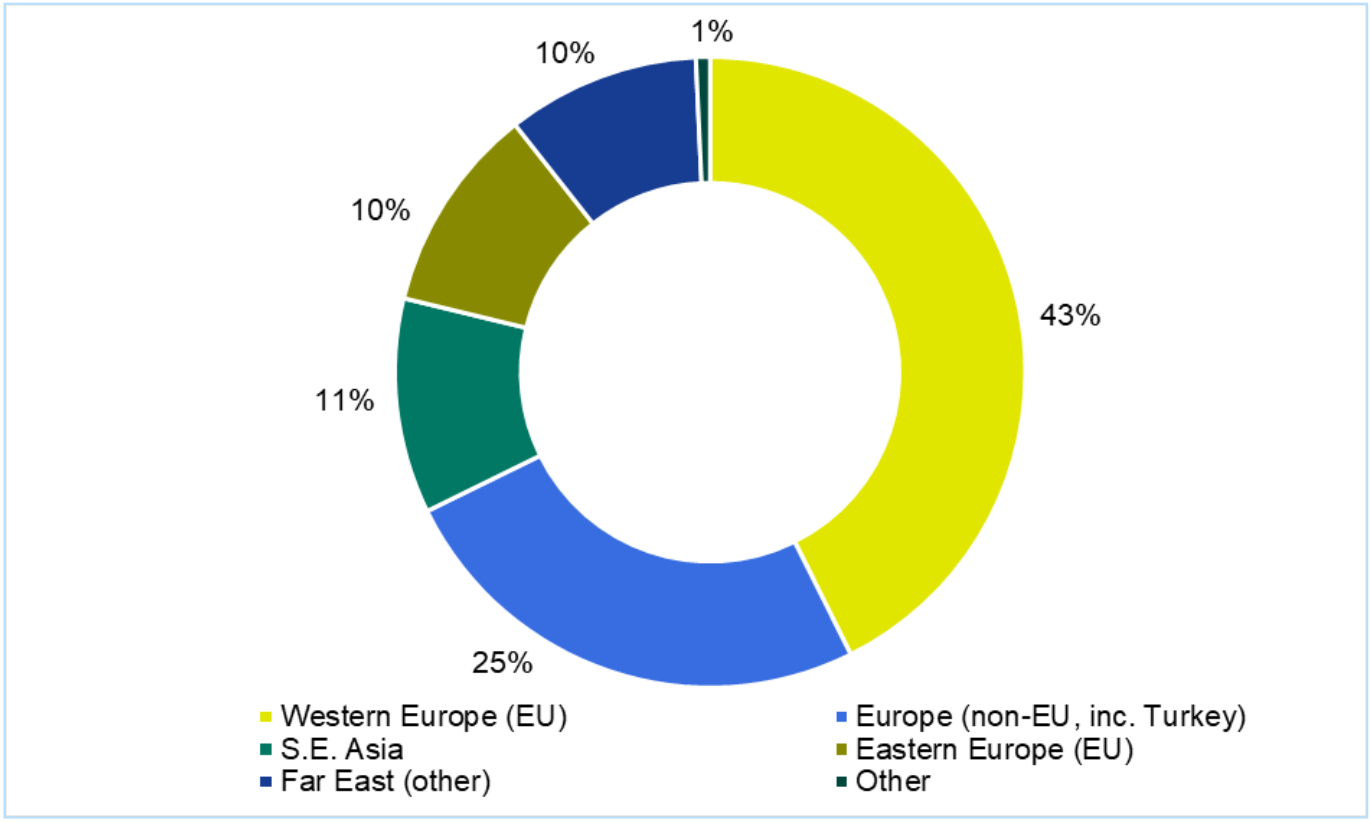
LDPE		
Application	**Examples**	**Indicative usage**
Construction films	Damp proof membranes, building films for temporary protection, gas barrier protection	40%
Plastic bags & sacks	Refuse sacks, recycling sacks, bags for life.	15%
Agricultural films	Crop cover (mulch film)	15%
Other	Packaging, rigid / semi-rigid products, plastic wood.	30%

Based on a conversion rate of 57.5%, 75k tonnes of PET is estimated to be recovered from the recycling process. If 40% of this material is used in the manufacture of new bottles, that would be approximately 30k tonnes of UK PET being utilised in the process.

As a result of the restrictions on imports of post-consumer waste plastic into China implemented at the end of 2017, a lot of the material was diverted to South East Asia and Turkey. Although some recycled pellet will be used in domestic applications, these markets often supply some back into China. It is likely that domestic end markets in Turkey would be broadly similar to those in Asian markets, for example, recycled PET used in the production of polyester fibre. Since the Plastic Flow 2025 report was published, the end markets for recycled LDPE polymer have changed. It is thought that more is used in film applications, such as construction films and plastic bags, and slightly less in agricultural film production and foamed applications.

A Freedom of Information Act request was made to the Environment Agency for information on where UK waste plastic packaging was exported to in 2019. Reproduction of this data is subject to the conditions set out in the Open Government License version 3.0. Please see conditions here:
http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Figure 9 – Export Destinations for UK Plastic Packaging Waste by Region, 2019 (%)



Conclusions and Recommendations for Further Work

Conclusions: POM

The project's estimate of UK plastic packaging POM for 2019 is 2,290k tonnes +/- 6%: a decrease of 71k tonnes[14] from previous figure of 2,361k tonnes for 2017[15].

The POM figure is the most robust estimate that can be derived using a variety of the most authoritative methods, including industry estimates, Valpak data and publicly available data.

Plastic packaging POM in the consumer sector is estimated to be 1,447k tonnes +/- 7% in 2019.

This is based on primary data alongside reliable market share data. No other method is used for deriving consumer data as this method is considered the most robust available and is accepted by industry as such.

Plastic packaging POM in the non-consumer sector is estimated to be 843k tonnes +/- 12% in 2019.

For film, this method is based on a combination of primary (survey) data and secondary research. For rigids, this is based on the findings of the WRAP/ Valpak report into rigid packaging in the C&I sector and on secondary research.

It is likely that increased sales of products using plastic packaging have been offset by light-weighting activity between 2019 and 2017.

The plastics packaging industry has believed for some time that packaging producer activity to light-weight plastic packaging[16] has negated any potential growth in consumption and the results of this work would seem to support this assumption.

Plastic drinks packaging is estimated to account for 401k tonnes of the total POM in 2019.

Valpak EPIC data and additional market data suggests that 73% of this tonnage is sold via the retail or consumer market and 27% via the non-consumer or hospitality sector, with 113k tonnes being HDPE, 286k tonnes PET and 2k tonnes other polymers. This figure are cross-checked with industry and published industry data.

Conclusions: Recycling

The UK's domestic plastic packaging recycling rate in 2019 is between 45% and 51%.

If measuring recycling (by weight) on entry to a reprocessor, the UK's domestic plastic packaging recycling rate is estimated at 51% (1,172k tonnes recycled). If measured after conversion on exit from reprocessing, the rate is lower at 45% (1,037k tonnes recycled).

The consumer plastic packaging recycling rate for the UK in 2019 is between 32% and 38%.

If measuring recycling (by weight) on entry to reprocessing, the UK's consumer plastic packaging recycling rate is estimated at 38% (549k tonnes recycled). If measured after conversion on the exit of reprocessing, the rate would be lower at 32% (465k tonnes recycled).

The non-consumer plastic packaging recycling rate for the UK in 2019 is between 68% and 74%.

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[14] 71k tonnes is a decrease of 3%. As the error margin around the total plastic POM figure is 6%, it is possible that there has been no real increase in POM.
[15] https://www.valpak.co.uk/more/material-flow-reports/plastic-flow-2025
[16] Including down-gauging activity.

If measuring recycling on entry to reprocessing, the UK's consumer plastic packaging recycling rate is estimated at 74% (623k tonnes recycled). If measured after conversion on the exit of reprocessing, the rate would be lower at 68% (572k tonnes recycled).

The non-consumer film recycling rate for the UK in 2019 is unfeasibly high.

The recycling rates of non-consumer film are estimated at 121-130%[17]. Based on a more feasible recycling rate of 70-80%, there remains 144-179k tonnes of non-consumer film recycling that cannot be identified. One explanation for this could be the incorrect allocation of PRN/ PERNs against either non-packaging film for non-UK packaging. Alternatively, or in addition, it could suggest that the non-consumer film POM estimate is low.

Conclusions: Plastic Packaging End Markets

The main application for UK recycled PET is in sheet applications such as trays.

Approximately 55% of UK recycled PET is made into sheet, which in turn is used for applications such as plastic trays. The majority of PET not used in this way is used to make new plastic bottles.

UK recycled HDPE is used comprehensively in a variety of applications, such as packaging, construction, horticultural and outdoors.

Approximately 45% of UK recycled HDPE is used in the packaging sector, a further 35% in the construction sector and 15% in horticultural & outdoors applications. The remainder is used in a variety of products such railway sleepers, garden furniture and boxes.

UK recycled PP is predominantly used to make automotive products and packaging.

Approximately 40% of UK recycled PP is used in automotive products and a further 40% in packaging.

UK recycled LDPE is mainly used to make new films for construction, bags, sacks and agriculture.

Approximately 40% of UK recycled LDPE is used for construction films, 15% for plastic bags & sacks and around 15% for agricultural films. The remainder is used in other applications such as packaging and the production of plastic wood.

Recommendations for Further Work

C&I plastic packaging film/rigids

The estimate of C&I film packaging appears low in comparison to the rigids figure. Furthermore, non-consumer film POM as a whole appears low when used to calculate non-consumer film recycling rates. This report recommends further work in this area to improve data accuracy.

Non-consumer film being allocated PRN/PERNs

In 2019 there was an unaccounted 73-107k tonnes of non-consumer film recycled: this may in part be due to a low POM estimate but may also be due to the incorrect allocation of PRN/PERNs to non-packing films or non-UK packaging film. This report recommends further work in this area to improve data accuracy.

[17] *An unfeasibly high non-consumer film recycling rate was also reported in the Plastic Flow 2025 report. It was outside the scope of this project to follow the recommendations made within the Plastic Flow 2025 report, however this report acknowledges that further work is needed in this area to improve data accuracy.*

Contents

Figures

Appendices

Glossary

ACP – Advisory Committee on Packaging

bn – billion

BPF – British Plastics Federation

CA – Civic amenity

C&I – Commercial and Industrial

C&D – Construction and demolition

DRS – Deposit Return Scheme

EA – Environment Agency

EfW – Energy from Waste

EPIC – Environmental Product Information Centre

FPA – Foodservice Packaging Association

HDPE – high-density Polyethylene

HWRC – Household waste recycling centre

INCPEN – Industry Council for Packaging & the Environment

k – Thousand

kt – Thousand tonnes

LA – Local authority

MRF – Materials Recovery Facility

NPWD – National Packaging Waste Database

ONS – Office of National Statistics

PE – Polyethylene

PERN – Packaging Export Recovery Note

POM – Placed on the market

PP – Polypropylene

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

PRN – Packaging Recovery Note

PS – Polystyrene

PTT – Pots, Tubs and Trays

PVC – Polyvinyl Chloride

RECOUP – Recycling of Used Plastics Ltd

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

SEPA – Scottish Environment Protection Agency

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

WDF – Waste Data Flow

WRAP – Waste and Resources Action Programme

Acknowledgements

Valpak Limited, the Industry Council for Packaging and the Environment (Incpen) and the Waste Resources Action Programme (WRAP) would like to thank the following organisations for their contributions to the plastic PackFlow Covid-19 project:

- The Advisory Committee on Packaging (ACP)
- The British Plastic Federation (BPF)
- Berry
- The Department for the Environment, Food and Rural Affairs (DEFRA)
- The Department of Agriculture, Environment and Rural Affairs (DAERA)
- The Environment Agency (EA)
- The Foodservice Packaging Association (FPA)
- The Packaging Federation
- Plastics Europe
- Recycling of Used Plastics Ltd (RECOUP)
- The Recycling Association
- The Scottish Environment Protection Agency (SEPA)
- The Scottish Government
- The Welsh Government
- Wastepack
- The Waste and Resources Action Programme (WRAP)
- Zero Waste Scotland (ZWS).

1. Introduction

1.1. Background

The PackFlow Covid-19 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 potential implications of lockdown and the ensuing recession on packaging materials flows, packaging materials collection & recycling, and to assess potential compliance risks versus the packaging targets.

The PackFlow Covid-19 project has two phases:

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- Updates baseline year to 2019 for estimates of packaging materials POM collections, recycling and end markets (from 2017 in the previous flow reports[18]).

Phase II

- Collates data and market intel on impact of the Covid-19 lockdown (materials flow, collections, recycling and end markets)
- Develop scenarios for packaging materials flow and recycling from 2020 to 2022
- Assess potential compliance risks versus targets.

To support Defra, Governments and other industry stakeholders in their packaging policy work and assist other industry stakeholders, this Phase I report focuses on generating robust estimates of UK plastic packaging placed on the market (POM)[19] that are as accurate as is reasonably possible. The report also considers the quantities of plastic packaging recycling, both in the UK and abroad, and provides insights into the end markets and products that are manufactured by plastic packaging recyclers in the UK.

1.2. Phase I Objectives

The PackFlow Covid-19 Project for plastic packaging has the following key objectives for Phase I:

- Provide updated (and cross-checked) baseline estimates of plastic packaging placed on the UK market in 2019, by packaging format, polymer type, stream and source:
  - Format (bottles, PTTs, film, etc)
  - Polymer (PET, HDPE, PP, PS etc)
  - Stream (consumer, non-consumer)
  - Source (handled by obligated producers who are registered, non-obligated plastic packaging)
- Estimate the quantities of plastic packaging collected through CA sites, kerbside and pick-up collections and other collection types, by stream;
- Estimate the quantities of plastic 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 plastic packaging that is recycled (i.e. is recorded as accredited recycling) and plastic packaging that is recycled but does not generate a PRN/PERN (i.e. is unrecorded or unaccredited).

[18] The previous packaging materials flow reports can found at https://www.valpak.co.uk/more/material-flow-reports .
[19] 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

In order to calculate plastic packaging recycling rates, the quantity of plastic packaging recycled is divided by the quantity of waste arisings. However, it is commonly accepted, and indeed is accepted by the EU, that establishing packaging POM is an appropriate method of estimating packaging waste arisings.

Using packaging POM as an estimate of packaging waste arisings has recently been called in to question by Eunomia (2018)[20] in the context of calculating plastic packaging recycling rates, particularly as estimates of waste arisings established through composition analysis applied to waste data collated from multiple sources, tend to present higher results. This report claims that the PRN data is likely to be subject to systematic underestimation, as companies have a vested interest in under-reporting their POM. It suggests that this might have resulted in an underreporting of POM and an overestimate of the recycling rate.

While the approach is valid, it (like any methodology) has several significant limitations, relying on accurate data for:

- The composition of household waste;
- Waste arisings from local authorities; and
- Waste arisings and composition from commerce and industry.

The justification of the use of POM data over alternatives is provided in full in section 1.3.1. of Plastic Flow 2025[21]. An overview of how the POM and recycling rates are calculated for this project is provided below.

1.3.1. POM

Plastic packaging POM was estimated using a bottom-up approach, that references a variety of data sources of plastic packaging products placed on the market combined with a gathering of data and estimates from industry. The results of this method have been cross-checked against an assessment of the plastic packaging POM reported on the National Packaging Waste Database (NPWD) by obligated producers. The baseline year was 2019. However, where 2019 data was not available the most recent available data was used.

1.3.1.1. POM Method (Bottom-Up Approach)

This approach built up the POM figure using a variety of components, based on the key sectors for plastic packaging including:

- Plastic packaging around food/drinks/other groceries, including body care/clothing/DIY products etc., as sold by supermarkets and other non-grocery retailers, sourced from the Environment Agency and Valpak's EPIC database[22];
- Plastic packaging around food/drink as consumed in the hospitality sector, sourced from Valpak's EPIC database[23];

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[20] *Eunomia: Plastic Packaging – Shedding Light on the UK Data, http://www.eunomia.co.uk/reports-tools/plastic-packaging-shedding-light-on-the-uk-data/*

[21] *http://www.wrap.org.uk/content/plasticflow-2025-plastic-packaging-flow-data-report*

[22] *The database is based on information collected direct from suppliers as well as information sourced internally, meaning that it holds a wide coverage of information across multiple product ranges. Product specific data collection is completed through site visits, supplier mailings and weighing in-house (purchasing product and collecting used product from staff). All data goes through a comprehensive checking process on receipt and is stored in Valpak's bespoke software Environmental Product Information Centre (EPIC).*

[23] *The database is based on information collected direct from suppliers as well as information sourced internally, meaning that it holds a wide coverage of information across multiple product ranges. Product specific data collection is completed through site visits, supplier mailings and weighing in-house (purchasing product and collecting used product from staff). All data goes through a comprehensive checking process on receipt and is stored in Valpak's bespoke software Environmental Product Information Centre (EPIC).*

- Plastic packaging discarded by retailers back of store, obtained through a survey undertaken for the purposes of this study;
- Plastic packaging used by the construction industry, based on secondary research sources, such as the Green Construction Board and BRE, using the same approach as in Plastic Flow 2025;
- Plastic packaging used in the manufacturing industry, using the POM calculated in Plastic Flow 2025, which was sourced from Steering Group member data and that collected in a survey as part of the Valpak/WRAP 2015 C&I Plastic Packaging[24] project; and
- Plastic packaging used in agricultural sector, based on Valpak report, 'UK AWP Waste Arisings, Valpak 2007', based on 2006 data.

