

THE RETAIL SECTORS DESIGN GUIDE FOR PLASTIC PACKAGING



PARTNERSHIP ON
PLASTIC IN THE RETAIL
SECTOR

 Ministry of Environment
of Denmark

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Purpose

This design guide is intended for companies that wish to realise the potential to re-use and recycle more of their plastic packaging. This guide is an aid to purchasers, product developers, and others who make decisions about packaging design. It can also assist in the dialogue with the producers of packaging, as a checklist of the requirements the packaging must live up to in order to be circular.

The guide presents a range of general circular design principles for the retail sector, which are applicable for both small and large companies. Ultimately, this shall enable a streamlining of packaging design in the retail sector, thus ensuring more efficient sorting and re-use or recycling, reduced use of plastic, and an increased use of recycled plastic in new packaging.

The design guide was developed in cooperation between the Danish Ministry of Environment and the retail sector and shall help the retail sector adhere to future producer responsibilities for packaging.

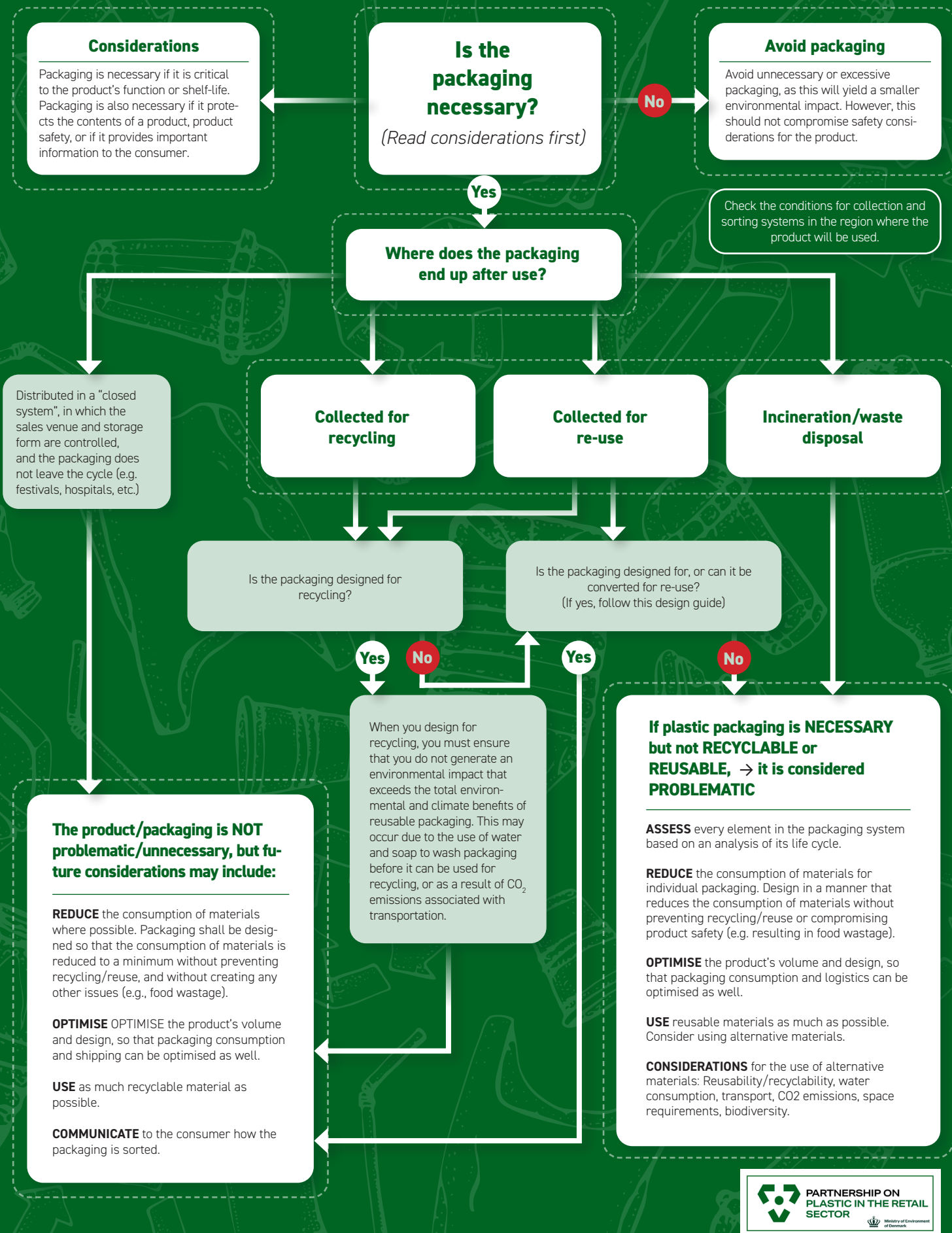
Limit your packaging

Before you start assessing which packaging is the best, you must determine whether packaging is necessary at all.

