# Final report

## Meat Packaging – The State of Play in An Evolving Market


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## Abstract

Sustained consumer awareness and concern regarding food packaging is a catalyst driving change globally as major packaging producers or rapid growth start-ups focus their R&D activities to provide commercially viable suitable alternatives. Voluntary commitments to national targets, compliance with legislation or reducing the risk from packaging tax are rapidly becoming barriers to trade in markets relying on packaged products. Recognising the variable requirements on packaging materials in key/high-growth markets, this project was commissioned to provide a technical overview on the progress or risk of the materials used by the Australian red meat sector domestically and in high-value export markets.

This report updates previous work on sustainable red meat packaging to support the MLA strategic objectives and provide guidance for the red meat industry.

# Executive summary

### Background

Increasingly rigorous sustainability requirements from key customers, timebound commitments, and legislation are presenting a risk to domestic and international trade of packed red meat products. The ability of businesses and brand owners to respond to these concerns is a key aspect to achieve long-term sustainable growth. As a major contributor to the Australian economy, it is critical to maintain the industry-leading brand position of Australian red meat and its clean, green, and safe image.

Red meat packaged in plastic is a crucial part of the current sales model and meat packers and packaging manufacturers have made good strides in developing more sustainable packaging and packaging that can be recycled. Australian consumers are well engaged in recycling packaging, yet the absence of a nationwide soft plastics recycling scheme is a major setback and risks losing consumer engagement. In addition, it slows progress towards establishing a circular plastics economy. These setbacks will likely lead to the introduction of extended producer responsibility rules to be implemented by 2025 which means that processors must pay to manage the plastic waste generated by products they place on the market.

This project was tasked with identifying the packaging materials at risk in the Australian market and to provide an unbiased baseline evaluation to support innovation and progression towards the future of sustainable meat packaging. This report updates previous work on sustainable red meat packaging to support the MLA strategic objectives and provide guidance for the red meat industry.

As we stand today, the materials at risk (deemed non-compliant based on current or expected legislation, commitments, or codes of practice) would incur a financial penalty or be prevented from sale if sold in 1) Australia 2) high growth export markets identified. The products affected (either retail form - purchased by the end consumer, or wholesale as primal - further handled, cut, diced, etc) will vary in different jurisdictions. As legislation, commitments or codes of practice are rapidly evolving, consultation of specific country and customer requirements is strongly recommended.

### Objectives

| Objective | Achieved |
|---|---|
| To provide an R&D report in the MLA format as an extension of V.RMH 0127 – A Horizon Scan of Sustainable Red Meat Packaging. | Yes – report delivered covering the aspects below including high-level global sustainable developments as relevant to packaging. |
| Specifically, directives to be assessed with the packaging materials: | |
| Primary packaging when in ‘direct contact with Red Meat’ with the Australian domestic market.<br><br>Provide insights into the technical specifications (substrates). | Yes – primary packaging at risk on shelf in Australia. Assessment by solution and component. Compliance with APCO guidelines. |
| Compliance with APCO requirements and Material at Risk (sustainable benefits versus the challenges) as produced by the main material manufacturers or widely adopted by Industry. | Yes – guide to choosing sustainable plastic packaging that aligns with APCO. |
| Targeting export markets in the EU, UK, China, Indonesia, Japan, Korea, MENA, Nth America, South Asia, India in research and summarise current or potential legislative changes or major customer requirements (i.e., retailer) impacting red meat packaging requirements and risk to trade. | Yes – target export markets key legislation outlined. |

| Objective | Achieved |
|---|---|
| Where changes are being driven by key customer requirements or commitments, provide a snapshot on the current requirements and outlook. | Yes – key domestic retailer requirements outlined. |
| Update on what's happening across leading retailers. | Yes – key developments in retailers in target export markets outlined. |

**Methodology**

The project focussed on red meat packaging in retail and foodservice using publicly available information, surveyed retailer/wholesaler/packaging manufacturer/meat processor websites and free-to-access academic journals. For added context, one packaging/film manufacturer was interviewed, and four retailer/wholesaler stores were visited.

Packaging solution formats were grouped according to their recyclability and circular economy fit and their compliance with APCO for national packaging targets.