The detail of how the amount of rigid and film plastic were estimated is given in section 2.

1.3.1.2. POM Cross-check (Net Pack Fill)

The cross-check compiled plastic packaging data reported by obligated companies into the NPWD. The estimate is thought to capture the vast majority of the relevant quantity but does omit the plastic packaging handled by non-obligated companies, free-riders (those companies who are above the packaging obligation threshold by having a turnover of £2 million and handling 50 tonnes of packaging or more but are not registered with the relevant agency) and packaging for internal company use, which is non-obligated packaging under the regulations.
To estimate the amount of packaging placed on the UK market by obligated companies, the calculation set out below was applied. This calculation uses the total data reported by obligated packaging producers and is available on the NPWD website[25]:

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

Due to the impacts of Covid-19 and the lockdown, it is anticipated that a number of late registrants in 2020. Valpak therefore undertook two methods to adjust the aggregated data tables provided by the Environment Agency under FOI to try and estimate the totals that would be expected in the final data tables. These methodologies are outlined in the PackFlow Covid-19 Phase II report[26] – following a discussion with the Steering Group, Valpak selected 'method 2' as the most appropriate for plastic.

1.3.2. Recycling

The level of accredited reprocessing (that which is eligible to raise a PRN/PERN) was established using a combination of a bottom-up (UK recycling and all format/polymer splits) and a top down approach (exports). Collection, recovery in[27] and recycling out[28] estimates were made for plastic packaging recycled in the UK from consumer and non-consumer waste streams. PERNs reported as issued in 2019 in NPWD were used as a proxy for plastic packaging exported for recycling.

Primarily, UK recycling estimates (and export polymer/ format splits) were made from the findings of a survey and discussions with over twenty UK reprocessors and exporters. All gathered information and internal project team knowledge were input into an Excel model, which was used to generate estimates. RECOUP's Local

[24] http://www.wrap.org.uk/sites/files/wrap/Rigid_Plastic_Packaging_report_0.pdf
[25] www.npwd.environment-agency.gov.uk
[26] https://www.valpak.co.uk/more/material-flow-reports
[27] *Plastic packaging waste accepted for recycling (input)*
[28] *Recycled polymer produced (output)*

Authority survey results[29] on the quantity of plastic packaging collected for recycling from the consumer sector were also fed into the model. Although this is based on 2018 collections, it was believed that these would be a close proxy for 2019. The estimate for plastic packaging recycled in the UK was cross-checked with the number of PRNs that were raised on plastic according to figures submitted to NPWD.

Accredited reprocessing is likely to be an underestimation as it is related to the level of PRNs raised; however, some additional recycling (unaccredited) may be carried out without a PRN being raised. The unaccredited reprocessing was estimated by using the number of reprocessors and exporters that were believed to be operational but not accredited in 2019, and the packaging they would normally handle as a proxy, providing a minimum quantity. Valpak's procurement team provided an estimate on the proportion of unaccredited reprocessing based on their industry expertise.

1.3.3 Data Robustness

As there are levels of uncertainty around the data used to establish the various elements that are combined to make the total POM, consumer, non-consumer and total plastic packaging POM are presented with error margins, providing a range around the estimate. The robustness scores established for each data piece used are presented in Appendix II and these have been converted into a percentage and related to appropriate indicative margins of error[30], as shown below. The respective margins of error are provided throughout the report.

Figure 10 – Relating Robustness Scores to Indicative Margins of Error

Robustness Score			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 an indicative margin of error for the total POM, the margins of error for the sub-elements that make up the total are converted to tonnages and then expressed as an overall percentage using a Root of Sum of Squares calculation (to approximate the overall error of a summation of subcategories with different error margins).

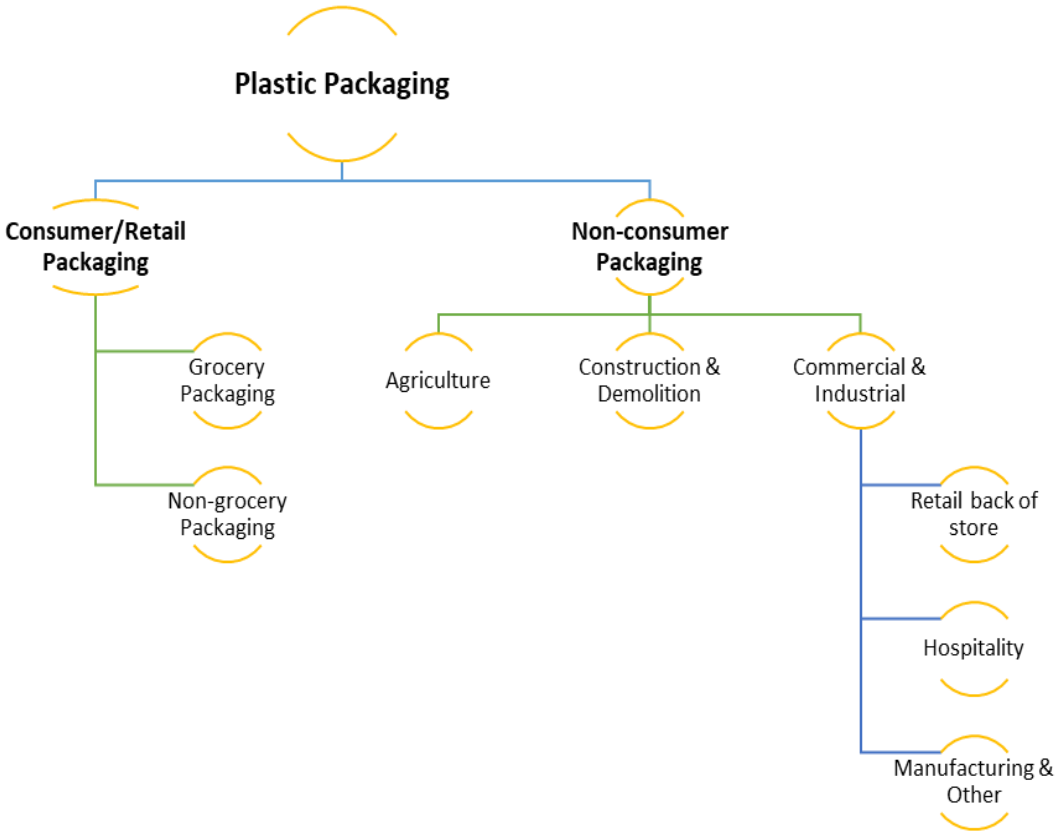
[29] *RECOUP's most recent survey based on 2019 data was not published at the time of writing this report and so the 2019 survey (based on 2018 data) was used.*
[30] *These are assumed to be indicative estimates of error margin and not the outputs of a statistical calculation.*

2. Plastic Packaging POM (Bottom-Up Approach)

2.1. Introduction

This section of the report provides an explanation of the method used to review the total plastic packaging POM in the UK in 2019. This method splits the POM into different elements and builds a picture from the bottom to the top. The key elements are shown in Figure 11.

Figure 11 – Plastic Packaging POM - Sector Breakdown



Packaging is considered plastic if plastic is the predominant material by weight in a composite[31].

2.2.Consumer POM

2.2.1. Grocery Retail

In order to estimate the amount of packaging POM by the grocery retail market, aggregated Environment Agency (EA) data was used. The data provided by the EA was 2019 plastic quantities reported in Table 1

[31] *The EA definitions of composite and multi-layered packaging are defined in, the 'Agreed position and technical interpretations – producer responsibility for packaging'. Composite packaging is: 'multi-layered sheets of dissimilar materials which are bonded together and cannot be separated by hand', such as laminated paperboard, whereas multi-material packaging is: 'packages constructed of assembled components of different material', such as a blister pack made from cardboard and plastic and can be separated by hand. Within the technical interpretations guidance, the packaging weight for laminate packaging 'should be recorded under the predominant material by weight', compared to multi-material packaging weights, which should be recorded separately, by the different component materials.*

Selling from NPWD (less exports) for 84% of UK grocery retailers[32]. This data was scaled up to 100% of the UK grocery market and resulted in an estimated plastic POM for 2019 of 972k tonnes.

This estimate was cross referenced with Valpak's Environmental Product Information Centre (EPIC)[33] which was assessed to provide data on annual sales and packaging weights for all relevant products packaged in plastic. This was taken from a selection of Valpak's supermarket clients representing a cross-section of grocery retailers in the UK. Using market share information from Kantar World Panel for these supermarkets, which represented 43% of the grocery retail market by sales value for 2019, the resulting quantity of plastic packaging was scaled up to represent an estimate for the UK grocery retail market. This method assumes that the plastic packaging profile of the supermarkets in EPIC is representative of those not represented. The plastic packaging in the grocery retail sector was estimated to be 865k tonnes in 2019. This represents a 2% decline on the consumer grocery retail figures identified for 2017 of 880k tonnes using the same methodology.

The EA data was found to be 11% higher than that produced using EPIC. In previous years the EPIC and EA data have been much more closely aligned and as such EPIC has been used, due to a greater confidence in the quality of the data, greater detail of plastic packaging composition and its representation of the full grocery market. However, based on the EA having higher market coverage and the increasing market share in the grocery sector of discount retailers such as Aldi and Lidl, which are not included in the Valpak data and could have greater packaging use per item, the EA data was selected for use. This was also the approach taken in the Plastic Flow 2025 project.

The grocery POM of 972k tonnes calculated from EA data was then amended based on recommendations from the Steering Group that the POM identified for drinks packaging was too low. Across the grocery and non-grocery retail sectors and hospitality, total drinks POM was estimated to have reduced by 17% from 2017 to 2019. It was felt that this was too big a decrease and that a decline of 10% during that period would be more realistic according to a survey that BPF conducted within their membership. Drinks POM was updated to reflect this, which subsequently altered the grocery, non-grocery and hospitality POM tonnages. More detail on drinks packaging can be found in section 2.8.1.

The final grocery retail plastic packaging POM for 2019 of 987k tonnes +/-6% error margin was therefore used. This is a tonnage increase of 4% of that identified for 2017; such a small difference in tonnage is within the likely margin of error of the estimate and so consumer plastic packaging POM is considered to have remained at the same level as 2017.

Appendix II provides a detailed assessment of relative levels of confidence in the data.

2.2.2. Non-grocery Retail

To scale up the grocery retail result to represent total UK retail, including non-grocery retail, the Office of National Statistics (ONS) retail sales data was used. This shows that the proportion of grocery spend of total UK retail spend was 43% in 2019[34].

However, simply scaling up using market share was not considered robust, since it was likely that packaging usage within both sub-sectors differed. Therefore, this difference in plastic packaging used by the grocery sector and other retail sectors was analysed using Valpak membership's reported data[35]. Analysis involved the following key stages:

- Identification of grocery and non-grocery retail members;

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[32] The figure does not include free-riders or non-obligated producers.

[33] The database is based on information collected direct from suppliers as well as information sourced internally, meaning that it holds a wide coverage of information across multiple product ranges. Product specific data collection is completed through site visits, supplier mailings and weighing in-house (purchasing product and collecting used product from staff). All data goes through a comprehensive checking process on receipt and is stored in Valpak's bespoke software Environmental Product Information Centre (EPIC).

[34] https://www.ons.gov.uk/businessindustryandtrade/retailindustry/datasets/poundsdatatotalretailsales

[35] Valpak membership represents approximately one third of all obligated companies, by obligation. The entire NPWD database was considered for analysis; however, for confidentiality reasons it was not possible to gain access to NPWD to conduct the same analysis on the complete dataset.

- Gathering of company reported data and information; and
- Calculation of plastic packaging tonnage per £billion turnover for grocery and non-grocery retailers (using Valpak data).

The method used assumes the packaging profile of those retailers within the sample is representative of those not in the sample and that turnover is a suitable scaling factor for packaging usage.

In addition to wholesale supply of soft drinks to non-grocery retailers (estimated through EPIC), soft drinks are also supplied to outlets directly from manufacturers, or indirectly from manufacturers through distribution companies. It is estimated that the tonnage of PET soft drinks bottles unaccounted for using Valpak EPIC data only is approximately 4k tonnes and this has been included in the Total Non-grocery POM figure provided below. Valpak were able to establish this estimate by comparing the estimated proportion of units sold of soft drinks in plastic established in EPIC, with the proportion of soft drinks volume sold in plastic[36].

The total estimate of non-grocery POM is 460k tonnes (+/- 18%).

2.2.3. Total Consumer POM

In summary the following key steps were taken to estimate total consumer retail plastic packaging POM (consumer grocery retail + consumer non-grocery retail) in 2019:

Total grocery plastic packaging flow in 2019 (see section 2.2.1)	972kt
Proportion of grocery spend of total retail spend in the UK in 2019[37]	43%
Total retail plastic packaging flow, assuming like for like packaging[38]	2,287kt
Non-grocery plastic packaging tonnes/£bn turnover as a proportion of grocery plastic packaging tonnes/£bn turnover[39]	35%
Applied 35% to the difference in tonnage between grocery (972kt) and total retail (2,287kt) and added in 4kt direct from manufacturer soft drinks sales to get the total non-grocery	460kt
Added the 15kt of plastic drinks bottles to grocery POM based on a 10% decline from 2017 to 2019 instead of 17%.	987kt
Total	**1,447kt**

Therefore, total retail plastic packaging flow in 2019 was estimated at 1,447k tonnes +/- 7%. This is a 6% decrease to the 2017 estimate for consumer plastic packaging POM of 1,532k tonnes and supports the project Steering Group's view that any growth in sales has largely been negated by packaging light-weighting.

2.3. Consumer POM Composition

2.3.1. Methodology

To provide a breakdown by format and polymer of consumer plastic packaging, supermarket packaging composition was used as a proxy for grocery packaging, but only the non-grocery categories of supermarket

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[36] UK Soft Drinks Report 2020, British Soft Drinks Association

[37] 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.

[38] Grocery packaging is scaled up to full retail based on the proportion of grocery spend of total retail spend in the UK, with grocery being assumed to be 43% of the retail market, and non-grocery assumed to be the remainder at 57% of the total retail market.

[39] Plastic packaging usage calculated from Valpak member data as: grocery 4,676 tonnes /£bn and non-grocery as 1,622 tonnes /£bn

packaging (around toys, electrical, clothing, etc.) were used as a proxy for non-grocery packaging. This follows the same methodology as Plastic Flow 2025.

In addition to non-grocery items, a certain quantity of drinks are sold through non-grocery retailers, although far less than is sold through supermarket groceries. For example, drinks are sold in shops such as Boots, Poundland and Wilko, and milk is also sold direct to consumers from farms and through doorstep delivery[40]. Allowances have been made for these non-grocery drinks sales in the non-grocery composition. For further details on drinks composition, please see section 2.8.1.

2.3.2. Results

The estimated composition of consumer plastic packaging in the UK is shown below.

Figure 12 – Consumer Plastic Packaging by Format and Polymer, 2019 (k tonnes)

	HDPE	LDPE	PE	PET	PP	PS	PVC	Other	Grand Total	
Bottle	274	0	2	348	17	0	0	1	643	*44%*
Film	16	103	17	43	80	4	3	46	311	*22%*
Other	43	21	3	44	77	2	1	2	194	*13%*
PTT	5	0	3	164	92	28	3	4	300	*21%*
Grand Total	338	125	24	599	266	35	7	53	1,447	
	23%	*9%*	*2%*	*41%*	*18%*	*2.4%*	*0.5%*	*4%*		

The category ‘Other’ includes elements of packaging such as caps & lids, toothpaste tubes, chocolate/sweet wrappers, egg boxes, blister packs and clothing hangers.