No matter which packaging material you use, you should always minimise the amount of packaging relative to the product. The minimisation of packaging must never compromise product safety, consumer safety, shelf-life, reusability or quality.

You should also consider whether you are using the packaging material that results in the smallest strain on the environment. For example, consider whether plastic packaging can be replaced with another packaging material, such as fibre-based packaging. The inverse question should also be asked, however: can plastic be used to replace other packaging materials to add some desired features or a reduction in packaging consumption in terms of weight? Plastic does have properties such as being so light that even small amounts of plastic materials can often provide the properties you need, such as reducing food waste.

IS PACKAGING NECESSARY?



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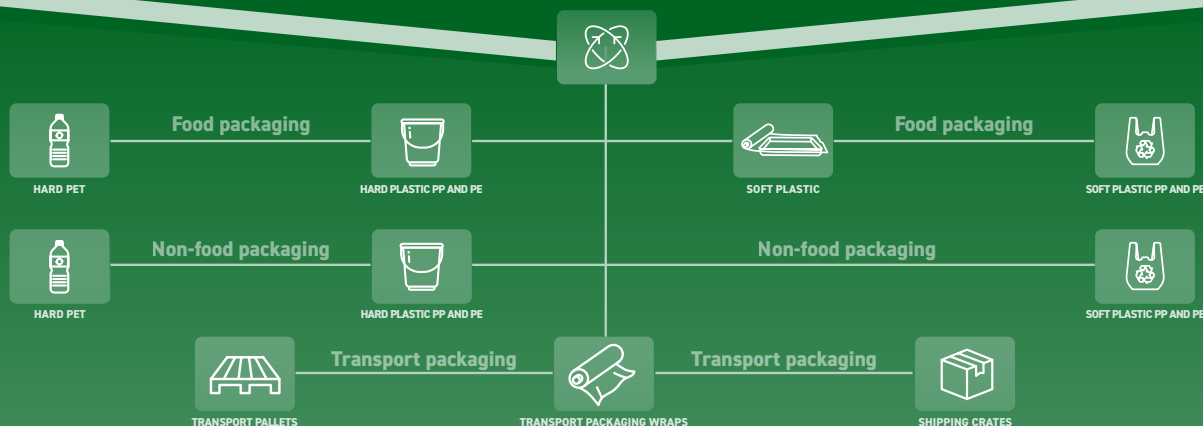
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GENERAL DESIGN PRINCIPLES

The design principles below are divided into general and specific design principles (food, non-food and transport packaging). The design principles represent the general guidelines for circular packaging design and sets

a standard for how packaging should be designed. The specific principles elaborate on concrete measures under each of the three categories, divided into the most common types of plastic (PET, PE, and PP).

DESIGN PRINCIPLES



General design principles

1. Use mono-materials

A mono-material is a material that consists of a single type of material. When multiple materials are combined, such as a cardboard box with a plastic window fastened with adhesive, then this renders it difficult for the overall packaging to be re-used. The same applies when multiple types of plastic are combined.

2. It must be easy to separate the packaging, so that the materials can be sorted into clean fractions

When different materials are used, it shall be easy for either the consumer or waste sorting facility to separate out its individual components.

3. Limit the use of PET, PE, and PP plastics

PET, PE, and PP make up the largest proportion of packaging volumes in household waste in Denmark, and the priority should therefore be to design for re-use. EPS can be used when there is a technical need for temperature regulation or special product protection during transport.

4. Limit the use of printing and colouring on packaging

The less printing and colouring are used in packaging, the higher the quality of the recycled packaging will be. For this reason, clear and transparent plastic is better to use than colour packaging, and lighter colours are better than dark ones.

5. When labelling is applied to packaging, it shall be ensured that the choice of materials and adhesives does not prevent recycling

See [plastindustriens designguide](#) for

designkrav til etiketter og lim (s. 40, 41, 45, 46, 53-55, 59).