**Results/key findings**

- There has been good progress towards achieving the APCO sustainability guidelines for red meat packaging placed on the market. The retailers' sustainability commitments for packaging are all based on APCO targets of 2025.
- The food industry overall is not expected to meet APCO targets, and this will likely lead to the introduction of Extended Producer Responsibility Regulations by 2025.
- Most rigid and plastic components surveyed complied with APCO guidelines: 75% in our sample of rigid plastic formats and 70% of soft plastic components complied. However only 20% of packaging accessories complied with APCO.
- Plastic red meat packaging has been reduced, fibre-based materials are more established and problematic packaging (containing chemicals harmful to the environment and black packaging) are very limited on shelf. Packaging accessories (such as bone guards, netting etc) continue to be unrecyclable although progress is being made to convert paper labels to plastic which is better for recycling.
- Packaging with reduced petrochemical based plastic alternatives are on shelf, however complete elimination of plastic remains unfeasible under the current consumption model which requires a robust shelf-life performance. Reusable containers have not made a mark on the domestic market.
- For the continued use of plastic to be sustainable, it requires a complete system to collect and reprocess it into materials that can be used again for food packaging. While recycling of rigid plastic red meat packaging via kerbside collection has been successful, processing of plastic into food grade material (advanced or chemical recycling) is not happening at the required scale. Without this capability, the Australian plastics economy does not benefit from full circularity and red meat risks economic penalties when EPR is introduced.
- The absence of a nationwide soft plastics scheme since November 2022 has set back sustainability of flexible red meat packaging which is now disposed of in household rubbish bins.
- The Soft Plastics Taskforce (SPT), which is a collaboration of retailers is working to find a solution for instore soft/flexible) plastics collection. The Australian Food and Grocery Council (AFGC) is piloting a kerbside soft plastics scheme.
- The absence of a soft plastics recycling scheme is impeding the launch of innovative soft plastic packaging which is considered a risk regarding consumer acceptance of packaging and future Extended Producer Responsibility (EPR) regulations.

**Benefits to industry**

- Sustainable packaging helps processors to comply with national commitments, gain consumer trust, contribute to the reputation of red meat brands and to be ready for likely developments in regulations such as plastic taxes.
- An updated guide to choosing sustainable packaging components can be adopted by the industry to make better decisions in packaging.
- A future path with upcoming developments in the packaging ecosystem (machinery, advanced recycling, data transparency) shows how the industry is moving towards a circular economy and where collaboration between different stakeholders across the value chain brings benefits and minimises risks from impending regulation and customer requirements.
- With a sharpened global focus on plastic pollution and greenhouse gas emissions, driven by the UN Plastic Treaty and Paris Agreement respectively, the report shows how sustainable red meat packaging can contribute to reducing plastics pollution, greenhouse gas emissions, and food waste.

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# 1.0 Background

With the growing risk to domestic and international trade by increasingly rigorous key customer requirements, commitments or legislation regarding primary packaging material and its sustainability attributes, it is important to provide an update to previous work on Red Meat Sustainable Packaging.

Sustainability requirements from key customers, timebound commitments, and legislation are presenting a risk to domestic and international trade of packaged red meat products. The ability of businesses and brand owners to respond to these concerns is a key aspect to achieve long-term sustainable growth. As a major contributor to the Australian economy, it is critical to maintain the industry-leading brand position of Australian red meat and its clean, green, and safe image.

Red meat packaged in plastic is a crucial part of the current sales model and meat packers and packaging manufacturers have made good strides in developing more sustainable packaging and packaging that can be recycled. Australian consumers are well engaged in recycling the packaging, yet the absence of a nationwide soft plastics recycling scheme is a major setback and risks losing consumer engagement. In addition, it slows progress towards establishing a circular plastics economy. Extended producer responsibility rules are expected by 2025 which means that processors may have to pay to manage the plastic waste generated by products they place on the market.

This project was tasked with identifying the packaging materials at risk in the Australian domestic market and to provide guidance for meat packers in choosing sustainable packaging. This report updates previous work on sustainable red meat packaging to support the MLA strategic objectives and provide guidance for the red meat industry.

This is our report of findings resulting from websites, literature reviews, international industry experience, and direct dealings with retailers/wholesalers/meat processors and packaging suppliers.

# 2.0 Objectives

Our hypothesis was that rapidly changing customer requirements, commitments and legislation concerning the use of primary packaging pose a risk to the sustainable growth of the red meat industry. As a major contributor to the Australian economy, it remains critical to maintain the industry-leading brand position of Australian red meat and its clean, green, and safe image. The objective is to provide a comprehensive update of developments in major customers i.e., retail companies in Australia and chosen export markets, concerning packaging requirements, national targets, and consumer sentiment. The overview will provide the Australian red meat industry with tools to make future investment and packaging decisions with a stronger sustainability lens.

The objectives require a review of primary packaging on the market and its compliance with APCO guidelines, identification of materials at risk, and trends in packaging and customer requirements. This is based upon:

- Survey of packaging on the Australian market to assess state of play and compliance with national targets.
- Identifying packaging at risk and indicating developments in alternatives or recycling infrastructure
- Outline of key retail trends in sustainable packaging
- Top-line status of innovative packaging solutions
- Review of export market regulation and retailer trends in sustainable packaging

# 3.0 Methodology

## 3.1 Survey

### 3.1.1 Products and packaging in scope

The products in scope were fresh beef, lamb, and goat meat with light references to poultry, seafood, and frozen meat to check for transferrable packaging technology developments. All cuts and some processing, for example, mince, were included.