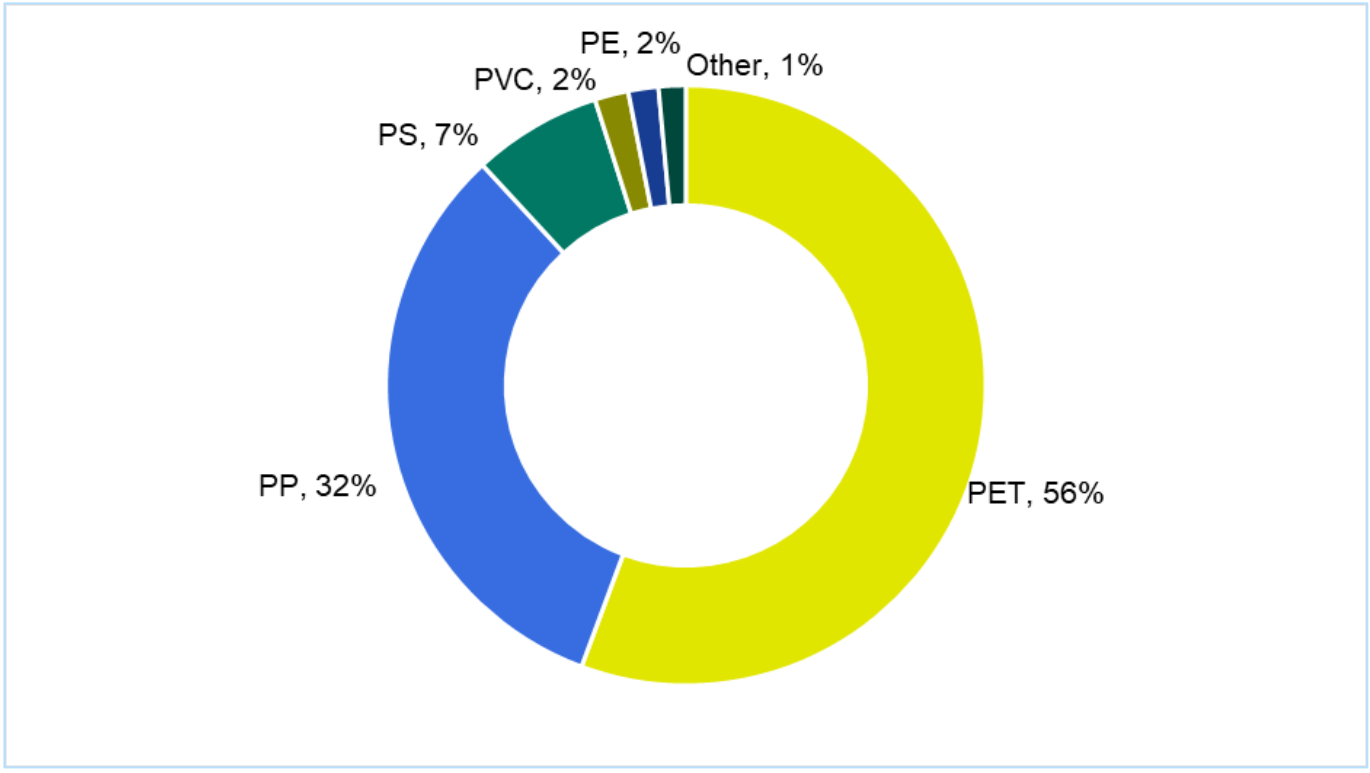
The estimated 2019 format splits are similar to those estimated for 2017 consumer plastic packaging in the Plastic Flow 2025 project, with less than 5%-point difference in each format. The polymer splits are comparable to those identified in 2017, also showing less than a 5%-point difference across polymer types.

[40] *Milk supplied through these routes is outside of traditional grocery and non-grocery retail and therefore would not be captured by the grocery calculations or non-grocery calculations and must instead be calculated separately.*

2.4. Consumer PTT Composition Update

After interrogating and analysing data from Valpak's EPIC database, it is estimated that just over half (56%) of PTTs are made of PET. The second most popular polymer is PP, constituting around one third of PTTs in the UK[41].

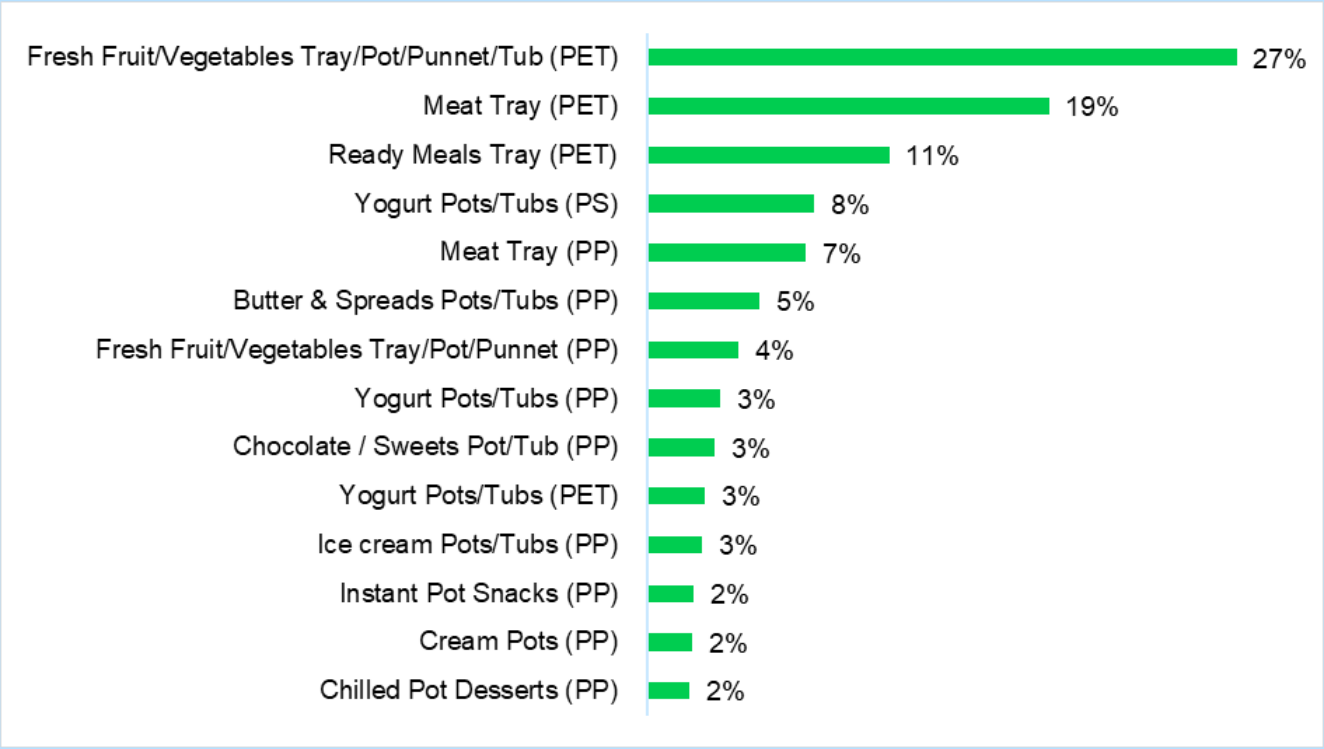
Figure 13 – Polymer Split UK PTTs, 2019 (%)



Further interrogation of the database showed that nearly half of PET used in PTT is used to package fruit and vegetables. Fruit and vegetable punnets, butter and spread tubs and meat trays account for just over half of PP PTTs.

[41] *Polymer composition of PTTs as given in this analysis vary slightly from those provided in the overall POM composition table. This is due to the film element of PTTs (closures, lids, etc) being included as part of PTTs in this analysis, but being included within the film category of the overall POM composition table. Including the film element of PTTs in this analysis allowed for comparison with previous work undertaken.*

Figure 14 – Key PTT Applications, 2019 (%)



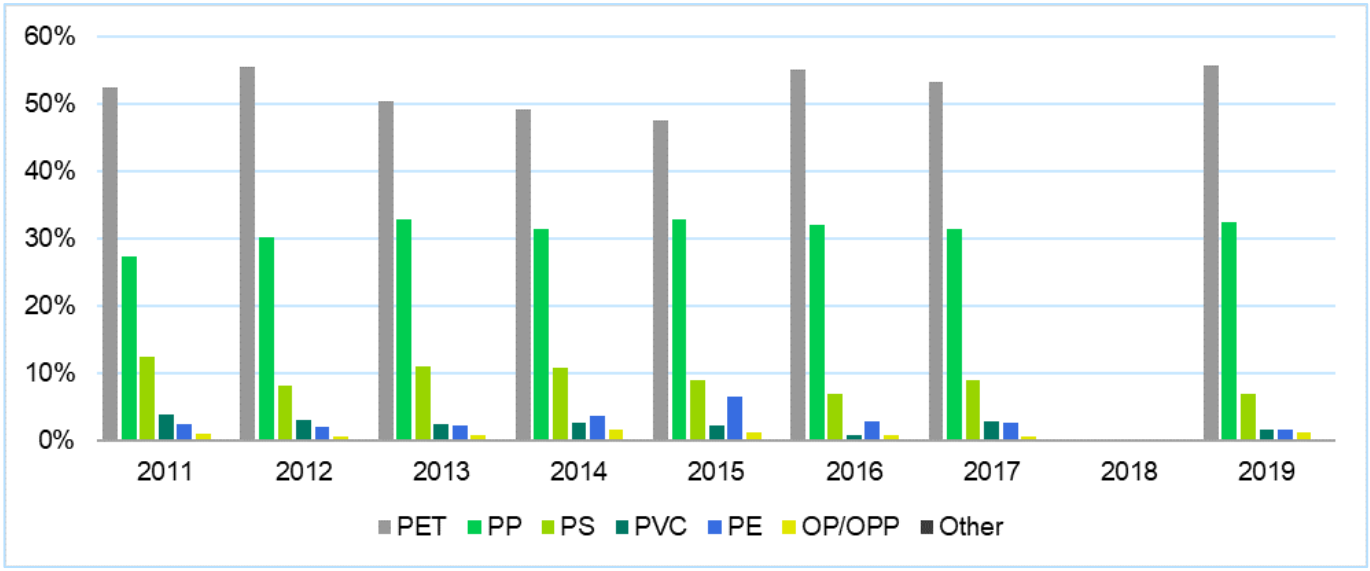
PET PTTs are considered 'less recyclable' because they are more brittle than bottle grade PET[42] even though PTTs are readily collected in the UK (~81% of LAs collect PTTs[43]).

[42] *https://www.letsrecycle.com/news/latest-news/ptt-plastic-going-to-efw-recoup-claims/ and RECOUP Local Authority Plastics End Market Analysis (May 2019)*
[43] *RECOUP UK Household Plastics Collection Survey 2019*

2.4.1. Polymer Switching Trends

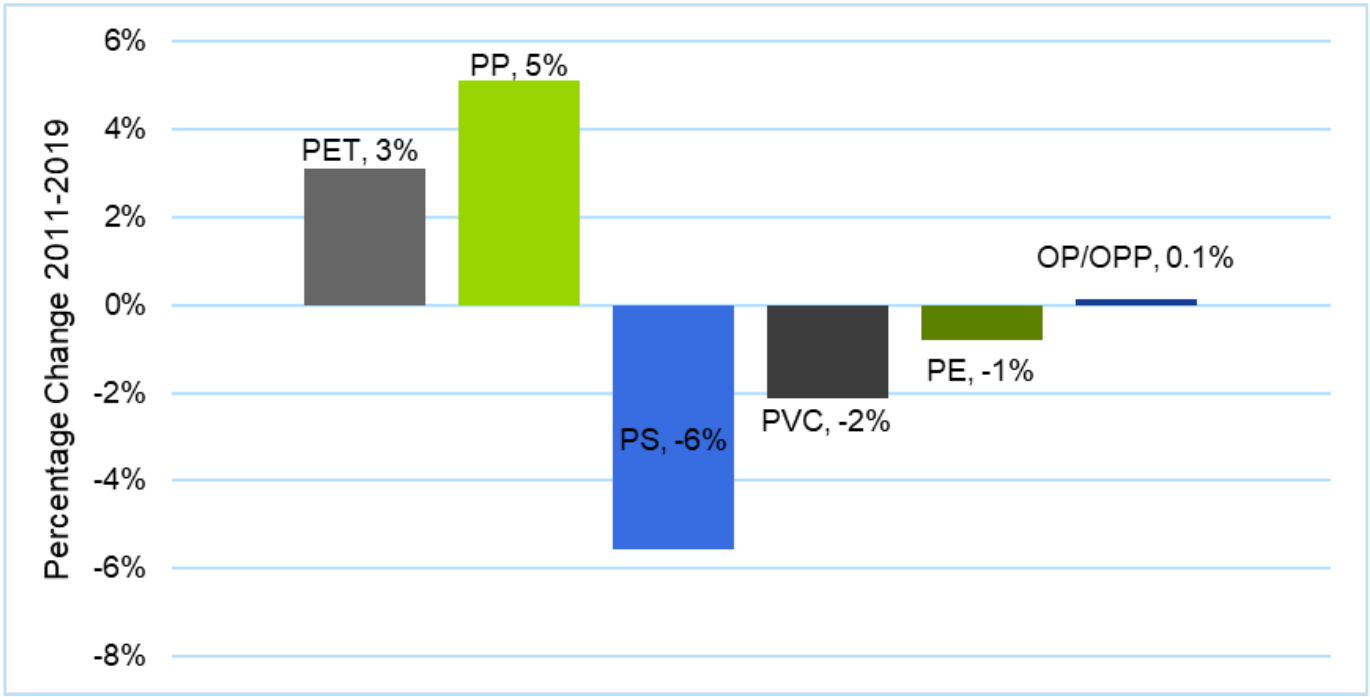
Comparing 2019 EPIC data to snapshots taken in 2011 through to 2019, there is a reducing proportion of PS and PVC used in PTTs. There is no data for 2018 because the aim of this project was to update the previous estimate of plastic packaging POM from 2017 to 2019, which would then act as the baseline for future projections. PTT polymer usage within 2018 was not seen as essential to this specific project, and based on the changes from 2017 to 2019, it is unlikely that 2018 would have been significantly different.

Figure 15 – Polymer Split Snapshots, 2011-2019



This data also shows an increase in the proportion of the 'more recyclable' polymer PP between 2011 and 2019.

Figure 16 – Change in PTT Polymer Usage, 2011-2019



It is impossible to say from our data set whether these changes represent switching from one polymer type to another, as factors such as light weighting may also have had an impact. Be that as it may, initiatives such as the UK Plastics Pact may have influenced polymer switching out of PS and PVC[44].

2.5. Consumer Grocery POM by Category

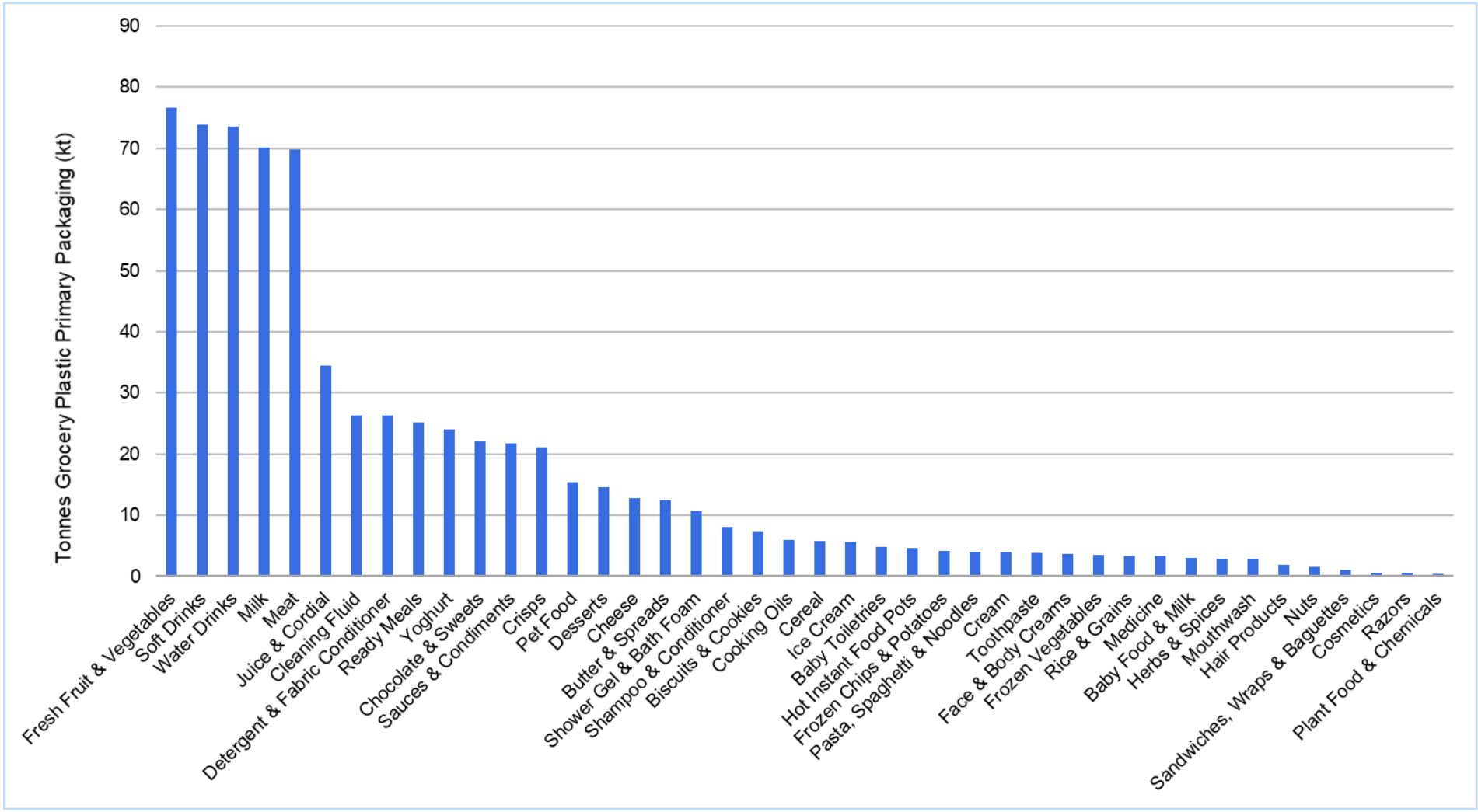
It was considered of interest to identify the plastic primary packaging POM used for key product categories. Valpak used its EPIC database covering 42.7% of the UK grocery market and scaled this up to represent 100% of grocery sales[45]. The data presented in the chart covers all plastic primary packaging attributed to each of the identified categories sold via the grocery market[46].