6. Design the packaging so that it is easy for the consumer to empty its contents

The design of the packaging shall make it easy for the consumer to, through normal use, completely empty the contents of the packaging, minimising food and product wastage

7. Guide the consumer on how to separate and sort the packaging for recycling or where to deliver it for re-use

The packaging in question should state how it can be sorted for recycling. Ideally, use [the common pictogram system](#).

8. The packaging should be made from recycled materials where possible

Efforts should be made to use as high a proportion of recycled materials as possible, without compromising on the packaging's features or consumer and product safety. There may be safety-related limits and requirements on the use of recycled plastics for, e.g., food and cosmetics packaging.

9. Avoid using recycled materials of a higher quality than is required by the product

There are different requirements on packaging, all depending on what products they contain. This may complicate the use of recycled plastic for purposes such as food packaging, as the producer must be able to document properties or cleanliness for the recycled plastic materials. To avoid an unnecessary loss of quality for the recycled plastic, you should only use the quality that is needed to satisfy product legislation or requirements for the product

type in question. This prevents situations such as food-grade recycled plastics being used for packaging with less strict requirements.

10. Avoid problematic chemicals in packaging

Undesirable chemicals in packaging (including printing, adhesives, labels, etc.) are a challenge for both health and recycling opportunities. Substances that are viewed as being particularly problematic to human health or the environment, are undesirable in packaging. See the guidelines for undesirable chemicals: [Candidate list](#), [Endocrine](#).

11. When using biobased plastics, you must consider a range of factors, such as the use of agricultural soil, CO2 emissions, pesticides, and water consumption

There may be both upsides and downsides to using biobased plastics. When using biobased plastics, rather than conventional plastics, there are several factors that should be considered. It is recommended here to view assessments that have already been conducted, and to secure relevant certifications for the materials, such as ISCC certifications. It should also be ensured that the biobased plastic can be included in the existing recycling of comparable types of materials.

12. Biodegradable plastics should be avoided in packaging

Biodegradable plastics are very rarely broken down in nature and require a separate system for collection, as the materials cannot be recycled alongside other types of plastic and may therefore affect the recycling quality of other types of plastic. For this reason, the use of biodegradable plastics should be completely avoided in packaging.

SPECIFIC DESIGN PRINCIPLES

Once you have reviewed the general design principles, you can find further recommendations for food, non-food, and transport packaging below, divided into the most common types of plastic (PET, PE, and PP). We distinguish

between hard and soft plastic, as they require different methods for sorting and recycling. Furthermore, soft plastic may often consist of several layers of different materials, making it difficult to recycle.

Food packaging

The primary function of food packaging is to protect food products, extend their shelf-life and prevent food wastage on the way from the producer to the consumer. Legislation places high safety requirements on food packaging to prevent undesirable substances from being transferred to food goods. Food goods are most commonly packed in hard plastic, soft plastic, or a combination thereof. Soft plastic is plastic that can be crumpled up or tied into a knot, e.g. bags and plastic wrap. Hard plastic is firm, stiff, and often thicker as a material than soft plastic, e.g. trays, cups, bottles, etc.

Hard PET

PET is a very chemically stable material that is only minimally contaminated by the product contents or substances that it comes into contact with. PET from food packaging can therefore be cleaned to a quality at which it can be recycled for new food packaging. This means that you can guarantee that 95% of the materials come from food packaging.

Recommendations for hard PET for food goods:

- **When** you use PET, there is a requirement to use recycled plastic as much as possible.
- **Use** clear or uncoloured PET, as this increases the recyclability of the packaging.
- **Avoid** directly printing, using additives, or coating, as this may threaten food safety in the next recirculation.
- **Use** labelling that can be pulled or washed off, sleeves or wrappers.

- **Closures** on PET packaging can be done with a non-printed/undecorated PET wrap. Alternatively, you can use a decorated mono-wrap with a different mass density, typically PE or PP, that can later be mechanically sorted.
- **Print** dyes used on closures or labels must not dissolve in water during pre-washing and washing, as this poses a potential risk for NIAS in the next cycle of the recycling process and may limit the material's suitability for contact with food goods.
- **Design** the packaging so that the food goods can easily be emptied or scraped out.
- **Avoid** foaming material, changing its mass density.



