Recyclability by Design

Back to Basics Case Studies 2022

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RECOUP

About RECOUP

RECOUP is a charity and leading authority providing expertise and guidance across the plastics recycling value chain. Built on a network of valued members, collaboration is central to RECOUP's activities. The organisation is committed to securing sustainable, circular, and practical solutions for plastic resources both in the UK and worldwide.

The content and analysis contained in this document is based on the information received. While every effort has been made to ensure the accuracy of the contents, RECOUP cannot accept responsibility or liability for any errors or omissions. Opinions expressed and recommendations provided herein are offered for the purpose of guidance only and should not be considered legal advice.

RECOUP works to maximise plastic recycling through stimulating the development of sustainable plastics waste management, including the improvement of plastics collection and sorting activities across the UK, undertaking research and analysis to identify good practices and remove barriers to the adoption of efficient recycling systems.

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'You cannot change the recyclability of a pack by passing onto the consumer the responsibility'

Stuart Foster, RECOUP CEO

Introduction

Back to basics is intended to break down packaging recyclability guidelines to the essential elements packaging producers should be looking at, to keep it simple for the consumers to do the right thing.

The Recyclability by Design (RBD) report was first published in 2006 and is now into its ninth update. While the motivation and objective of the publication has not changed, the societal pressure on packaging manufacturers continues to increase each year. Consumer demand for sustainability is now higher than ever and industry needs to evolve to meet this demand.

Many of the principles in the RBD booklet are as relevant today as they were in 2006. The focus has started to shift to the finer details that influence the recyclability of a product, this includes:

- Labels and sleeves
- Mono-polymer construction
- Clear polymers
- Minimal colour uses where possible
- Clear, easy to understand recycling information
- Adhesives

This study will analyse what effect the materials used by the producers have on the recyclability of their products and how well are they able to put the message across to the consumer about how and where they can recycle the packaging?

Producer Responsibilities

Social Responsibility

Consumers are becoming increasingly aware of the roles of business in relation to the environment and sustainability. Social responsibility encompasses the impact companies have on three key areas.

Individual

The respect for the individual is the first factor in achieving good social responsibility. Businesses need to understand that each consumer is unique and will have unique needs, despite this, every consumers needs are of equal value to the business.

Community

Ethical practices contribute to economic development while improving the quality of life for the workforce and wider community. Companies are a part of the community, and their activities can directly influence societal values with community activities such as charitable affiliations and events to raise environmental awareness and good recycling practices.

Environment

Sustainability is a valuable selling point to a business and can boost a business' public image. Environmental sustainability is impacted by a business' approach to recycling, waste management, research and development, energy usage, and resource efficiency.

Economic Benefits

There are multiple ways good recyclability practice and design can have economic benefits to a business.

Circularity

Closed loop circularity for resources results in increased capture rates for recyclates and means less resources are wasted. Designing packaging with circularity in mind increases opportunities for the reuse of resources, reducing the need for virgin materials. Improved circularity also has the added benefit of being able to avoid the plastics tax due to improved availability of recyclates.

Collected?

Using materials that are already collected kerbside by household collections makes better use of existing infrastructure and has the added benefit of reducing costs to business and consumers who won't need to utilise other recycling routes such as send back schemes or front of store collection points.

Marketability

Sustainability is a key marketing pull for many consumers who like to feel that their actions and purchases are making a difference to the environment. Improving the recyclability of packaging used for products not only has the benefit of reducing costs and resource use, but it also has the bonus of being more marketable to the wider public and may boost revenues. It is important to note the difference between positive meaningful change and greenwashing. Reducing the recyclability of a pack for the marketing buzz of using less plastic has a net negative effect on the environment as more virgin resources are needed despite the pack using less plastic, more is being produced to meet demand.