[44] https://www.wrap.org.uk/content/eliminating-problem-plastics PS and PVC packaging are included in the list of eight problem plastics to be eliminated by the end of 2020, to feed into the UK Plastics Pact 2025 targets.

[45] Data included in the chart relates to the grocery market only, not total sales made to consumers or those made through the hospitality sector for example.

[46] This is a selection of categories of interest and does not account for all plastic primary packaging handled by the sector.

Figure 17 – Grocery Plastic Packaging POM by Category across All Formats, 2019 (k tonnes)



The chart indicates that drink products represent the largest tonnage of plastic primary packaging POM by the grocery sector of those categories covered, accounting for around 268k tonnes, with fruit and vegetables representing 77k tonnes, meat 70k tonnes and cleaning fluids 26k tonnes.

2.6. Non-Consumer POM

In order to avoid duplication between consumer and non-consumer packaging (i.e. including packaging within the non-consumer sector that has already been included in the consumer sector) non-consumer waste production is assessed using the bottom-up method[47].

The non-consumer sector is broken down into sub-sectors:

- Construction and demolition (C&D);
- Agricultural; and
- Commercial and Industrial (C&I).

2.6.1. Construction & Demolition

Since the Plastic Flow 2025 report was published in 2018, there has not been any new research into the volumes or composition of plastic packaging waste consumed within the construction and demolition sector. Therefore, the same methodology and assumptions from the Plastic Flow 2025 report for 2017 POM have been used to produce an estimate for 2019 POM, but based on an updated construction spend.

To quantify plastic packaging consumption within the construction industry, a variety of secondary research sources were used, including the finding from UK construction companies surveyed in 2014 that estimated approximately 15% of packaging used in the sector is plastic[48].

In 2014 the BRE Smartwaste Portal was reviewed and using information for data for projects across all industry sectors (commercial, industrial, houses etc.) showed an average 0.3 tonnes of packaging per £100k spend[49]. If this quantity of packaging per spend is applied to the total construction spend of £170 billion[50] (22% higher than in 2017) in the UK estimated for 2019[50], this results in an estimate of 509k tonnes of packaging used in the sector. Applying the estimated plastic composition of 15% as per the finding reported above, gives a figure of plastic packaging arising in the sector in 2019 of 76k tonnes.

Research commissioned by the Green Construction Board[51] (GCB) estimates that 289k tonnes of packaging (all materials) arose in the UK construction sector in 2009. Based on the estimate of total packaging arising in the sector, this would equate to approximately 40k-45k tonnes of plastic packaging. When this was used to estimate 2017 POM using the increase in construction spend reported as a proxy for growth, the 2017 estimate was between 55k to 61k tonnes of plastic packaging in construction. Following the same approach and using the 22% growth in construction spend reported above for 2019, it provides an estimate of between 67k tonnes and 74k tonnes.

Although the upper end of this estimate is within 3% of the 76k tonnes calculated using the Plastic Flow 2025 methodology, it is based on research commissioned by the GCB from 2009, and extrapolations from then should be observed with caution.

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[47] It is assumed that waste production is equal to POM in this case. An example would be where retailer sales is included within consumer but retail back of store waste within the non-consumer sector. The justification for assessing the POM in this way is included in section 1 of this report.

[48] It is recognised that estimating the proportion of plastic packaging used in construction is very challenging, even for those companies active in the sector.

[49] Derived independently of the other similar estimate above using different data.

[50] INDUSTRY INSIGHTS, Construction Skills Network Forecasts 2019-2023, CITB in association with Experian https://www.citb.co.uk/about-citb/construction-industry-research-reports/search-our-construction-industry-research-reports/forecasts/csn-forecasts-2019-2023-uk/

[51] Internal research only.

The final project estimate for the construction sector is therefore 76k tonnes, +/-21% error margin. The film/rigid split identified in the WRAP/ Valpak 2011 plastics packaging composition study[52] has been applied to provide an indicative film (68k tonnes) and rigid (8k tonnes) packaging split. It is also possible to derive an indicative polymer split from the compositional study and this is illustrated below:

Figure 18 – Indicative Composition of Plastic Packaging in C&D, 2019 (k tonnes)

Polymer	Format	% of Arisings	Approximate Tonnage	Film	Rigids
PE	Film	86%	66	66	
PP	Pots	10%	8		8
HDPE	Pots & Bags	4%	3	3	0.3
Total			**76**	**68**	**8**

Appendix II provides a detailed assessment of relative levels of confidence in the data.

2.6.2. Agriculture

As per the Plastic Flow 2025 report, figures relating to plastic packaging used around goods consumed in the agricultural sector are derived from the Valpak report, 'UK AWP Waste Arisings, Valpak 2007', based on 2006 data. The total for rigids and film is 37k tonnes +/- 21%. This dataset is relatively old, and evidence would suggest[53] that total crop output has increased by 22% since 2006. However, as there has also been down-gauging of most non-consumer films and light weighting of rigid plastic containers, it is believed[54] the total tonnage remains about the same.

The film/rigid split identified in the WRAP/Valpak 2011 plastics packaging composition study[55] has been applied to provide an indicative film (30k tonnes) and rigid (7k tonnes) packaging split. It is also possible to derive an indicative polymer split from the compositional study and this is illustrated below.

Figure 19 – Indicative Composition of Plastic Packaging in Agriculture, 2019 (k tonnes)

Polymer	Format	% of Arisings	Approximate Tonnage	Film	Rigids
PE	Film	56%	21	21	
PP	Film	26%	10	10	
HDPE	Bottles	14%	5		5
HDPE	Cores	4%	1		1
Total			**37**	**30**	**7**

Appendix II provides a detailed assessment of relative levels of confidence in the data.

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[52] http://www.wrap.org.uk/sites/files/wrap/Plastics%20Composition%202011%20Report.pdf

[53] https://www.gov.uk/government/statistical-data-sets/agriculture-in-the-united-kingdom - *volume of cereals harvested has increased by 22% since 2006.*

[54] *Plastic Packaging Data Flow Project Steering Group*

[55] http://www.wrap.org.uk/sites/files/wrap/Plastics%20Composition%202011%20Report.pdf

2.6.3. Commercial & Industrial

For the purposes of this work, the commercial and industrial sectors were broken down into three key sub-sectors:

- Retail back of store;
- Hospitality; and
- Manufacturing and other.

2.6.3.1. Retail Back of Store

The quantity of plastic packaging discarded by grocery retailers at back of store was derived from surveying retailers during June/July 2020, with data collected representing 43% of the grocery retail market. Data was then scaled up to UK level for grocery. The final figure for grocery retail back of store was 68k tonnes of plastic packaging, which represents a decrease of 13% since 2017 (78k tonnes).

This was then scaled up to include the non-grocery retail back of store plastic packaging. However, simply scaling up using market share was not considered robust, since it was likely that packaging usage within both sub-sectors differed. Therefore, this difference in plastic packaging used by the grocery sector and other retail sectors was analysed using Valpak membership's reported data[56]. Analysis involved the following key stages:

- Identification of grocery and non-grocery retail members;
- Gathering of company reported data and information; and
- Calculation of plastic packaging tonnage per £billion turnover for grocery and non-grocery retailers (using Valpak data).

The method used assumes the packaging profile of those retailers within the sample is representative of those not in the sample.

Therefore, the following key steps were taken to estimate total back of store retail plastic packaging consumption in the consumer (retail) sector in 2019:

Total grocery plastic packaging flow in 2019 (see section 2.2.1)	972kt
Proportion of grocery spend of total retail spend in the UK in 2019[57]	43%
Total retail plastic packaging flow, assuming like for like packaging[58]	2,287kt
Non-grocery plastic packaging tonnes/£bn turnover as a proportion of grocery plastic packaging tonnes/£bn turnover[59]	35%
Applied 35% to the difference in tonnage between grocery (972kt) and total retail (2,287kt) and added in 4kt direct from manufacturer soft drinks sales to get the total non-grocery	460kt
Added the 15kt of plastic drinks bottles to grocery POM based on a 10% decline from 2017 to 2019 instead of 17%.	987kt
Total	**1,447kt**

[56] *Valpak membership represents approximately one third of all obligated companies, by obligation. The entire NPWD database was considered for analysis; however, for confidentiality reasons it was not possible to gain access to NPWD to conduct the same analysis on the complete dataset.*

[57] *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.*

[58] *Grocery packaging is scaled up to full retail based on the proportion of grocery spend of total retail spend in the UK*

[59] *Plastic packaging usage calculated from Valpak member data as: grocery 4,676 tonnes /£bn and non-grocery as 1,622 tonnes /£bn*

Plastic Flow 2025 used confidential survey data from two retailers to estimate the split between rigid and film packaging resulting in 2k tonnes rigids and 124k tonnes film. In order to provide an indicative breakdown by polymer type, Valpak/Verde internal knowledge was used, resulting in a film split of 90% LDPE, 5% PP and 5% HDPE. For rigids, a simple 50:50 split was applied between the two most likely polymers of PET and PP[60]. The baseline year for Plastic Flow 2025 was based on 2017 data, and so the same format and polymer splits have been assumed for 2019. The indicative composition of plastic packaging in the Retail BoS sector is shown below.

Figure 20 – Indicative Composition of Plastic Packaging in Retail BoS, 2019 (k tonnes)

	HDPE	LDPE	PET	PP	Total
Bottle					
Film	5	89		5	99
Other					
Rigids			1	1	1
Total	5	89	1	6	100

Appendix II provides a detailed assessment of relative levels of confidence in the data.

2.6.3.2. Hospitality

Hospitality plastic packaging is plastic packaging that is primarily 'household-type' but includes both primary and secondary packaging and is consumed in pubs, cafés, hospitals etc. and tertiary packaging found at back of wholesale store of associated distribution centres. The household-type packaging is generally similar in type as that consumed at home, but may not be collected by a local authority for recycling or disposal, and includes some non-household type packaging such as large tubs and buckets used for items such as oils and sauces.

2019 estimates for the quantity of rigid and film plastic packaging used in the hospitality sector have been updated using newly available Valpak EPIC data relating to 33% of the cash and carry and delivered foodservice industry[61]. Market share information for the companies included in the sample were used to scale up the resulting tonnage to represent the whole foodservice, catering and hospitality sector.

[60] *No further data was available to provide a split between PP and PET, therefore 50:50 was used.*

[61] *Valpak's EPIC database holds sales data and packaging weights information for clients signed up for the fully managed service.*

Figure 21 – Overview of the Foodservice, Catering and Hospitality Sector[62]

Customer ordering platform

£m	Online	Telesales/PLOF	In-depot	Total
Retail	7,962	2,029	5,682	**15,673**
Catering	3,153	5,785	2,008	**10,946**
PBUs	87	1	1,575	**1,663**
Total	**11,202**	**7,815**	**9,265**	**28,282**

Customer fulfilment

£m	Delivery	Collect	Total
Retail	10,023	5,650	**15,673**
Catering	8,987	1,959	**10,946**
PBUs	88	1,575	**1,663**
Total	**19,098**	**9,184**	**28,282**

In addition to foodservice, hospitality and catering suppliers, soft drinks are also supplied to hospitality outlets directly from manufacturers, or indirectly from manufacturers through distribution companies. It is estimated that the tonnage of PET soft drinks bottles unaccounted for using Valpak EPIC data only is approximately 38k tonnes and this has been included in the Total Hospitality figure provided below. Valpak were able to establish this estimate by comparing the estimated proportion of units sold of soft drinks in plastic established in EPIC, with the proportion of soft drinks volume sold in plastic[63]. This comparison highlighted a gap equating to approximately 38k tonnes of PET plastic bottles.

This assessment resulted in a total plastic packaging POM for the hospitality sector of 220k tonnes +/- 15%, approximately 13% higher than the Plastic Flow 2025 report (196k tonnes). This increase was supported by the project Steering Group which indicated that consumers eating habits are changing and that consumption of takeaway meals (and consequently the packaging associated with takeaways) are increasing significantly. The British Takeaway Campaign Report 2019 confirms this, demonstrating that growth in the sector has doubled from 2016 to 2018, with further growth anticipated in future years[64].

Based on the data held by Valpak relating to 33% of the foodservice, catering and hospitality sector, 40k tonnes of this total was film and 181k tonnes was rigid packaging. This represents a change from the 2017 estimates (37k tonnes and 159k tonnes respectively).

It was also noted from the data that 90% of the plastic packaging identified for the sector was primary or consumer packaging and 10% was secondary/tertiary packaging. The proportion of primary packaging has

[62] https://retailanalysis.igd.com/presentations/presentation-viewer/t/uk-grocery--foodservice-wholesaling-2019-sector-performance--statistics/i/9027
[63] *UK Soft Drinks Report 2020, British Soft Drinks Association*
[64] https://www.britishtakeawaycampaign.co.uk/wp-content/uploads/2019/08/BTC-report_FINAL.pdf

increased from 84% in 2017. The figure below illustrates the film and rigid tonnages, broken down by polymer as per Valpak's EPIC hospitality dataset.

Figure 22 – Indicative Composition of Plastic Packaging in Hospitality, 2019 (k tonnes)

	HDPE	LDPE	Other	PE	PET	PP	PS	PVC	Total
Bottle	41	0	0	0	97	0	0	0	139
Film	1	22	6	4	1	5	1	0	40
Other	5	0	0	0	0	3	0	0	10
PTT	16	1	0	1	2	11	1	1	32
Total	62	23	7	5	101	20	2	1	220

Appendix II provides a detailed assessment of relative levels of confidence in the data.

2.6.3.3. Manufacturing & Other

The manufacturing sector includes the following sub-sectors[65]:

- Food, drink & tobacco;
- Textiles/wood/paper/publishing;
- Power and utilities;
- Chemicals/non-metallic minerals manufacturing;
- Metals manufacturing;
- Machinery & equipment (other manufacturing);
- Transport & storage; and
- Other Services.

The rigid packaging element of C&I Manufacturing and Other was the focus of a dedicated project undertaken by WRAP and Valpak in 2015. Manufacturing industry's plastic packaging usage is notoriously difficult to quantify, and the Plastic Flow 2014 project failed to provide a robust estimate for the sector.

Plastic Flow 2025 adopted the rigid plastic packaging figure (292k tonnes) for manufacturing and other established in the 2015 C&I Plastic Packaging[66] project. Due to no new data being available, a film figure for C&I Manufacturing (117k tonnes) was established by subtracting the sum of the other non-consumer sectors' film tonnages from an updated Plastic Flow total non-consumer film tonnage.