Case: Færch - Evolve food trays

Evolve are food trays that consist of collected and recycled bottles and food trays made from the mono-material PET. They consist of 91% non-coloured rPET - recycled plastic. The packaging is designed with natural colour variations that represent the flow of waste, and that reflect the specific combination of recycled content that makes up the tray. The labels are made with soluble adhesive that can be removed in sorting.

Hard PP and PE

PP and PE are more open to the penetration of contaminants such as mineral oil than PET is. For this reason, mechanically recycled PP and PE are not permitted to be used for food packaging, unless you can guarantee a 100% closed return system.

Recommendations for hard PP and PE for food goods:

- **Use** clear or uncoloured PP/PE, as this increases the recyclability of the packaging.
- **Use** direct prints, or labels, and wrap-pings using the same materials as the packaging.
- **Closure** on PP and PE packaging shall be made from a wrap of the same material as the packaging.
- **Design** partial components using the same material. If, as an exception, a different material is used, then the design shall ensure that the component can easily be separated from the packaging during use or opening.
- **Design** the food packaging so that it can easily be emptied by the consumer.
- **Minimise** the use of barriers, oxide coating, or EVOH (see [the plastic industry's design guide](#)).
- **Avoid** fillers, e.g. lime, that increase mass density to over 1g/cm³.

Case: Arla - Kærgården

- Packaging was made 100 % recyclable by changing all partial components to PP.
- The paper wrap is easily removable.
- All parts can be separated and sorted for recycling.



Soft PET

PET wraps should be avoided in general, as there is no established recycling market. Soft PET can, however, be used as an unprinted cover wrap for hard PET packaging, as hard PET will not be contaminated by other materials this way.

Recommendations for soft PET for food goods:

- **When** PET wraps are used, there is a requirement to use recycled plastic as far as this is possible.
- **Use** clear or uncoloured foil.
- **Avoid** printing.

Soft PE and PP

Soft plastic/flexible wraps have the advantage that they consume far less material than hard plastic packaging. They cannot be recycled for new food contact materials, but enter into other products, provided they are collected and processed.

Recommendations for soft PE and PP for food goods:

- **If** PE or PP are used, only use one type of plastic to ensure mono-materials.
- **Print** using light colours and reduce colour coverage if possible.
- **Where** a barrier is needed, you can use different coatings or additives that do not reduce recyclability, e.g. metallisation, or oxide, acrylic,

or PVOH coatings, or EVOH with a maximum 5 %. See [the plastic industry's design guide](#) p. 58 and 59.

- **Avoid** fillers, e.g. lime, that increase mass density to over 1g/cm³

Case: Castus Fruit Sticks

The wrapper consisted of PET/OPP and was replaced with the mono-material PP. The new design needed to have the same properties with regard to barriers and food safety. While the composition was changed, the bag size was minimised, leading to a material savings of approx. 10%. The recyclability of the material is tested by a recycler to ensure recyclability.



SPECIFIC DESIGN PRINCIPLES



Non-food packaging

The primary purpose of non-food packaging is to protect the product. It may also serve as a barrier with regard to safety requirements, protection against impact and damage, or to extend durability. Non-food products are packed in both hard and soft plastic, and often a combination of the two. Soft plastic is plastic that can be crumpled up or tied into a knot, e.g. bags. Hard plastic is stiff, and you can drum on it with your finger, e.g. buckets or crates.

Recommendations for hard PET for non-food goods:

- **When** you use hard PET, there is a requirement to use recycled plastic as much as possible.
- **Use** clear or uncoloured PET, as this increases recycling options for the packaging.
- **Minimise** direct printing, as this increases recycling options for the packaging.
- **Labels**, sleeves or wrappers on the packaging shall be easy to remove either for the consumer or by washing during the recycling process. [See the plastic industry's design guide](#), p. 40-41 and 53-55 for design requirements on labels and adhesives.
- **Use** labels and covers made from PE/PP and with a maximum 60 % coverage of the product's surface.
- **If** a wrap is used as a closure or for sealing, then it should be ensured that the wrap is not printed or coloured.

- **Minimise** the use of barriers and coatings.
- **Use** PE or PP for closures (such as caps/lids).

Case: Netto - Hello Sensitive laundry detergent

- The packaging is 100 % rPET (recycled plastic) and no colouring has been added.
- Printing on the packaging is minimised as only a date code is printed on it.
- The cap is made from PP and can be sorted in the sorting process.