Understanding The Recycling Chain

1. Disposal

2. Collection

3. Sorting

4. Reprocessing

5. Recycling

There are five stages of recycling and for packaging to be recycled and manufactured into something new it must pass these five stages

1. Providing the consumer with reliable and accurate instructions when it comes to deciding how and where to dispose of used plastics is vital. Consumers need to be able to make informed decisions, safe in the knowledge that they are responsibly disposing of items and what the end destination for each material is.
2. Consistent kerbside collections for recyclable materials are a crucial step in the plastics value chain. If recyclable materials are not collected and sorted, then regardless of the recyclability of an item the resource could be wasted.
3. Sorting of materials is now largely completed using NIR technology which detects materials via laser. Components such as sleeves and labels left on bottles or pots means that recyclable items such as PET can be mis-identified and possibly leave the recycle chain and end up destined for landfill or waste to energy.
4. Consistent sorting of plastics is a crucial step in achieving true circularity. Contaminants such as adhesives and inks can affect the quality of the recycled materials making them undesirable to reproducers.
5. As pressure builds on producers to increase recycled content in their products the need for clean plastics is becoming more important. Clear plastics are more desirable and have higher value to producers.

Labels and Sleeves

Labels

Preferred label materials vary depending on the pack material:
PET bottles: HDPE; LDPE; PP; OPP.
HDPE bottles: HDPE; MDPE; LDPE; LLDPE; PP; OPP.
PP bottles: HDPE; MDPE; LDPE; LLDPE; PP; OPP.

If the item is a bottle, the label should not cover more than 40% of the pack. If it is a pot, tub, or tray, the label should not cover more than 60% of the pack.
Use of paper labels should be carefully considered, if they delaminate, fibres may contaminate the plastic recyclate. The paper may also pulp in the wash tank. If they must be used, they are acceptable if the correct adhesive is used, and separates easily during processing.

Full Sleeves

Where a full sleeve is to be used on a bottle, the sleeve should be easily removed, and instructions should be clearly displayed to remove the sleeve before placing in the recycling bin. If left on, the sleeve will cause the bottle to be detected incorrectly and sent to the wrong recycling stream or rejected completely.

Sleeves should not be made of the same material as the pack as this is difficult to remove in a float-sink sort and contaminates the recyclate and lowers the quality.

Preferred sleeve materials vary depending on pack material:
PET bottles: PE; PP; OPP; EPS.
HDPE bottles: PE; PP.
PP bottles: PE; PP.

Inks

Inks and pigments, selected to colour and print the container and labels, must comply with restrictions on the use of heavy metal components. Heavy metal inks should be avoided as they may contaminate the recovered plastic recyclates.

Inks that would dye the wash solutions should be avoided as this may discolour the recovered plastic recyclate, diminishing or removing its value completely.

Heavily pigmented containers should also be avoided as this can result in a significant increase in the density of the polymer causing separation problems and can also lead to identification errors with NIR sensors.

Adhesives

The types of adhesives used has important implications in terms of ease of recycling. The amount of adhesive used, and surface coverage should be minimal to maximise the yield and ease of reprocessing.

Water soluble between 60-80°C and hot melt alkali soluble adhesives are the preferable options as they are the easiest to remove.

Label adhesives that are difficult to remove can coat the plastic regrind and embed undesirable contaminants to the recyclate. Seals such as films or foils that leave residues or remnants of either the seal material or adhesives are contaminants and should be avoided.

Watermarks

Manufacturers are experimenting with watermark technology on full sleeves and labels. The innovation allows brands to use smart digital watermarks, which are invisible to the naked eye, but can be seen by high resolution cameras on sorting lines.

This is an imperfect solution to an existing problem with consumers being relied upon to remove labels and sleeves from packaging before recycling.

The infrastructure required to facilitate the sorting of these watermarks is not readily available in the UK. This may be an expense many facility operators are unwilling to take on, when existing infrastructure can sort packages through NIR sufficiently if the design is right, the impact of watermarks will be determined by the rate the technology is adopted.

Digital watermarking example from Lenor packaging. Source: Packaging Europe

Polymer Options

Clear PET

PET is one of the most widely recycled plastics used in household packaging and is viewed by many as the most recyclable polymer widely used in drinks bottles.

Clear PET has good sorting and reprocessing capacity in the UK as well as a high value return on the recyclate.

In the UK, Clear PET pots, tubs and trays are all considered high value target assets for recycling as the rPET volumes are lower than current demand for producers.

Coloured PET is not desirable to many PET recyclers as it interferes with the quality of the recyclate as the end products can be colour sensitive.

HDPE

HDPE is also a widely used polymer for its circularity in products. Natural HDPE is the polymer of choice for many milk bottles as it is easy to reprocess and recycle into new milk bottles.