UK manufacturing statistics[67] show minimal change in manufacturing output in recent years, and so the tonnages estimated in Plastic Flow 2025 have been assumed to be still relevant. Members of the Steering Group felt that any increase in plastic packaging usage would be largely offset by downgauging. Therefore, the C&I manufacturing and other rigid and film plastic packaging POM are estimated at 292k tonnes and 117k tonnes, respectively.

The quantity of C&I manufacturing and other film estimated in 2017 was comparatively lower than the 2014 estimate of 247k tonnes. Plastic Flow 2025 recommended that further work was undertaken to verify the total

[65] *Commercial and Industrial Waste Survey 2009: Final Report. Defra, 2010.*
[66] http://www.wrap.org.uk/sites/files/wrap/Rigid_Plastic_Packaging_report_0.pdf
[67] http://www.parliament.uk/briefing-papers/SN01942.pdf

non-consumer film estimate and to investigate potential incorrect issuing of PRN/PERNs. It has not been possible to do this within the scope of this project, but it is believed that more work is needed to improve the accuracy of the data.

The project estimates that for the manufacturing & other sector the plastic packaging POM is 409k tonnes +/- 24% in 2019.

Appendix II provides a detailed assessment of relative levels of confidence in the data.

2.6.3. Total Non-consumer POM

A summary of the sectoral estimates for non-consumer POM in 2019 are given in the table below. The final total non-consumer POM estimate is 843k tonnes +/- 12%. Section 2.1 of this report for the method used to establish the margin of error on a total derived from tonnages with differing margins of error.

Figure 23 – Summary of Non-consumer Plastic Packaging POM by Sector, 2019 (k tonnes)

Non-Consumer Plastic Packaging POM				
Sector	**Film**	**Rigid**	**Total**	**Error Margin**
C&D	68	8	76	+/- 21%
Agriculture	30	7	37	+/- 24%
C&I Retail BoS	99	1	100	+/- 15%
C&I Hospitality	40	181	220	+/- 15%
C&I Manufacturing + Other	117	292	409	+/- 24%
Total	**354**	**488**	**843**	**+/- 12%**
Lower Total	**– 12% margin of error**		**738**	
Upper Total	**+ 12% margin of error**		**948**	

This estimate is 2% (13k tonnes) higher than that of 2017 non-consumer plastic packaging POM estimate (830k tonnes); it does not necessarily mean that POM has remained at a relatively consistent level between 2017 and 2019.

The tonnages for agriculture and C&I manufacturing and other have not been changed from the Plastic Flow 2025 estimates.

Whilst the estimates for C&I hospitality and C&D have increased from 2017, C&I Retail BoS has decreased, so where there has been a change in sectoral POM volumes, the overall non-consumer POM tonnage has increased only marginally.

2.7. Summary of Indicative Non-consumer POM Composition

Summing the indicative non-consumer sectors' compositions gives the indicative total non-consumer POM composition shown in Figure 24:

Figure 24 – Summary of Indicative Non-consumer POM Composition, 2019 (k tonnes)

	HDPE	LDPE	PE	PET	PP	PS	PVC	Other	Total	
Bottle	238	0	0	99	0	0	0	0	338	*40%*
Film	8	228	91	1	20	1	0	6	354	*42%*
Other	7	0	0	0	3	0	0	0	11	*1%*
PTT	33	1	1	11	70	23	1	0	139	*17%*
Total	286	229	92	112	94	23	1	7	843	
	34%	*27%*	*11%*	*13%*	*11%*	*3%*	*0%*	*1%*		

Although this non-consumer POM composition is indicative, the format and polymer splits are consistent with those identified for 2017 in PlasticFlow 2025.

2.8. Plastic Packaging POM by Format and Polymer

The combined consumer and non-consumer plastic packaging POM by format and polymer type are summarised in Figure 25.

Figure 25 –Total UK Plastic Packaging POM Composition, 2019 (k tonnes)

	HDPE	LDPE	PE	PET	PP	PS	PVC	Other	Total	
Bottle	512	0	2	447	17	0	0	1	980	*43%*
Film	24	331	107	44	100	4	3	53	666	*29%*
Other rigid	50	21	3	45	80	3	2	2	205	*9%*
PTT	37	1	4	176	162	51	4	4	439	*19%*
Total	623	354	116	711	359	58	8	60	2,290	
	27%	*15%*	*5%*	*31%*	*16%*	*3%*	*0%*	*3%*		

The 2019 total plastic packaging POM is estimated at 2,290k tonnes with film accounting for 29%. The remaining 71% is mainly rigids, however the consumer 'Other' category contains packaging such as toothpaste tubes. Consumer accounts for 63% of plastic packaging POM and non-consumer 37%. The 2019 total plastic packaging POM estimate of 2,290k tonnes is slightly lower than the 2017 estimate of 2,361k tonnes, but still within the +/-6% margin of error.

There is a good degree of confidence in the estimates for the consumer sector with an estimated error margin of only +/-7%. There is, however, a much lower level of confidence in the estimates for the non-consumer sector and an error margin of +/-12% for the total non-consumer figure has been estimated. This is due to the fact that many of the estimates have been derived from single sources (often with small data sets) and it has not been possible to cross-reference them. Appendix II provides a detailed assessment of relative levels of confidence in the data.

2.8.1. Drinks Packaging POM

As a Deposit Return Scheme (DRS) in both Scotland and England is being developed, it was considered of interest to present the plastic primary packaging data relating to the drinks market as a separate category. This data has been derived from the following sources:

- Consumer:
  - Drinks packaging sold via the grocery market has been estimated using Valpak's EPIC database, covering 43% of the UK grocery sales. Drinks packaged in plastic have been identified and the total tonnage scaled up to represent the UK. Some further drinks packaging was identified as sold via non-grocery retailers and this has also been estimated using Valpak's database and included.
  - 1k tonnes of HDPE has been included to represent sales of milk through a traditional milkman and 1k tonnes through direct sales from farmers to consumers, which would not otherwise have been included using only Valpak's EPIC database[68].
- Non-Consumer:
  - Drinks packaging sold via the hospitality sector were estimated using Valpak's EPIC database relating to 33% of the cash and carry and delivered foodservice industry and scaled up to represent the UK.
  - Additionally, it was identified that in some cases this sector purchases milk direct from dairies and soft drinks via distributors rather than from the foodservice sector. As such, data relating to disposable coffee cup usage was used to estimate consumption of milk purchased directly and scaled to represent the UK[69]. This equated to around 30k tonnes of milk packaging. For soft drinks, data relating to the full market in litres[70] was used to estimate the proportion sold via distributors, which was estimated to be approximately 38k tonnes[71].

Figure 26 – Plastic Drinks Packaging POM, 2019 (k tonnes)

Drinks container by polymer	Consumer	Non-Consumer	Total
HDPE	76	37	113
PET	215	71	286
Other	2	0.4	2
Total	293	109	401

The initial calculations estimated a decline of 17% in PET drinks bottles from 2017. It was felt by stakeholders that although the volume of drinks sold in plastic bottles had reduced over this period, a decline of 17% was greater than should be expected. Based on a survey that BPF conducted within their membership, a 10%

[68] *1% of HDPE milk sales were found to be through a traditional milkman and 1% direct from farmers. Average packaging weights have been applied to calculate the tonnage of HDPE this relates to http://www.dairyuk.org/images/documents/publications/THE-WHITE-PAPER-2017.pdf. Milk supplied through these routes is outside of traditional grocery and non-grocery retail and therefore would not be captured by the grocery calculations or non-grocery calculations and must instead be calculated separately.*

[69] *House of Commons Environmental Audit Committee – Disposable Packaging: Coffee Cups https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/657/657.pdf*

[70] *BSDA 2020 UK Soft Drinks Report https://www.britishsoftdrinks.com/write/MediaUploads/BSDA_Annual_Report_2020.pdf*

[71] *The total soft drinks market in litres was compared to that covered by the data held by Valpak for the retail and hospitality sector and the difference assumed to be that sold directly via distributors (16% or 38k tonnes) and was added onto the total.*

decline from 2017 to 2019 was estimated and agreed by stakeholders to be a more realistic level. A number of reasons were highlighted by stakeholders and those surveyed by BPF as to why there has been fewer drinks sold in plastic bottles, such as light-weighting, material switching and consumers opting to purchase larger formats. The weather was thought to be a factor too, as the summer of 2019 was not as warm as in 2017. The use of reusable bottles is increasing as well, especially for water. It was noted that the high PRN price for plastic in 2019 may have stimulated companies to improve the accuracy of their packaging weights in order to minimise costs. Through their auditing activities, the EA were able to provide some support to these factors affecting plastic drinks bottle usage, with lower sales, packaging optimisation and consumer pressure being stated as reasons for lower than usual plastic usage.

Consequently, the tonnage of drinks in PET bottles was recalculated for both the consumer and non-consumer sectors. The final analysis indicates that in 2019 there was 401k tonnes of plastic drinks packaging placed onto the UK market[72]. In order to verify this data, Dairy UK data relating to the milk market was assessed, with total milk sales for the UK in litres and by each key market, such as retail and hospitality, being identified[73]. This revealed that approximately 85% of milk is sold in the UK (after exports have been excluded) via the retail sector, direct from farmers or via a milkman and 15% through the hospitality sector[74]. Valpak's estimate of 68% of all milk packaging being sold through retail markets and 32% through hospitality does not align with the Dairy UK data. However, it is possible that this is due to the changes in consumer trends since the Dairy UK report was published in 2017. For example, increasing growth in demand for milk alternatives[75], as well as a growth in the coffee shop sector[76]. Using this data and average packaging weights, a total milk packaging estimate of 115k tonnes was made, this compares to Valpak's estimate of 113k tonnes[77], which is 1% lower than found using average weights and litres sold data.

Milk is not to be included within the DRS due to hygiene and contamination issues, as well as increasing the cost of milk which is seen as a staple food. Therefore, it is important to quantify and exclude milk packaging from the other drinks in plastic packaging. It is estimated that 288k tonnes of drinks are sold in plastic bottles excluding milk, based on the full market estimate for milk in plastic bottles being 113k tonnes and the full drinks market being estimated at 401k tonnes.

[72] *Bottled drinks only, including all caps and labels.*
[73] *http://www.dairyuk.org/images/documents/publications/THE-WHITE-PAPER-2017.pdf*
[74] *Including caps and labels*
[75] *https://store.mintel.com/uk-added-value-in-dairy-drinks-milk-and-cream-market-report*
[76] *IBISWorld Market Research Report https://www.ibisworld.com/united-kingdom/market-research-reports/cafes-coffee-shops-industry/*
[77] *Including caps and labels*

3. POM Cross-check (Net Pack Fill)

3.1. Introduction

This section of the report is used as a cross-check of the total plastic POM in the UK in 2019, based on the data stored on NPWD, as reported to the EA by obligated organisations.

This method is not used to estimate total flow as it does not include non-obligated businesses or those not reporting in the system as described below, but to provide a sense check on the total flow and allow for non-obligated flow to be estimated.

3.2. Net Pack Fill

The 2019 UK flow of plastic packaging was calculated using the packaging weights reported to the EA by registered producers and is made publicly available on the NPWD website. Due to the impacts of Covid-19 and the lockdown, there has been an unprecedented number of late registrants in 2020. Valpak therefore undertook two methods to adjust the aggregated data tables provided by the Environment Agency under FOI. These methodologies are outlined in PackFlow Covid-19 Phase II report[78] – on discussion with the Steering Group, Valpak selected 'method 2' as the most appropriate for plastic.

The net pack fill calculation used is shown 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

This methodology took the weight reported at the *packing* stage of the supply chain as opposed to the *selling* stage of the supply chain. This was used as it is believed by stakeholders[79] that there would be fewer unobligated packers in comparison to unobligated sellers, due to the likely size of the businesses. In addition, raw material manufacturing will include process losses, i.e. not everything manufactured will be converted or pack/filled, so it is expected that the tonnage goes down as moving down the supply chain.

Using this method, the total obligated plastic POM in 2019 is 1,982k tonnes (as shown in Figure 27).

[78] https://www.valpak.co.uk/more/material-flow-reports

[79] *No evidence data is available to support this.*

Figure 27 – Obligated Plastic Packaging (Net Pack Fill), 2019 (k tonnes)

	Plastic
Table 1 Pack/Fill (UK pack/filling)	1,560
Imports:	
3A Selling (filled imports)	511
3B (packaging removed from imports)	91
Total	**2,161**
2A P/F (direct exports)	170
2B P/F (third party exports)	9
Total Exported	**179**
Net Pack Fill	**1,982**

This method does not account for plastic packaging handled by unregistered producers, which was likely to include the following:

- Non-obligated producers – those below the registration thresholds of 50 tonnes of packaging or £2 million turnover;
- Free-riders – those obligated to register but not doing so; and
- Illegal importers.

There is no way of robustly quantifying the unreported quantity of packaging. Based on feedback from the stakeholder group, it is believed that the number of pack/fillers who are unobligated is small due to the likely volumes handled by the types of companies performing this activity.

An estimate of the unobligated tonnage (308k tonnes, 13%) has been made by subtracting the net pack fill figure of 1,982k tonnes from the project's POM estimate of 2,290k tonnes. Further details are provided in section 4 of this report.

4. Summary of Plastic Packaging POM

This project's estimate of plastic packaging POM in 2019 is 2,290k tonnes (+/- 6%).

This is made up of a combination of top down (non-consumer total film) and bottom-up (consumer, non-consumer rigid packaging and non-consumer film sector breakdown) methods. It has been cross-checked with reported obligated data on NPWD.

The estimate of plastic packaging POM in the consumer sector is 1,447k tonnes (+/-7%) in 2019.

This method is based on primary data alongside reliable market share data. No other method is used to derive consumer data as this method is considered the most robust there is available and is accepted by industry as such.

The estimate of plastic packaging POM in the non-consumer sector is 843k tonnes (+/- 12%) in 2019.

For film, this method is based on a combination of primary (survey) data and secondary research. For rigids, this is based on the findings of the WRAP/Valpak report into rigid packaging in the C&I sector and on secondary research.

Figure 28 – Plastic Packaging POM[80] by Sector and Format, 2019 (k tonnes)

	Total	Bottles/PTTs	Film	Other
Consumer	1,447 +/- 7%	942	311	194
Non-consumer	843 +/- 12%	477	354	11
Total	**2,290** +/- 6%	**1,420**	**666**	**205**

The total POM estimate was found to be 308k tonnes higher than data reported by obligated companies under the Packaging Waste Regulations (using the UK net pack/fill calculation method). This suggests that non-obligated companies (handling fewer than 50 tonnes of packaging or with lower than £2 million turnover), account for 13% of plastic packaging in the UK. This has decreased from the 17% non-obligated POM identified in 2017.

It is important to stress that the net pack/fill estimates are themselves open to the possibility of a degree of error because they rely on the robustness of the data that is submitted 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 reasonably possible to them, which is then audited by the regulating body. This data is used by policy makers and their agencies.

[80] *Totals may not sum due to rounding*

5. Collection and Recycling of Plastic Packaging

5.1. Introduction

The levels of plastic packaging collected for recycling within the UK in 2019 were assessed. Plastic packaging collections and recycling are split into consumer and non-consumer waste streams. Each stream is then broken down into the following:

- Consumer bottles and PTTs;
- Consumer film;
- Non-consumer bottles;
- Non-consumer other rigids; and
- Non-consumer film.

Data from NPWD, UK reprocessor and exporter discussions/survey and RECOUP's UK Household Plastics Collection Survey 2019[81] were fed into an Excel model to quantify the collection and recycling of UK plastic packaging. The UK reprocessor and exporter survey formed part of the Plastic Flow 2025 project and the results provided estimates form 2017 recycling. Further discussions, together with in-house knowledge of how the plastics recycling sector has changed since then, have been used to provide 2019 estimates. The results are provided below.

5.1.1. Assumptions

The outputs from recyclers were calculated based on discussions with industry and allow for removal of:

- Non-target recyclables, e.g. coloured PET bottles. These may be recycled by others or exported and so show up elsewhere in the analysis;
- By-products, such as the polyolefin float fraction (caps, labels from PET recycling). As with the above, this fraction may be recycled by others and so show up elsewhere in the analysis;
- Process loss;
- Non-plastic waste.

Based on in-house expertise and Steering Group guidance, the conversion rates (percentage of r-polymer out compared to recovered plastic in) identified for 2019 are:

- PET bottles / trays: 57.5%[82]
- HDPE bottles / trays: 80%
- PP bottles / trays: 67.5%
- LDPE film (household): 70%
- LDPE film (C&I, agricultural and C&D): 80%.