Hard plastic PE and PP

Hard PP and PE are largely recycled mechanically. However, a number of considerations should be made in packaging design to avoid unnecessary impurities and contaminations in the recycled materials, which may result in a lower quality of materials. Recycled PP and PE can be used as packaging for other products, as legislation for these products is less restrictive.

Recommendations for hard PE and PP for non-food goods:

- **When** you use hard PE and PP, there is a requirement to use recycled plastic as much as possible.
- **Use** clear or light colours, as this improves opportunities to recycle the packaging to a high quality.

- **Minimise** direct printing, as this increases recycling options for the packaging.
- **Labels**, sleeves or wrappers on the packaging shall be easy to remove either for the consumer or by washing during the recycling process. [See the plastic industry's design guide](#), p. 40-41 and 53-55 for design requirements on labels and adhesives.
- **Use** labels and covers made from PE/PP and with a maximum 60 % coverage of the product's surface.
- **If** a wrap is used as a closure or for sealing, then it should be ensured that the wrap is not printed or coloured.
- Minimise the use of barriers and coatings.
- **Use** PE or PP for closures (such as caps/lids).
- **B** fillers, e.g. lime, that increase mass density to over 1g/cm³.

Case: Dermapharm - Airless sunscreen

Derma's sunscreen was previously sold in a tube made from PE and PP plastic. They were changed to an "airless" design focused on emptying the product. At the same time, the tube, pump, and label were designed to consist of PP plastic alone. Compared to the previous emptying degree of 82.9 % (17.1 % remains in the tube), the new airless packaging has an emptying degree of 95.2 % (4.8 % remains in the tube).



Soft plastic PE and PP

Soft plastic/flexible wraps have the advantage that they consume far less material than hard plastic packaging. PE/PP wraps made from mono-materials can be recycled for new products if they are collected and processed.

Recommendations for soft PE and PP for non-food goods:

- **When** you use PE and PP wraps for non-food products, there is a requirement to use recycled plastic as much as possible.
- **When** using soft plastic/flexible foil, use either PP or PE mono-materials.
- **Print** using light colours and reduce colour coverage if possible.
- **Where** a barrier is needed, you can use different coatings or additives that do not reduce recyclability, e.g. metallisation, or oxide, acrylic, or PVOH coatings, or EVOH with a maximum 5 %. [See the plastic industry's design guide](#) p. 58 and 59.

- **Avoid** fillers, e.g. lime.
- **When** using closures, such as zip locks, spouts, or caps, then these must be made from the same materials as the wrap.

Case: TrioWorld - recycled plastic wrap

TrioWorld produces PE wraps to pack a number of non-food products. The amount of recycled plastic is up to 60%, and it is recyclable as well. At the same time, the plastic has been made thinner, allowing for less plastic to be used.



SPECIFIC DESIGN PRINCIPLES

Transport packaging

Large amounts of different types of transport packaging are used in the retail sector, both when products are sent between companies and to customers. This may, for example, be when shipments are packed in crates using plastic wrap, or other materials. Additionally, three areas that have potential with regard to re-use and recycling are addressed below: pallets, wraps, and shipping crates.

Transport pallets

Plastic pallets may have certain advantages over conventional wooden pallets. The best material for pallets depends on the material and its use, which is to be re-used as many times as possible and later recycled.

- **Examine** whether there is a returns system for the pallets, so that they can be used as many times as possible.
- **Re-use** plastic pallets as many times as possible and recycle them when they are done being used.
- **Request** pallets made from recycled plastic.
- **Request** HDPE or PP plastic pallets.

There is no standardised returns system for plastic pallets, but there are many vendors that wish to have their customers return their pallets so that they can be re-used. One example is Dansk Transport Emballage, who receive both their own pallets and those from other vendors. The plastic pallets they are unable to re-use are sent for recycling. Discuss with your plastic pallet supplier to arrange to have the pallets returned for re-use, and ultimately recycling.



Transport packaging wraps

I transporten bruges der store mængder folieplast, ofte til at vikke paller og produkter ind i. Krympe og stræk-folie er den bløde, tynde plast, som også kaldes plastwrap.

- **Request** LDPE plastic, as this is the type of plastic that the majority of transport packaging is made from. It is also the type of plastic whose properties are the best and the cheapest for this purpose.

- **Request** transparent plastic wrap. If it must be coloured, request to have as few types of colours as possible, and preferably lighter shades. Colours may ideally be water-based, which makes them easier to handle in the recycling process.
- **Request** recycled plastic when plastic wrap is used as transport packaging.
- **Avoid** labels as much as possible, as labels are an obstacle to recycling. If possible, request to print on the wrap instead. If labels must be used, limit the amount and request easily soluble adhesive.