HDPE is also a popular polymer for chemical containers such as household cleaning products. Clear HDPE has the highest return value, but HDPE is sensitive to contamination with PP due to the close densities of the two polymer types.

PP

PP is another popular and recyclable material often used in food packaging. White PP is often the material of choice for products such as noodle pots, which require the addition of hot water for preparation. PP is also a widely used cap material for many bottles as it is easy to separate in a float/sink tank from materials such as PET.

PP is also sensitive to contamination from HDPE. Currently PP is not recycled into food grade recyclate although this is an area being investigated. PP is widely recycled into other end market products, has a dedicated recycling stream and is collected kerbside.

Instructions to Consumers

OPRL

The OPRL labelling system is the only system linking the availability of recycling services with the packaging materials and components. OPRL labels should be displayed clearly so that consumers can make informed choices when they are recycling products.

Multiple Components

If a package contains multiple components the labelling should specify how the consumer is to recycle each component using the common usage term for each component; if a consumer will relate to an item as a box, the label should refer to the recyclable component as a box.

Where possible it is best to avoid the use of full sleeves so that the burden of responsibility is not forced onto the consumer, a sleeve with a tear strip for example should include the instructions to remove before recycling.

Misleading Instructions

It should be assumed that the consumer does not know anything to do with the recycling of packaging, as such the instructions should be unambiguous in their delivery. If an item is marked as recycled it should be safe for the consumer to assume kerbside collection of the packaging. Where specialist collection methods are used, this should be clearly stated on the packaging recycling instructions.

Consumers have been shown in research to be confused by the inclusion of the mobius loop on packaging, so it is recommended not to include this on the packaging. SPI codes on packaging can also create confusion with consumers leading to otherwise recyclable items being discarded into waste streams.

Further Instructions

Consumers may still be confused about certain aspects of the recycling process and what is acceptable due to mixed messaging from different local authorities and packages.

To avoid confusion for the consumer instructions should identify key details for small items such as lids, with directions for caps on bottles, or straws inserted into cartons before recycling. Details such as the removal of film or foil lids should be provided to ensure as much material is captured as possible.

In the case of bottles, instructions should include the emptying and flattening of the bottle with the cap on, this is because the caps are commonly under 40 mm in diameter and will be lost early in the sorting process if not attached.

Pots should be emptied and rinsed with any film or foil lids removed completely as these will not be recycled and could affect detection. Rigid lids of the same polymer should be replaced on the tub for recycling.

Case Study 1: Carbonated Bottles

Lucozade Energy

Lucozade is a good example of polymer use for plastic bottles, the bottle uses clear PET which provides a high quality and valuable recyclate. However, the bottle has a surface area of ~290.5 cm^2 of which ~275.5 cm^2 is covered with a PET sleeve (95%), the recommended maximum coverage for a label is 40%.

The sleeve does have a form of perforation for ease of removal for recycling, there is no mention of this being necessary on the OPRL labelling, meaning that it is unlikely a consumer will remove the label. The label is made of clear PET, but it is printed over ~80 % which means that if the bottle goes through a MRF it may be mistakenly identified as coloured PET. The label being the same polymer as the bottle may be an issue for recyclers as it would not be separated in a float/sink tank and the label materials, if not removed might contaminate the clear PET recyclate.

The OPRL instructs the consumer to recycle the bottle with the PE cap on only. This is good because the cap has a diameter of ~3.5 cm meaning that it is too small to be caught in the sorting phase if it is recycled separately.

Suntory say that bottles for Ribena and Lucozade Sport products use 100% recycled plastic and Lucozade Energy bottles contain 30% recycled material and has committed to using 100% rPET for their on-the-go bottle production including all Ribena and Lucozade products in the future. The future Lucozade sport bottles will be comprised of a rPET bottle with a PP sleeve that covers 50% of the bottle, meaning that in the future the bottle and sleeve will be separated in a float tank during reprocessing.

Ribena

Suntory has improved the recyclability of their on-the-go Ribena bottles with the removal of the full sleeve, which has been replaced by a thin PP label that covers less than ~40% of the bottle surface area. This enhances the chances of the bottle being identified as clear PET during sorting. The bottle is produced using rPET, meaning it is part of a closed loop recycling process, reusing the same materials from recycled bottles in its production.