Clearly, there can be differences based on what the recycler is targeting and input quality, but these are felt to be a reasonable average across the sector. It should be noted that the conversion rates are estimated in increments of 2.5% and do not necessarily represent a greater degree of accuracy. The non-consumer LDPE film conversion rate reflects the fact that it is predominantly the higher grades of packaging film that are recycled

[81] *RECOUP's most recent survey based on 2019 data was not published at the time of writing this report and so the 2019 survey (based on 2018 data) was used*

[82] *Whilst it is acknowledged that PET bottles tend to have a higher conversion rate than PET trays/other rigid packaging, separate conversion rates have not been included within this project. Conversion rates vary between reprocessors due to quality and levels of contamination as well as different packaging formats, and it was felt that after several discussions with reprocessors within the PET recycling sector, a PET bottle/tray conversion rate of 57.5% was a reasonable estimation of the mid-range. All of the conversion rates have also been checked and agreed on by the Steering Group.*

in the UK. C&I other rigids recycled in the UK are assumed to be items such as crates and other large plastic items with minimal contamination and process loss.

The Environment Agency list of plastic reprocessors accredited to issue PRNs splits into two sizes of reprocessors, small (able to issue up to 400 tonnes of PRNs per annum) and large (able to issue over 400 tonnes per annum). Effort was focused on identifying how much those defined as large recyclers processed, in particular those believed to be handling more than 10k tonnes per annum. It was assumed that all small recyclers (as defined by the Environment Agency) processed 300 tonnes of packaging waste per annum.

5.1.2. UK Recycling Cross-check

The final figures from this exercise, in relation to output of recycled polymer, were sense checked against PRNs issued in the UK in 2019. The total recycled output was calculated to be 345k tonnes and PRNs issued in 2019 were 449k tonnes, and so they are reasonably close when considering the use of generalised assumptions for conversion rates.

5.1.3. Export

An analysis of the export market is made difficult due to the wide range of waste plastic packaging grades exported and the number of exporters. The number of PERNs issued in 2019 was used as a proxy for the tonnage of waste plastic exported for recycling: 692k tonnes. However, it should be noted that in principal exporters are required to remove any non-target plastic packaging waste (including contamination) from the tonnage of recovered plastic packaging they export prior to issuing PERNs. The following approach was taken for breaking exports down by polymer/format.

Firstly, the RECOUP LA Collection Survey data was used as a basis for household (consumer) waste plastic packaging collected in the UK. Having produced an estimate for how much of the collected material was recycled in the UK, it was assumed the remainder was exported for recycling. In doing this, the assumption was made that any loss of collected material during polymer sorting (most notably this would be in the PTT fraction) was balanced by the export of the PTT residual fraction and inclusion of non-target contamination in the sorted polymer. Where mixed polymer material (unsorted) such as mixed bottles is exported directly then the loss would occur overseas. Due to these assumptions the figures used are clearly approximations only.

It was then assumed that the remainder of the material exported (based on PERNs issued) was non-consumer plastic packaging. An estimate was made on how this packaging was split between rigids and films based on the proportions for each that were identified in 2017. Rigid non-consumer packaging accounted for 26% of total non-consumer exported packaging, and films accounted for 74%.

Films are known to be a key component of waste plastic exported from the UK. Large volumes of LDPE films are produced in the UK from C&I sources; however, it is generally only the highest quality grades that are recycled domestically, typically the higher grades of 98:2 film and above. The majority of these C&I films, grades 70:30 to 98:2, are exported.

The findings derived from the aforementioned methodology resulted in the following 2019 outputs:

- Consumer Collections
- Consumer recycling (in/out)
- Non-consumer UK recycling (in/out)
- Consumer exports
- Non-consumer exports
- Total recycling

Each of these are discussed in more detail in the sections below.

5.1.4. Consumer Collections

The consumer (Local Authority) collection figure of plastic packaging in the UK in 2018 from the RECOUP survey was used as a proxy for 2019 collections[83], as it was felt that there would be little difference between the two years. Details of the collection figures can be found in Figure 29.

Figure 29 – Consumer Plastic Packaging Collected, 2019 (k tonnes)

	Total
UK Total Bottles	371
UK Total Plastic Pots, Tubs & Trays	157
UK Total Film	21

The figure above splits the consumer collections into bottles, rigids and films, as in the RECOUP collections report. Based on this, Figure 30 shows the collection tonnages, and the associated collection rates of all consumer streams in 2019.

Figure 30 – Consumer Plastic Packaging Collection Rates, 2019 (k tonnes,%)

Stream	2019		
	POM	Collected	Collection Rate
Consumer Total	1447	549	38%
Consumer PTTs/Bottles	942	528	56%
Consumer Film	311	21	7%
Consumer Other	194		

This shows that 549k tonnes of consumer plastics were collected for recycling in 2019. Compared to 2017, this represents an increase in bottles of 6%, 29% for film, and a 1% decrease for PTTs collected[84].

RECOUP data is used rather than WasteDataFlow (WDF) as it is considered more appropriate: RECOUP receive more timely data which is relevant to the same time period as the POM. WDF data relating to all of 2019 is not yet released[85]. RECOUP is also able to calculate more appropriate splits where plastic packaging data is reported co-mingled with other materials (WDF is mainly based on averages).

However, WDF data was used as a sense-check, which supported this estimate[86]. It was also used to identify where plastic packaging is collected and showed that the majority of consumer plastics are collected at kerbside with 99%, followed by CA sites and bring sites both at <1%[87].

Appendix II provides a detailed assessment of relative levels of confidence in the data.

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[83] *RECOUP's most recent survey based on 2019 data was not published at the time of writing this report and so the 2019 survey (based on 2018 data) was used*

[84] *Film was reported separately in the RECOUP data used for 2017 collections, and so it was assumed to have been included in the PTT fraction. However, film was reported separately in the 2018 collection data. When the totals for bottles and PTTs collected from 2018 (528k tonnes) are compared to the 2017 estimate after film had been excluded (509k tonnes), this shows an increase of 4%.*

[85] *At time of reporting*

[86] *The latest published WasteDataFlow (WDF) figures (2018/19) were used to sense check the RECOUP estimates for consumer plastics collected. Using WDF data there were 537k tonnes of consumer plastics collected for recycling. This is within 2% of the RECOUP figure which supports this estimate.*

[87] *WDF data (2018/19)*

5.1.5. Consumer Recycling

It is estimated that 250k tonnes of consumer waste plastic packaging was recycled in the UK during 2019, of which the majority was rigid material (bottles and PTT). RECOUP estimate that there was 528k tonnes of rigid consumer plastic collected when using 2018 as a proxy for 2019. This would mean that 46% of rigid consumer waste plastic packaging was recycled in the UK. Of the small amount of consumer films collected, 5k tonnes was identified as being recycling in the UK[88].

Figure 31 – Consumer UK Domestic Plastic Packaging Recycling, 2019 (k tonnes)

Recovered plastic grade	Recovered plastic (IN)	Recovered plastic (OUT)
Rigid PET (bottles, trays)	130	75
Rigid HDPE (bottles, trays)	80	64
Rigid PP (bottles, trays)	35	24
Films	5	4
Total	**250**	**166**

5.1.6. Non-consumer Recycling UK

For non-consumer recycling in the UK, the largest fraction being recycled is LDPE films, at almost 75% of the total. The packaging films being recycled in the UK tend to be the higher quality grades, typically the highest quality C&I films such as 98:2 and 99:1 / 100% clear and coloured grades. Non-consumer film tends to be from C&I sources; however, a small fraction will be C&D and agricultural film.

Figure 32 – Non-consumer UK Domestic Plastic Packaging Recycling, 2019 (k tonnes)

Recovered plastic grade	Recovered plastic (IN)	Recovered plastic (OUT)
Rigid PET (bottles, trays)	0	0
Rigid HDPE (bottles, trays)	20	16
Rigid PP (bottles, trays)	40	27
Films	170	136
Total	**230**	**179**

Rigid non-consumer plastic packaging recycled in the UK tends to be relatively clean HDPE and PP material, including items such as crates, pallets, trays and drums. Some polyolefin plastics packaging material also arises in mixed rigid plastics from civic amenity sites. It has been assumed this has come from C&I sources (for example, small businesses and restaurants), although some will also have come from consumer sources. C&I rigid plastics plastic that do not require washing can be processed using relatively inexpensive equipment and

[88] *Since 2017, one reprocessor has started recycling household films, and it is estimated that they have an operational capacity of 5k tonnes.*

as a result recycling of this stream is relatively dispersed. The majority of rigid non-consumer packaging will be C&I, however there will be a small amount from C&D and agricultural sources.

5.1.7 Consumer Export

All polymer sorted grades of consumer rigid plastics are exported for recycling, including PET, HDPE and PP. In addition, unsorted mixed bottles are also exported for polymer sorting and recycling overseas. As mentioned above, the export figure is the balance of the RECOUP collection figure not believed to be recycled in the UK.

Figure 33 – Consumer Plastic Packaging Exported, 2019 (k tonnes)

Recovered plastic	Tonnage exported
Bottles and PTT	283
Film	16
Totals	299

5.1.8 Non-Consumer Export

It is believed that the vast majority of the LDPE films exported are C&I films sitting in the grade range of 70:30 to 98:2. These exports are driven by lower costs of processing overseas, in particular, due to the level of manual intervention required to remove non-target items and labels. Exports from this category include nearly all film produced back of store in the grocery sector and the majority from other retailers.

Figure 34 – Non-consumer Export (films), 2019 (k tonnes)

Recovered plastic	Total exported
Films (agricultural)	0
Films (C&D)	10
Films (C&I)	281
Totals	292

C&I rigids include items such as HDPE drums, PP crates & pallets, PP bulk bags other PRN-able scrap from C&I supply chains such discarded bottles, trays, etc. It also contains bottles and PTT derived from the hospitality sector.

Figure 35 – Non-consumer Export (rigids), 2019 (k tonnes)

Recovered plastic	Total exported
Rigid (agricultural)	0
Rigid (C&D)	0
Rigid (C&I)	102
Totals	102

5.2. Unaccredited Recycling

Unaccredited recycling is when plastic packaging is recycled without a PRN/PERN being raised for it.

The total tonnage for plastic packaging recycling in 2019 was estimated to be 1,172k tonnes. This figure was established through several discussions with UK reprocessors and exporters, and is therefore considered to be a robust estimate of total recycling (unaccredited and accredited).

In 2019, the total accredited plastic recycling was 1,141k tonnes based on PRN/PERN issue. Subtracting accredited recycling (1,141k tonnes) from the estimate for total recycling (1,172k tonnes) results in a difference of 31k tonnes, which is assumed to be the total volume of unaccredited recycling.

As a crosscheck, an additional estimate based on Valpak knowledge was made. Plastic Flow 2025 estimated that unaccredited recycling ranged between 0.1% to 2.3% of accredited recycling in 2017. Due to the higher PRN prices for plastic during 2019 (average of £264 per tonne in 2019 compared to £49 per tonne in 2017), Valpak market knowledge estimates that the upper limit for unaccredited recycling is more likely to be between 1% and 1.5% for 2019. Using the mid-point of this range to provide an estimate for total recycling was then agreed by the Steering Group. If unaccredited recycling was 1.25% of the total accredited packaging for 2019 (1,141k tonnes), this would equate to approximately 14k tonnes. Adding this to the accredited gives a total recycling volume of 1,156k tonnes, which is within 1.4% of the 1,172k tonnes established through conversations with UK reprocessors and exporters.

Although the two estimates of unaccredited recycling differ by 16k tonnes[89], this is likely due to the fact that unaccredited recycling is very challenging to measure accurately as previously described. Therefore, the final estimate of unaccredited recycling is estimated to be between 14k tonnes and 31k tonnes, which are 1.25% and 2.61% of the total accredited recycling for 2019.

Unaccredited recycling is difficult to verify and due to it not being reported, does not count towards the UK's recycling achievement. Therefore, it has not been included in any of the total recycling analysis in the following sections of this report.

5.3. Total Plastic Packaging Recycling

Figure 36 – Total Plastic Packaging UK Recycling & Export, 2019 (k tonnes)

Stream	2019	
	Recovered Plastic IN	Recycled Polymer OUT
Consumer UK Recycling	250	166
Consumer Export	299	299
Non-consumer UK Recycling (films)	170	136
Non-consumer UK Recycling (rigids)	60	43
Non-consumer Export (films)	292	292
Non-consumer Export (rigids)	102	102
TOTAL Recycled or Exported	**1,172 – 1,037**	

[89] *31k tonnes based on the difference between total and accredited recycling, and 14k tonnes from Valpak's market knowledge – 16k tonnes difference due to rounding*

6. Plastic Packaging Recycling Rates

Figure 37 – Summary of UK Plastic Packaging Recycling Rates, 2019 (k tonnes,%)

Stream	2019						
	POM	Collected	Recovered Plastic (IN)	Recycled Polymer (OUT)	Collection Rate	Recycling Rate (IN)	Recycling Rate (OUT)
Consumer Total	1,447	549	549	465	38%	38%	32%
Consumer PTTs/Bottles	942	528	528	445	56%	56%	47%
Consumer Film	311	21	21	19	7%	7%	6%
Consumer Other	194						
Non-consumer Total	843		623	572		74%	68%
Non-consumer Rigids	477		162	145		34%	30%
Non-consumer Film	354		462	428		130%	121%
Non-consumer Other	11						
Grand Total	2,290		1,172	1,037		51%	45%

As can be seen from the above table, there is a discrepancy in the recycling rates of non-consumer film (121-130%). Based on a more feasible recycling rate of 70-80% recycling of non-consumer film, there remains 144-179k tonnes of non-consumer film recycling that cannot be identified. One explanation for this could be the incorrect allocation of PRN/PERNs against either non-packaging film or non-UK packaging. Alternatively, or in addition, it could suggest that the non-consumer film POM estimate is low.

It is suggested further research is required to fully understand why there is a mismatch of this size. Research is recommended both into non-consumer film POM and the incorrect issuing of PRNs.

7. Plastic Packaging End Markets

7.1. Introduction

This section looks at the key uses for recycled polymer produced in the UK from packaging waste. A summary of areas of usage by polymer is shown below. The breakdown in the tables that follow is based on estimates of how recycled polymer produced in the UK is used, based on in-house knowledge and discussions with industry experts and recyclers. For PET, the recycled polymer is produced from bottles and trays (consumer and non-consumer from the hospitality sector). For HDPE, the largest volume of recycled polymer comes from bottles/ household trays, but rigid C&I packaging also forms part of this stream. For PP there is a roughly equal split between recycled polymer produced from bottles/ trays and PP from rigid C&I packaging. Recycled LDPE is nearly all derived from C&I and manufacturing films.

r-PET is used in relatively few well defined markets making it easier to assess. For HDPE and PP, there are a wide range of different products manufactured from recycled polymer, which makes it difficult to provide a detailed split across all applications. Here, discussions with recyclers focused on the key market sectors and examples of products in each. HDPE and PP polymers are also sometimes blended to produce products, and in addition, recyclers may not always know the application for which they are being used. Percentages shown in the table below should therefore be treated as indicative. The vast majority of LDPE is used to make film products of different types, although some is used to make semi-rigid and rigid items (such as plastic wood). Products tend to be those where a small degree of discoloration, which can occur with the use of r-LDPE, does not cause any concerns amongst users, or where the film is often coloured. Hence the construction and agricultural sectors being key users of film produced with recycled content.

7.2. PET

A key application is the production of PET sheet which is then used to produce packaging items, such as trays. The use of PET in food contact applications, notably bottles, also remains an area of high demand.

Figure 38 – End Markets for PET Recycled in the UK

Application	Examples	Indicative usage
Sheet manufacture	Used to make packaging trays, etc.	55%
Bottles	Food contact applications, such as drinks bottles.	40%
Fibre	Polyester fibre for fill	5%

Based on the output of recycling as identified in sections 5.1.5. and 5.1.6. and the indicative usage percentages above, it is estimated that 41k tonnes of recycled PET is used in sheet manufacture, 30k tonnes is used in bottle manufacture, and 4k tonnes is used in fibre production.

7.3. HDPE

Pipe manufacture is a key use of recycled HDPE polymer, particularly for coloured HDPE pellet. Another key use of recycled HDPE, from consumer sources, is the production of bottles. This includes food contact applications such as the production of milk bottles, but also increasingly to produce non-food contact bottles. Natural HDPE pellet, produced from milk and juice bottles, are typically preferred in these applications.