Case: Coop - multi-use bags

- Wraps are exclusively made from transparent LDPE
- Wraps are collected from storage or shops and are recycled for the already existing production of multi-use bags for Coop shops.
- The materials are used for the production of highly durable multi-use bags that consumers are encouraged to use again and again.
- The shopping bags are mainly produced using light colours to aid in future recycling done by the consumer.



Shipping crates

Packaging that is used when products are to be sent to consumers' homes. Crates, "envelopes", etc.

- **Place** requirements on the recycled plastic content of shipping crates that are not intended to be in direct contact with food goods.
- **Shipping** crates may ideally be re-used many times (e.g. bread crates, milk crates, and beer crates). When they are done being used, they can be recycled if they are made from mono-materials.

When choosing EPS (Styrofoam crates) as transport packaging, the following design rules shall be upheld:

- **Request** mono-materials, or a layer of PS if relevant.
- **Avoid** labels. If labels must be used, use PS.
- **Avoid** colouring and printing as much as possible. Use laser printing if relevant.
- **If** other types of materials are to be used alongside EPS, then this should be PS. All other types of materials will degrade the recyclability of the EPS.
- **Avoid** fillers, e.g. lime.
- **Avoid** the unnecessary addition of chemical substances that are not part of the production process itself.

Case: Nemlig.com - thermal crates

Thermal crates used to deliver daily goods at Nemlig.com are made from EPS. The crates are received back from the consumer and are re-used after being washed at an automatic washing facility. Thermal crates that can no longer be used are recycled for items such as insulation materials.



DEFINITIONS AND GLOSSARY OF TERMS

Circular economy - the Danish Environmental Protection Agency's definition: "Circular economy is either the recycling of materials or - better yet - the prevention of waste through products that can, for instance, be repaired or upgraded. It is also about innovative business models, in which the consumer can return the product for repairs or upgrades. Alternatively, products can be leased instead of selling them to get the most out of the products and their resource consumption." Source: The Danish Environmental Protection Agency.

Packaging: All products, regardless of type and material, that are used for packaging, protection, handling, shipping from producers to users or consumers and the presentation of goods, whether these are raw ingredients or processed goods. All single-use articles that are used for the same purpose shall accordingly be considered packaging. Source: The EU Packaging Directive.

Recycling: "Any recovery operation in which waste materials are processed into products, materials, or substances, whether these are used for their original purpose or for other purposes. This includes the processing of

organic matter, but not for energy production or processing into materials that are used as fuel or for backfilling operations." Source: The Danish Environmental Protection Agency.

Food packaging (food): Food packaging refers to materials that are specifically intended for contact with food goods. Food packaging shall live up to prevailing EU legislation, which stipulates rules and requirements for materials. General rules are given in EU Regulation 1935/2004 on materials and articles intended to come into contact with food. Additionally, the specific rules given in EU Regulation 10/2011 apply as well. When recycling plastic for food packaging, EU Regulation 282/2008 provides special rules with the intention of preventing recycled plastic food packaging resulting in the contamination of the food goods this packaging contains. View the figure on circular and spiral recycling on page 28-29.

Non-food packaging (non-food): Non-food packaging shall comply with REACH legislation and other relevant product legislation depending on what the packaging is intended to protect. For example, packaging for personal care and cleaning/washing is subject to some

product safety requirements that can be found in the Cosmetics Regulations and the Detergent Regulations. In addition, there is a need for contamination-free packaging on products labelled with the blue wreath (The Blue Label), which are subject to a zero-tolerance policy for even the most minute contamination of allergens.

Mono-material: A mono-material is a material that consists of a single type of material.

Types of plastics:

PET - Polyethylene terephthalate is a thermoplastic with a broad range of uses in sectors such as the packaging industry. For example, you will encounter PET almost every time you drink from a soda or water bottle.

PE - Polyethylene occurs in many varieties. These range from flexible to stiff. The most common types are LDPE and HDPE.

PP - Polypropylene is a hard thermoplastic material. The material initially has a faintly white-to-clear colour and can be dyed to pretty much any colour.

EPS - Expanded polystyrene is a thermoplastic and a cellular plastic that consists of up to 98 % air and just 2 % polystyrene.