The use of clear rPET means that there is a higher return for the producer in terms of value. The cap material is still a coloured PP and is not tethered to the bottle, meaning that it could be lost if it is not attached for recycling.

The use of clear PE/PP could increase the recyclability, but may affect the marketability with cap colours being associated with product identification for consumers.

The bottle can be recycled with the cap on, without the need to remove the label as this along with the cap materials will be separated during processing in a float tank. The label is made using PP, this means that it can also be separated in a float tank.

Case Study 2: Instant Noodle Cups

Itsu Satay Rice Noodles

The Itsu cup uses a clear PP inner cup in combination with a cardboard outer insulating sleeve and the cup is sealed with a printed foil lid. The use of clear PP is a positive for this pack as the material is recyclable. The cardboard insulating sleeve is attached using only two points of adhesive, while this does allow relatively easy separation there is no tear strip and the sleeve itself is tightly bound together.

The recycling information on the pack uses OPRL labels to indicate that the cup, lid, and sleeve are recyclable, the pack also includes an instruction to remove the outer card from the cup. This still places the responsibility onto the consumer to ensure the pack is recycled and may not always be followed. As there are also no instructions to remove the foil lidding material, this may still be attached to the cup when it is sorted and as a multilayer laminated material is not suitable for recycling.

The recyclability of this pack could be improved with the addition of a tear strip to ease the removal of the sleeve. The sleeve is a good feature as it provides insulation for the handling of the product during preparation, though it does pose a considerable problem during sorting if it is not removed. A change in lidding material will also benefit the pack as the foil lid is not recyclable. The use of OPRL labelling and clear instructions for the consumer that the individual components of the pack must be separated is vital as each component contaminates the stream of the other components.

Naked Rendang Curry Veg Pot

The Naked noodle pot uses a white PP cup surrounded by a cardboard outer insulating sleeve, with a film-based lid. The use of white opaque PP polymer for the cup means the cup is recyclable. The cardboard outer sleeve is attached with the minimal amount of adhesive in only one point. The sleeve also has a tear strip for removal that is only attached for 2/3rds of the sleeve length making removal easy. The lidding material is a PE film which is not currently recycled kerbside in all local authorities meaning the pack is not 100% recyclable everywhere.

The pack makes use of OPRL labelling and has information relating to the pot, sleeve, and lid as individual components. The instructions state that the pot and sleeve can be recycled separately with an additional instruction to remove the sleeve. It does however state that the lid is not recyclable, so should go in general waste.

The sleeve comes away from the pack easily, assisted by the 2/3rds attachment which creates a kind of quick release tab on the sleeve. While the sleeve is easily removable, it still places the responsibility on the consumer for removal and may mean that a percentage of packs do not have the sleeve removed before being placed into recycling. The PE lid is also not recyclable and there is no clear instruction to remove it other than to say it is not recycled. This means that if it is not removed it may contaminate the PP recycling stream.

Case Study 3: Drink Bottles

Mars

Mars utilises a white PET bottle, a clear PET bottle would improve recyclability and have the highest value return from the recyclate. The bottle has a fully printed PP sleeve which means the bottle would likely be incorrectly identified during sorting losing valuable resources.

The sleeve does have a perforation for ease of removal, there is however no instruction on the bottle for the label to be removed to aid recycling. The PE cap is ~40mm in diameter and is a sports cap which means it does not need to be removed for consumption. There is however a small clear cap ~25mm in diameter which is not tethered to the main cap, meaning it may be lost or discarded rather than being recycled. Tethering this additional cap would increase the recyclability of the cap. There is also a foil seal under the cap that needs to be removed before consuming and would likely be discarded in general waste or possibly even littered. If left on the bottle it affects the recyclability, so an alternative sealing method would be advantageous in terms of recyclability.

The OPRL labelling on the bottle instructs that the foil may be recycled but doesn't specify removal. It also mentions that the bottle is recyclable with the cap on, with no mention of removing the label. This means that the bottle would likely be identified as a coloured polymer and not be recycled correctly losing the resource. The OPRL should specify label removal.