Figure 39 – End Markets for HDPE Recycled in the UK

Application	Examples	Indicative usage
Packaging	Food and non-food bottles.	45%
Construction	Pipes, chambers, roof spacers, plumbing items.	35%
Horticultural & outdoors	Compost bins, water butts, wheel bins, garden furniture, watering cans.	15%
Other	Wide range of items including inclusion in plastic wood applications, garden furniture, household items such as boxes and buckets.	5%

Compared to the indicative usages identified in the Plastic Flow 2025 report, the use of recycled HDPE within packaging is estimated to have increased from 25% to 45%. This is likely a result of a number of factors including an increase in domestic recycling capacity for HDPE since 2017, a greater number of brand and retailer commitments to using a more recycled content within packaging (which in some cases may be a result of initiatives such as the Plastics Pact, however some brands and retailers may have their own plastic reduction objectives too), and also in preparation for the Plastics Tax and packaging EPR reform.

Based on the output of recycling as identified in sections 5.1.5. and 5.1.6. and the indicative usage percentages above, it is estimated that 36k tonnes of recycled HDPE is used in packaging manufacture, 28k tonnes is used in construction, 12k tonnes is used in horticultural/outdoors products, and 4k tonnes is used in other applications.

7.4 PP

The automotive sector is a key user of recycled PP polymer. It is used in an increasing range of applications both in the car's interior (dash, etc), under the bonnet (battery cases, ducting) and externally (wheel arches, mudguards). The production of packaging is also a major use of recycling PP polymer, for example to produce crates, pallets, paint pots, etc.

Figure 40 – End Markets for PP Recycled in the UK

Application	Examples	Indicative usage (%)
Automotive	Interior design items, wheel arches, ducting, battery cases, mudguards.	40%
Packaging	Paint pots, pallets, crates, trays, boxes	40%
Horticulture	Plant pots, etc	15%
Other	Wide range of items including inclusion in plastic wood items	5%

Based on the output of recycling as identified in sections 5.1.5. and 5.1.6. and the indicative usage percentages above, it is estimated that 20k tonnes of recycled PP is used in automotive parts, 20k tonnes is used in packaging, 8k tonnes is used in horticultural products, and 3k tonnes is used in other applications.

7.5. LDPE

The construction sector is a key user of recycled LDPE polymer. The production of damp proof membranes is perhaps the largest user of recycled LDPE within the sector but it is also used to produce gas protection film (laid under the house to act as a barrier for radon gas) and also general-purpose film used on building sites, such as to cover and protect part completed structures and materials. Recycled LDPE is also widely used in the production of refuse and recycling bags.

Figure 41 – End Markets for LDPE Recycled in the UK

Application	Examples	Indicative usage
Construction films	Damp proof membranes, building films for temporary protection, gas barrier protection	40%
Plastic bags & sacks	Refuse sacks, recycling sacks, bags for life.	15%
Agricultural films	Crop cover (mulch film)	15%
Other	Packaging, rigid / semi-rigid products, plastic wood.	30%

Based on the output of recycling as identified in sections 5.1.5. and 5.1.6. and the indicative usage percentages above, it is estimated that 56k tonnes of recycled LDPE is used in construction films, 21k tonnes is used in plastic bags/sacks, 21k tonnes is used in agricultural films, and 42k tonnes is used in other applications.

7.6. Export Markets

As a result of the restrictions on imports of post-consumer waste plastic into China implemented at the end of 2017, a lot of the material was diverted to South East Asia and Turkey. Although some recycled pellet will be used in domestic applications, these markets often supply some back into China. It is likely that domestic end markets in Turkey would be broadly similar to those in Asian markets, for example, recycled PET used in the production of polyester fibre. Since the Plastic Flow 2025 report was published, the end markets for recycled LDPE polymer have changed. It is thought that more is used in film applications, such as construction films and plastic bags, and slightly less in agricultural film production and foamed applications.

7.7. Export Destinations for UK Waste Plastic Packaging Waste

A Freedom of Information Act request was made to the Environment Agency for information on where UK waste plastic packaging was exported to in 2019. Reproduction of this data is subject to the conditions set out in the Open Government License version 3.0. Please see conditions in the attached link:

http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

The data provided by the Environment Agency was analysed to produce the pie chart and list of top 10 destinations below. The tonnages shown in the breakdowns below relate to PERNs issued, and as such the actual tonnage shipped may be slightly higher as any non-UK derived plastic packaging waste in the shipment should have been removed prior to PERNs being issued.

Of particular note, the lower volume of waste plastic packaging exported to China than in 2017 is around 160k tonnes less (based on the same information for 2017 also provided by the Environment Agency). This is primarily a result of the ban on imports of post-consumer waste plastic into China implemented at the end of 2017.

The pie chart below shows the top 10 export destinations for UK derived waste plastic packaging waste by region.

Figure 42 – Export Destinations for UK Plastic Packaging Waste by Region, 2019 (%)

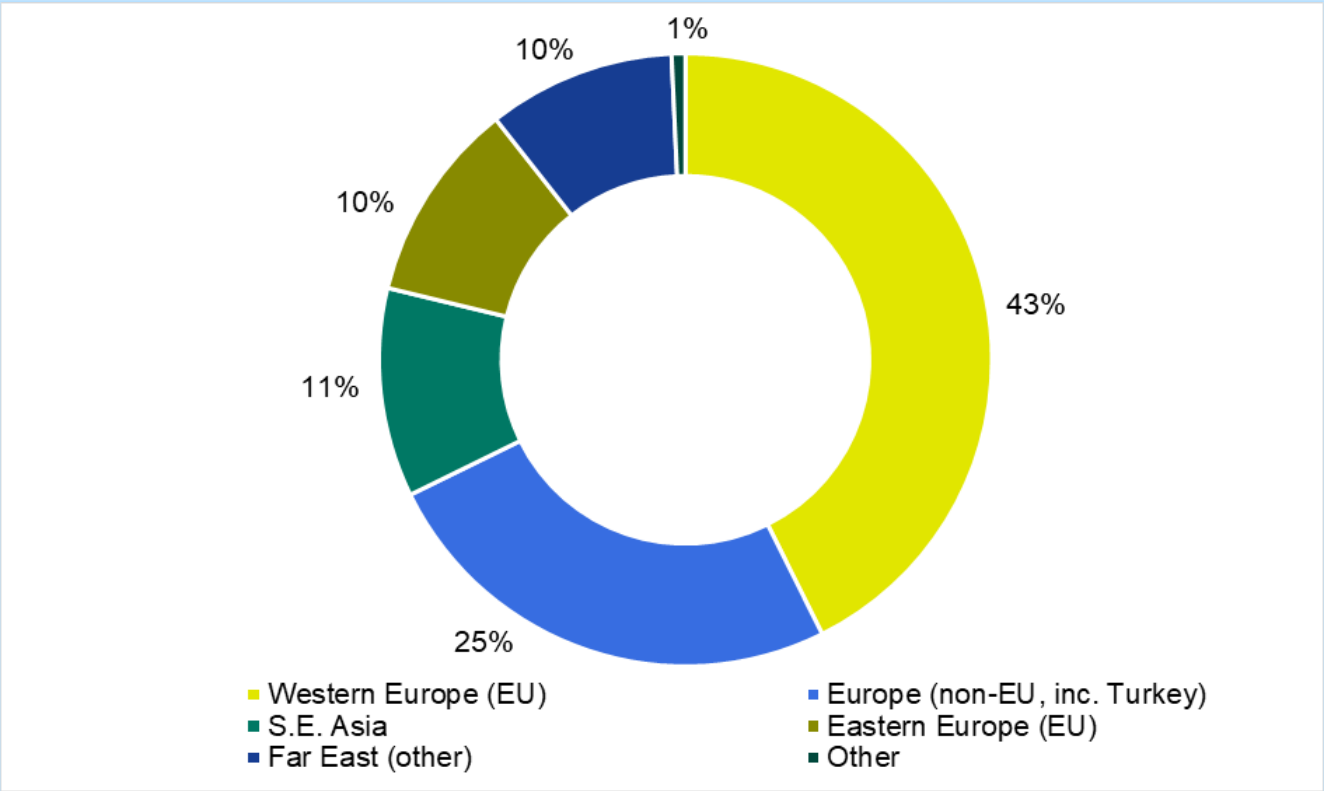

Figure 43 shows the top 10 export destinations for UK derived waste plastic packaging waste.

Figure 43 – Export Destinations for UK Plastic Packaging Waste by Region, 2019

Destination Country	Tonnage Exported (k tonnes)
Turkey	168
Netherlands	96
Germany	65
Poland	56
Hong Kong	50
Malaysia	46
Spain	35
France	32
Belgium	31
Indonesia	21

Source: The Environment Agency

8. Conclusions & Recommendations for Further Work

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

8.1. Conclusions: POM

This project's estimate of UK plastic packaging POM for 2019 is 2,290k tonnes +/- 6%: a decrease of 71k tonnes[90] from the previous estimated figure for 2017.

This is the most robust estimate that can be derived using a variety of the most authoritative methods, including industry estimates, Valpak data and publicly available data and is regarded as such by industry.

The estimate of plastic packaging POM in the consumer sector is 1,447k tonnes +/- 7% in 2019.

This method is based on primary data alongside reliable market share data. No other method was used for deriving consumer data as this method is considered the most robust there is available and is accepted as such by industry.

The estimate of plastic packaging POM in the non-consumer sector is 843k tonnes +/- 12% in 2019.

For film, this method is based on a combination of primary (survey) data and secondary research. For rigids, this is based on the findings of the WRAP/Valpak report into rigid packaging in the C&I sector and on secondary research.

It is likely that increased sales have been offset by light-weighting activity.

The plastics packaging industry has believed for some time that packaging producer activity to light-weight plastic packaging[91] has negated any potential growth in consumption and the results of this work would seem to support this assumption.

Plastic drinks packaging is estimated to account for 401k tonnes (or 18%) of total plastic packaging POM in 2019.

Using Valpak EPIC data and additional market data, suggests that 73% of this tonnage is sold via the retail or consumer market and 27% via the non-consumer or hospitality sector, with 113k tonnes being HDPE, 286k tonnes PET and 2k tonnes other polymers. This has been cross-checked with industry and published data.

8.2. Conclusions: Recycling

The plastic packaging recycling rate for the UK in 2019 is between 45% and 51%.

If measuring recycling on entry to reprocessing, the UK's plastic packaging recycling rate is estimated at 51% (1,172k tonnes recycled). If measured after conversion on the exit of reprocessing, the rate would be lower at 45% (1,037k tonnes recycled).

The consumer plastic packaging recycling rate for the UK in 2019 is between 32% and 38%.

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[90] *71k tonnes is a decrease of 3%. As the error margin around the total plastic POM figure is 6%, it is possible that there has been no real increase in POM.*

[91] *Including down-gauging activity.*

If measuring recycling on entry to reprocessing, the UK's consumer plastic packaging recycling rate is estimated at 38% (549k tonnes recycled). If measured after conversion on the exit of reprocessing, the rate would be lower at 32% (465k tonnes recycled).

The non-consumer plastic packaging recycling rate for the UK in 2019 is between 68% and 74%.

If measuring recycling on entry to reprocessing, the UK's consumer plastic packaging recycling rate is estimated at 74% (623k tonnes recycled). If measured after conversion on the exit of reprocessing, the rate would be lower at 68% (572k tonnes recycled).

The estimated non-consumer plastic packaging film recycling rate for the UK in 2019 is unfeasibly high.

The recycling rates of non-consumer film are estimated at 121-130%[92]. Based on a more feasible recycling rate of 70-80%, there remains 144-179k tonnes of non-consumer film recycling that cannot be identified. One explanation for this could be the incorrect allocation of PRN/PERNs against either non-packaging film for non-UK packaging. Alternatively, or in addition, it could suggest that the non-consumer film POM estimate is low.

8.3. Conclusions: End Markets

The main application for UK recycled PET is in sheet applications such as trays.

Approximately 55% of UK recycled PET is made into sheet, which in turn is used for applications such as plastic trays. The majority of PET not used in this way is used to make new plastic bottles.

UK recycled HDPE is used comprehensively in a variety of applications, such as packaging, construction, horticultural and outdoors.

Approximately 45% of UK recycled HDPE is used in the packaging sector, a further 35% in the construction sector and 15% in horticultural & outdoors applications. The remainder is used in a variety of products such railway sleepers, garden furniture and boxes.

UK recycled PP is predominantly used to make automotive products and packaging.

Approximately 40% of UK recycled PP is used in automotive products and a further 40% in packaging.

UK recycled LDPE is mainly used to make new films for construction, bags, sacks and agriculture.

Approximately 40% of UK recycled LDPE is used for construction films, 15% for plastic bags & sacks and around 15% for agricultural films. The remainder is used in other applications such as packaging and the production of plastic wood.

[92] *An unfeasibly high non-consumer film recycling rate was also reported in the Plastic Flow 2025 report. It was outside the scope of this project to follow the recommendations made within the Plastic Flow 2025 report; however, this report acknowledges that further work is needed in this area to improve data accuracy.*

8.4. Recommendations for Further Work

C&I plastic packaging film/rigids.

The estimate of C&I film packaging appears low in comparison to the rigids figure. Furthermore, non-consumer film POM as a whole appears low when used to calculate non-consumer film recycling rates. Further research is recommended to improve the accuracy of data in this area.

Non-consumer film being allocated PRN/PERNs.

In 2019 there was an unaccounted 73-107k tonnes of non-consumer film recycled: this may in part be due to a low POM estimate, but may also be due to the incorrect allocation of PRN/PERNs to non-packing films or non-UK packaging film. Further research is recommended to improve the accuracy of data in this area.

Appendix I

Unaccredited Plastic Packaging Recycling

The accredited reprocessing was estimated from NPWD data using the quantity of PRNs and PERNs issued. However, it is understood that there is additional recycling that takes place where a PRN or PERN is not raised on the packaging. This is referred to as unaccredited recycling, and due to it not being reported, does not count towards the UK's recycling achievement.

During the Plastic Flow 2014 project an assessment was made into the possible tonnage of plastic packaging that may be being recycled by unaccredited reprocessors. It was estimated that 50 facilities in the UK were recycling plastics but were unaccredited in 2011. However, this was at a time when the average PRN price was £4.64 per tonne. Since then the PRN price has increased to an average price of £264 per tonne in 2019, which makes it more cost effective for reprocessors to become accredited.

The decision to become accredited (or not) was assumed to be based on a financial cost-benefit comparison of gaining accreditation, namely the breakeven point between average PRN revenue and accreditation fees/administration costs. This was based on Valpak's market knowledge but was corroborated by assessing the number of accredited reprocessors/exporters against the average plastic PRN price. The results did give an indication that following a year with an inflated PRN price, such as 2008, 2013, the general trend is that reprocessor accreditations increase, and when the PRN price is depressed, such as in 2009 and 2010, the number of facilities becoming accredited decreases. Since 2013, the PRN price has been consistently above £30 per tonnes and although the price has fluctuated above this level there has been a steady increase in the number of accredited reprocessors/exporters.

Based on analysis of the average price of a PRN in 2019 and the cost of accreditation, it was identified that a 'small' facility would need to recycle 6 tonnes of plastics and a 'large' facility 17 tonnes in 2019 to breakeven against accreditation costs. However as large reprocessors are accredited to recycle 400 tonnes (and above), it is assumed that all unaccredited reprocessors are small based on the assumption that the decision to become accredited is based on cost. The figures indicate that it is clearly cost effective for reprocessors to be accredited.

However, estimating unaccredited recycling in this way may not take into account all examples of plastic packaging recycling being undertaken without a PRN being raised. Other instances where this could happen include:

- New entrants to the marketplace that are not included in the quantity of organisations identified as reprocessing plastics but not accredited;
- Export to non-accredited sites. Maybe a trial load that does not result in ongoing business, and as such, is not worth doing the paperwork and paying the fee to get the site accredited. Or perhaps when the market is in 'crisis' and the priority is moving material and it turns out afterwards the site does not have the paperwork needed to get registered;
- Start-up businesses that have not worked out how the system works;
- Small non-waste businesses that may export waste but may not be aware that PERNs can be issued;
- Overseas buyers that may not have a UK presence and so cannot get registered to issue PERNs; and
- Packaging material in non-packaging material at levels where it is not worth the effort to sample the material and work out how much is packaging so as to be able to issue PRNs. An example here would be seed sacks (packaging) in silage wrap (non-packaging).

For the reasons listed above, it is inherently difficult to accurately measure and document the exact level of unaccredited recycling. However, for the purposes of this project, an attempt has been made to estimate this using the methodology outlined below.

The total tonnage for plastic packaging recycling in 2019 was estimated to be 1,172k tonnes. This figure was established through several discussions with UK reprocessors and exporters, and is therefore considered to be a robust estimate of total recycling (unaccredited and accredited).

In 2019, the total accredited plastic recycling was 1,141k tonnes based on PRN/PERN issue. Therefore, subtracting accredited recycling (1,141k tonnes) from the estimate for total recycling (1,172k tonnes), results in a difference of 31k tonnes, which is assumed to be the total volume of unaccredited recycling.

As a crosscheck, an additional estimate based on Valpak knowledge was made. Plastic Flow 2025 estimated that unaccredited recycling ranged between 0.1% to 2.3% of accredited recycling in 2017. Due to the higher PRN prices for plastic during 2019 (average of £264 per tonne in 2019 compared to £49 per tonne in 2017), Valpak market knowledge estimates that the upper limit for unaccredited recycling is more likely to be between 1% and 1.5% for 2019. Using the mid-point of this range to provide an estimate for total recycling was then agreed by the Steering Group. If unaccredited recycling was 1.25% of the total accredited packaging for 2019 (1,141k tonnes), this would equate to approximately 14k tonnes. Adding this to the accredited gives a total recycling volume of 1,156k tonnes, which is within 1.4% of the 1,172k tonnes established through conversations with UK reprocessors and exporters.

Although the two estimates of unaccredited recycling differ by 16k tonnes[93], this is likely due to the fact that unaccredited recycling is very challenging to measure accurately as previously described. Therefore, the final estimate of unaccredited recycling is estimated to be between 14k tonnes and 31k tonnes, which are 1.25% and 2.61% of the total accredited recycling for 2019.

[93] *31k tonnes based on the difference between total and accredited recycling, and 14k tonnes from Valpak's market knowledge – 16k tonnes difference due to rounding*

Appendix II

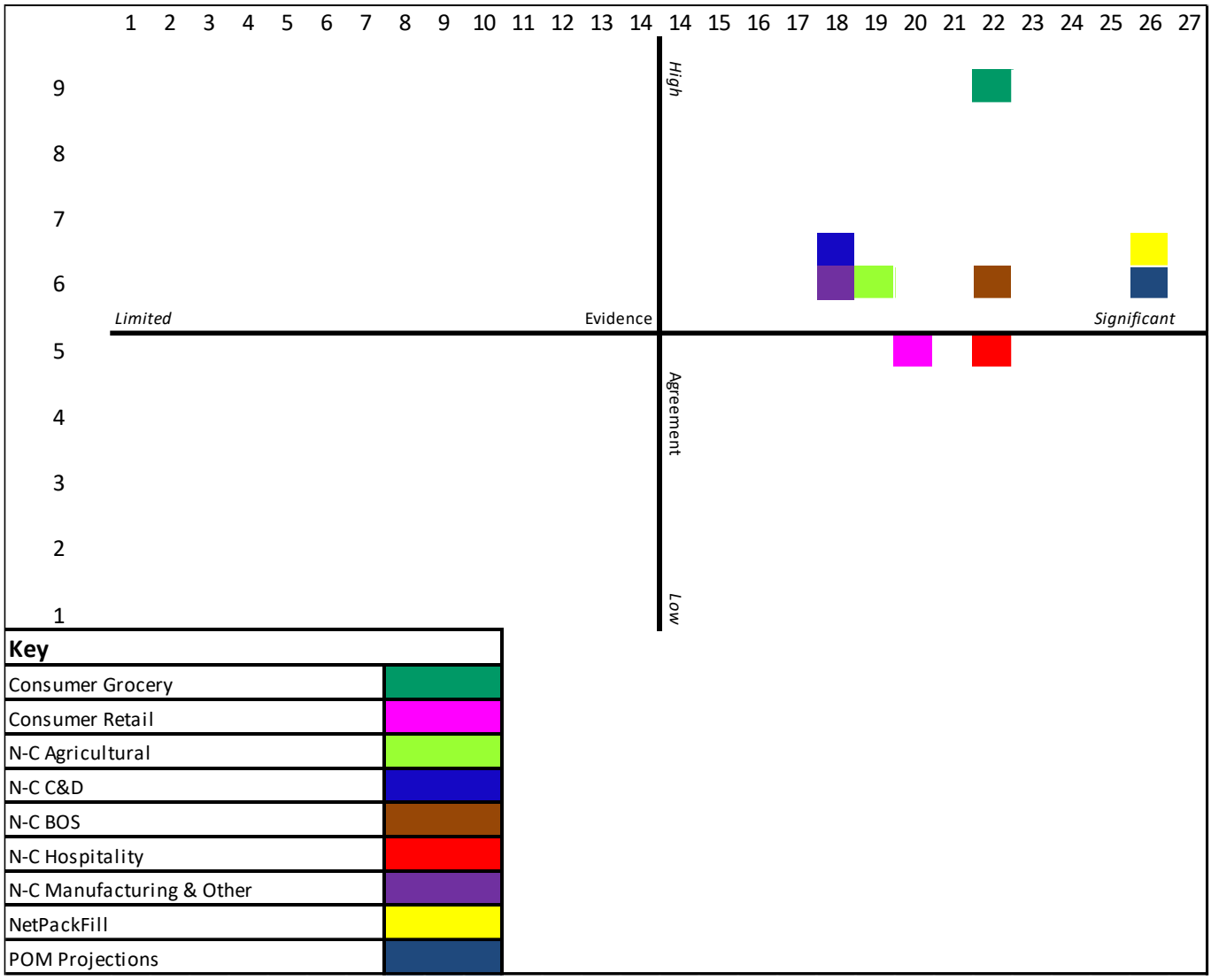
Data Robustness Assessment

A robustness analysis is 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 44 (POM),

Figure 45 (Recycling) and a summary in Figure 46, 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 44 – Data Robustness Assessment Results – POM



To convert scores to a percentage that could be used to relate to an appropriate error margin[94], the evidence and agreement levels scores were added and the percentage of the total possible score taken.

[94] *These are assumed to be indicative estimates of error margin and not the outputs of a statistical calculation*

Figure 45 – Data Robustness Assessment Results – Recycling

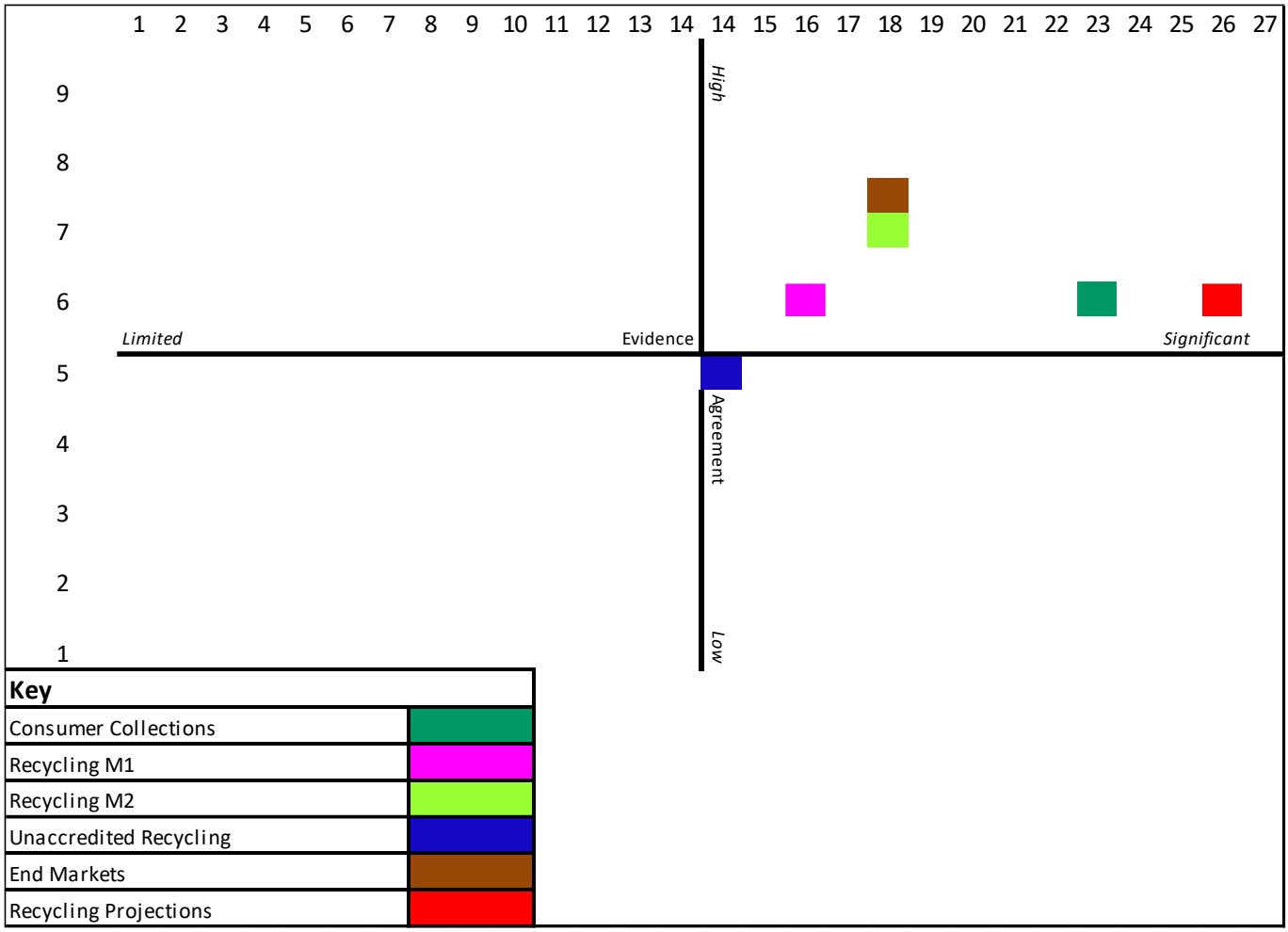


Figure 46 – Data Robustness Assessment Results – Summary

	Data & Source	Robustness Scores	
		Evidence (Robustness and completeness, max 27):	Degree of agreement around the findings (max 9):
1	Environment Agency Grocery Retailer Packaging Handled	24	9
2	Valpak Turnover & Packaging Handled Data	20	6
3	The White Paper Dairy UK 2017	20	3
4	UK Soft Drinks Report 2020	20	4
5	Survey of Grocery Retailers 2019	22	6
6	Valpak Hospitality EPIC Data	22	6
7	Industry Insights - Construction Skills Network Forecasts 2019-2023	18	6
8	Survey of Construction Companies (2014)	16	6
9	BRE Smartwaste Portal	18	6
10	Internal research by the Green Construction Board, 2009	15	6
11	Primary Research by the C&I Rigid Plastic Packaging Report Team, 2014	17	6
12	UK AWP Waste Arisings, Defra/Valpak 2007	17	6
13	NPWD + Valpak estimate of final 2020 obligation/NPF	23	6
14	Recoup Survey 2019	22	6
15	Verde Research and Consulting Ltd Survey of Recyclers and Exporters 2020	18	7
16	Letsrecycle PRN Values 2008-19	14	6
17	NPWD Recycling Data 2019	26	6

Figure 47 – Environment Agency Grocery Retailer Packaging Handled

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

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 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 (max 9):	Scoring (Max 09)	
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 48 – Valpak Turnover & Packaging Handled Data

Data
Valpak Turnover & Packaging Handled Data
Source
Valpak
Data Used In:
Consumer Non-grocery

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?	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)?	No	0
Total		**20**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 49 – Survey of Grocery Retailers 2020

Data
Survey of Grocery Retailers 2020
Source
Valpak
Data Used In:
C&I Back of Store

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Y	3
Does the data provide complete coverage?	Yes with some reservations	2
Has the data been sourced from credible, up-to-date sources?	Y	3
Is the underlying data reasonably free from concerns (e.g. official data from the ONS)?	Y	3
Have the findings been independently peer-reviewed?	N	0
Is the methodology/calculation reasonably free from concerns?	Y	3
Have the methodology/calculations been independently checked (internally or externally)?	Y	3
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Y	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 (max 9):	Scoring (Max 09)	
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 50 – The White Paper Dairy UK 2017

Data Used In:
The White Paper Dairy UK 2017
Source
Dairy UK
Data Used In:
Drinks calculations

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes with some reservations	2
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)?	No	0
Total		**20**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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?	No	0
Total		**3**

Figure 51 – UK Soft Drinks Report 2020

Data
UK Soft Drinks Report 2020
Source
British Soft Drinks Association
Data Used In:
Drinks calculations

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 with some reservations	2
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	3
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes with some reservations	2
Total		**20**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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	3
Total		**5**

Figure 52 – Valpak Hospitality EPIC Data

Data
Valpak Hospitality EPIC Data
Source
Valpak
Data Used In:
Hospitality

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?	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 (max 9):	Scoring (Max 09)	
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 53 – Industry Insights – Construction Skills Network Forecasts 2019-2023

Data
Industry Insights - Construction Skills Network Forecasts 2019-2023
Source
CITB
Data Used In:
C&D

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes with some reservations	2
Does the data provide complete coverage?	More yes than no, but equivocal	1
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)?	No	0
Total		**18**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 54 – Survey of Construction Companies (2014)

Data
Survey of Construction Companies (2014)
Source
WRAP
Data Used In:
C&D

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	More yes than no, but equivocal	1
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)?	More yes than no, but equivocal	1
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)?	No	0
Total		**16**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 55 – Internal Research by the Green Construction Board 2009

Data
Internal research by the Green Construction Board, 2009
Source
Green Construction Board
Data Used In:
C&D

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	More yes than no, but equivocal	1
Does the data provide complete coverage?	More yes than no, but equivocal	1
Has the data been sourced from credible, up-to-date sources?	More yes than no, but equivocal	1
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	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		**15**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 56 – BRE Smartwaste Portal 2014

Data
BRE Smartwaste Portal, 2014
Source
BRE Smartwaste Portal
Data Used In:
C&D

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	More yes than no, but equivocal	1
Does the data provide complete coverage?	More yes than no, but equivocal	1
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	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		**18**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 57 – Primary Research by the C&I Rigid Plastic Packaging Report Team 2014

Data
Primary Research by the C&I Rigid Plastic Packaging Report Team, 2014
Source
C&I Rigid Plastic Packaging Report Team, 2014
Data Used In:
C&I Manufacturing

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes with some reservations	2
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)?	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)?	Yes	3
Total		**17**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 58 – UK AWP Waste Arisings, Defra/ Valpak 2007

Data
UK AWP Waste Arisings, Defra/Valpak 2007
Source
Defra/Valpak 2007
Data Used In:
Agriculture

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	More yes than no, but equivoca	1
Does the data provide complete coverage?	Yes	3
Has the data been sourced from credible, up-to-date sources?	More yes than no, but equivoca	1
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)?	No	0
Total		**17**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 59 – NPWD Producer Data 2019

Data
NPWD Producer Data 2019 (2020 submission)
Source
NPWD + Valpak estimate of final 2020 obligation/NPF
Data Used In:
POM crosscheck & unobligated tonnage

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes with some reservations	2
Does the data provide complete coverage?	More yes than no, but equivocal	1
Has the data been sourced from credible, up-to-date sources?	Yes with some reservations	2
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		**23**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 60 – RECOUP Consumer Collections

Data
RECOUP Consumer Collections
Source
RECOUP Survey 2019
Data Used In:
Consumer Recycling

Evidence (Robustness and completeness, max 27):	Scoring (Max 27)	
Does the data cover the correct time-frame?	Yes with some reservations	2
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?	Yes with some reservations	2
Is the methodology/calculation reasonably free from concerns?	Yes	3
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		**22**

Degree of agreement around the findings (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 61 – Survey of Recyclers and Exporters 2020

Data
Survey of Recyclers and Exporters 2020
Source
Verde Research and Consulting Ltd
Data Used In:
Recycling and End Markets

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)?	More yes than no, but equivocal	1
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	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)?	More yes than no, but equivocal	1
Total		**18**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
Does more than one data source confirm the findings (within +/- 5%)?	Yes with some reservations	2
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	3
Total		**7**

Figure 62 – Letsrecycle PRN Values 2008-2019

Data
Letsrecycle PRN Values 2008-19
Source
Letsrecycle
Data Used In:
Unaccredited Recycling

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?	No	0
Has the data been sourced from credible, up-to-date sources?	Yes with some reservations	2
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?	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)?	More yes than no, but equivocal	1
Is the quantitative evidence well rooted in a wider qualitative understanding of the issue?	Yes with some reservations	2
Have the findings been sense-checked against credible alternative sources (incl. inconclusively)?	Yes with some reservations	2
Total		**14**

Degree of agreement around the findings (max 9):	Scoring (Max 09)	
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 63 – NPWD Recycling Data 2019

Data
NPWD Recycling Data 2019
Source
NPWD
Data Used In:
Recycling Projections

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 (max 9):	Scoring (Max 09)	
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**