An ideal solution for this packaging would be the use of a clear PET bottle with a tethered cap and the removal of the foil seal. The label should cover no more than 40% of the bottle and use water soluble adhesive to that it may be easily removed during processing.

Frijj

Müller utilises a clear PET bottle which is widely recycled and collected in every local authority in the UK. The bottle also has a full PP sleeve with a perforated tear strip to ease removal for recycling, unlike the Mars product the Frijj packaging contains instructions on the OPRL label to remove the sleeve to aid recycling.

There is also a message on the tear strip to promote the sleeves removal. There are also instructions to rinse the bottle and replace the cap before recycling the bottle. The PE cap is ~40 mm which is on the borderline for being lost in processing. This product does not have a foil seal under the cap which is another boost for the recyclability of the packaging.

The sleeve, despite the instruction for removal remains a negative for packaging of this category. Sleeves are not seen as recyclable and should be avoided as much as possible. Ideally a label that covers no more than 40% of the bottle and can be removed easily during processing is the best solution. Tethered caps also have the added benefit of being attached to the bottle and would increase the capture rate of small items in the sorting process.

Case Study 4: Household Products

Comfort

Unilever makes use of a clear PET bottle which is collected kerbside by 100% of local authorities in the UK, which Unilever claim is produced from 100% recycled PET. The bottle has a PP cap which is recyclable. The bottle has a full sleeve attached which may be PET and is fully printed, which has a negative impact on the recyclability of the pack as it may not always be removed by the consumer.

OPRL labels are displayed on the side of the bottle close to a perforated strip to ease removal of the sleeve to recycle the bottle. This is reliant on the consumer removing the sleeve and rinsing the bottle before recycling, which means that the bottle could be mis-identified as coloured PET if the sleeve is not removed, which removes valuable clear PET from the recyclate stream.

The OPRL labels prompt the consumer to recycle the bottle, although there is no additional instruction to rinse the bottle of any residual liquids. There is a label to recycle the cap, which is made of clear PP, this will be separated through float/sink separation during reprocessing.

Potentially a label that covers less than 40% of the bottle and is attached by a water-soluble adhesive would be the ideal solution for an already recyclable bottle material. This would remove the reliance placed on the consumer to remove the sleeve prior to recycling and the problem of the sleeve not being recyclable.

Lenor

Proctor and Gamble have also used a clear PET bottle for several lines in their Lenor range, although some still make use of coloured opaque PET which reduces the value of the recyclate. The bottle has a PP label that covers just over 60% of the bottle, which is over the recommended maximum of 40% coverage. This means that there is a high probability that the pack would be mis-identified during sorting and end up in the coloured fraction. The cap is made using coloured PP, which can be separated in a float tank during reprocessing.

The OPRL labels on the pack inform the consumer that both the bottle and cap may be recycled, there are no additional instructions on the label such as rinsing the bottle or recycling with the cap on.

Improvements could be made by reducing the size of the label so that it covers no more than 40% of the pack for better detection rates. Also, the cap material could be changed to a clear polymer to enhance the value of the recyclate, where possible a cap made of the same material as the bottle would maximise the recyclability of the pack.

Lenor have been introducing watermarks on their packs to assist in identification at MRFs. However, this is not applicable in the UK as currently there is no infrastructure to use this technology in identification processes.

Case Study 5: Hot Beverages

Horlicks

Horlicks is packaged in a natural opaque HDPE jar with a blue coloured PP lid with a multilayer paperboard seal to the top. The jar is covered completely with a printed sleeve of which the top two centimetres act as a seal which is removed to open the jar. Beneath the lid is a seal made of a polymer/aluminium multilayer, which is difficult to remove without leaving any remnants.

The sleeve contains OPRL labels with instructions to recycle the jar and cap separately. The lid is around 70mm in diameter so should not be an issue in the sorting phase, a clear polymer would still be a better and more valuable option than coloured PP. The OPRL labels include instructions to remove the sleeve before recycling, with another instruction at the base of the jar along the perforation to 'tear here to recycle jar.' These instructions are not clear and the perforation, though simple to use is not highlighted and easy to miss.

The recyclability is impacted by the fact the jar has a full-length sleeve, which is dependent on the consumer for removal as well as the difficult to remove multilayer seal. Improvements could be made by utilising a clear PET jar material with a label attached with a water-soluble adhesive for easy removal at the sorting facility. The label could cover up to 60% of the pack and the clear plastic would be more aesthetic than opaque HDPE with the smaller labels.

Case Study 6: Bread and Cake

Cadbury Dairy Milk Caramel Mini Cookies

The Cadbury cookies are packaged in a clear PET container with an attached lid, which is marked as r-PET.

The package has a paper label which covers less than 50% of the pack. The paper label is fixed completely with an adhesive layer and is not easy to detach from the container.

This means that the label would be difficult to remove during reprocessing and could contaminate the recyclate with pulp or fibres. A PP or PE label with only a couple of water soluble adhesive points would be preferred as this could be separated in a float tank during reprocessing.

The use of clear r-PET for the tub is great because it is a high value polymer and has a high return value and circularity.

Sainsbury’s Chocolate And Orange Mini Rolls

The Sainsbury’s baked treats tubs are packaged in a natural PP tub with a natural PP lid. The pack has an in-mould label which covers almost 100% of the circumference of the tub. The tub is sealed with a tab that does not detach from the tub once the seal is broken, which is good for recycling.

The unpigmented PP material used in the tub is widely recycled and is a target material for reprocessors, there are currently no dedicated recycling streams for food grade PP. The in-mould printed label is a negative factor in the recyclability because all surface printing on clear or natural unpigmented PP is a contaminant and affects the quality of the recyclate.

The labelling could be improved with a paperboard sleeve that can be removed simply with a tear off or some other self-removing technology. Alternatively smaller labels on the front and rear of the tub with just the essential information covering no more than 60% of the pack, allowing the clear packaging to advertise the product would be the optimal solution, allowing the label material to be separated in a float tank during reprocessing.

Summary

Awareness of the value and the versatility of used plastic packaging needs to be enhanced further. In multiple post- consumer and post-industrial markets, the potential opportunity for recycled materials is expanding.

As we already know there are five stages in the recycling process and packaging needs to pass each stage to be recycled.

Most plastics can be recycled, but some are more versatile and widely collected than others, while also carrying a higher intrinsic value.

Many products already use clear polyethylene terephthalate, polyethylene or polypropylene polymers as their primary polymer of choice. These polymers offer the highest value return for recyclates as well as the versatility to promote circularity in food grade packaging.

Clear guidelines and efficient use of resources such as adhesives and label choices could ensure that more plastic packaging remains in the recycling chain, creating a sustainable circular economy.

There is vast shortfall in the volumes of rPET being processed in the UK and the market is struggling to fulfil the demands of reprocessors while less desirable recyclates are wasted. A switch to a more desirable polymer, where possible increases the available resources for reprocessors and helps brands become more circular with their packaging.

There are also a wide range of non-food opportunities for recyclates in sectors such as the construction industry; transport and road safety; garden furniture; stationary; and clothing fibres.

Conclusion

There are no perfect solutions when it comes to packaging products with the intention of making it simple and convenient for consumers. There are countless intricacies that result in some argument as to whether something is more or less recyclable, from polymer selection; label choice; to sleeves and tear strips. It is easy for a brand to claim a package is recyclable through the addition of a tear strip with the instruction to separate this from the polymer before being placed in the recycling bin. This places the responsibility onto the consumer as to whether recyclability is achieved, which can be considered a contradiction to corporate social responsibility values, which should champion the individual; community; and the environment.

As technology develops it will become much simpler and acceptable for brands to use packaging that does not place as much responsibility onto the consumers. The adoption of smart digital watermarks or other tagging technologies will enable sorting facilities to identify packs without the need for separation during consumer disposal. This would still leave the issue of the sleeves and labels needing to be removed by other methods later, but at least means that capture rates of target materials would be improved. Furthermore the expansion of optical sorting technology will enable packs to be detected irrespective of the materials chosen for labels or sleeves in the future meaning that target materials can be separated with increased accuracy improving capture rates of target polymers for recyclers.

It is important to remember that through all the improvement in sorting technology, the labels and sleeves, etc will still need separating and sorting into the correct streams which takes additional time and resources. So the improvements in sorting will not remove the responsibility for the brand and manufacturers to ensure that packaging is easy to sort and recycle, without placing the burden on the consumer.

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