**Table 1: Products and packaging in scope**

| Products In Scope | In Scope | Check for transferable technology | Out of Scope |
|---|---|---|---|
| Beef, Lamb, Goat | Vacuum Packaging | Burger patties | Other livestock |
| Whole and part Carcase | Vacuum Skin Packaging | Sausage | Secondary and tertiary packaging for retail |
| Primal and other cuts (bone and boneless) | Overwrap | Offal | Butcher Stores |
| Processing - mince | Modified Atmospheric Packaging | In-store butchery | |
| Retail packs - all forms | Trays | Frozen | |
| Foodservice - primary and secondary packs | Cartons | Foodservice corrugated packaging | |
| | Bone Guards/Protectors | Fresh Poultry | |
| | Soaker Pads | Fresh seafood | |
| | Scavenger Sachets | | |
| | Labels | | |

### 3.1.2 Organisations in scope

The research comprised of desktop research of different value chain players and light literature reviews of online reports, news articles, and a legislation portal. Desktop research of retailers'/wholesalers' (7), meat processors' (5), and packaging and film manufacturers' (10) websites and retailers' online shops (where accessible) were included as were all organisations' available sustainable packaging commitments. Desktop research included sustainability NGOs and industry collaborations relevant to the packaging and waste space.

Images of new and/or different packaging were captured alongside press releases and other literature that were used to verify the interest.

For added context, one packaging/film manufacturer was interviewed (via webinar) and four retailers were visited.

**Table 2: Companies who contributed directly and retail stores that were visited**

| Value chain stage | Country |
|---|---|
| 1 Packaging and film manufacturer interviewed | Australia |
| 1 Meat processor interviewed | Australia |
| 4 Retailers / wholesaler branded outlets visited | Australia |

**Table 3: Organisations who were surveyed via desktop website review**

| **Value chain stage** | **Organisation** | **Country** |
|---|---|---|
| Packaging and film manufacturers | Amcor | Australia |
| | Berry Global | USA |
| | Bolloré Group | France |
| | Flexopack | Australia |
| | GEA | Germany |
| | LINPAC (Klöckner Pentaplast) | UK/Germany |
| | Select-Equip/Mondini | Australia/Italy |
| | Mondi Plc | UK |
| | PLANTIC™ | Australia/Japan |
| | SEE (formerly Sealed Air) | Australia/USA |
| Meat processors | ABP | UK |
| | Cargill | USA |
| | Hilton Food Group | Holland |
| | JBS | USA |
| | Tyson | USA |
| Retailers / wholesalers | ALDI, | Australia |
| | Coles | Australia |
| | Woolworths | Australia |
| Industry collaborations and NGOs | The Australian Packaging Covenant Organisation (APCO) | Australia |
| | ANZPAC Plastics Pact (ANZPAC) | Australia, NZ |
| | CEFLEX | Europe |
| | Ellen McArthur Foundation | Global |
| | Recycling Near You | Australia |

### 3.1.3 Interview questions

Questions integrated and updated those of V.RMH.0127 (MLA, 2021), adding additional questions to reflect developments in the circular economy. Questions were customised and defined in advance to ensure comparability in response to the different value chain players. Interview questions are detailed below.

Survey questions for retail, wholesale, foodservice, and meat processing industries:

1. What red meat packaging formats are you currently using?: Barrier Vacuum Bags (non-shrink) / Barrier Vacuum Shrink Bags (PVDC barrier) / Barrier Vacuum Shrink Bags (EVOH barrier) / Barrier Vacuum thermoform, fill, & seal films / Barrier Vacuum Skin Packaging (VSP) film with Plastic Tray / Barrier Vacuum Skin Packaging (VSP) film with Fibre Tray / Barrier Film Flow Wrapped Cuts – Modified Atmosphere / Barrier Film Flow Wrapped Trays – Modified Atmosphere / Plastic tray with Barrier Lidding Film – Modified Atmosphere / Non-Barrier B2B bags and films / black coloured packaging.
2. Do you use any of the following in your red meat packaging formats: Bone Guard Protectors – woven (cloth) / Bone Guard Protectors - plastic films / Soaker Pads / Sachets - e.g., Oxygen Scavengers / Netting / Labels – plastic / Labels – paper / Paper Board Cartons - one way / Paper Board Cartons – reusable / Plastic Cartons - one way / Plastic Cartons – reusable.
3. What are your key focus areas for improvements to pack sustainability?
4. Do you have a policy around packaging that is:
   Made to be recyclable / Made from renewable resources / Made from compostable materials / Has a recycled material content.
5. Do you receive case-ready packs in bulk secondary MAP bags?
6. Who/what are the key red meat pack format drivers?
7. What are the roadblocks to change in current formats?
8. Do you support in-store collection for recycling?
9. Do you participate in in-store collection for recycling?
10. Is all red meat packaging designed or specified in accordance with prescribed sustainability objectives e.g., APCO's Sustainable Packaging Guidelines?
11. Is all red meat packaging recyclable, renewable or compostable?
12. What is the cut-off date for all red meat packaging to be recyclable, renewable, or compostable?
13. Do you have/are you involved with recycling developments around mechanical recycling?
14. Do you have/are you involved with recycling developments around chemical recycling?
15. Regarding recycled content – are you able to specify what percentage is used currently?
16. What are the barriers to using or increasing the content?
17. What are your customers asking for?

Survey questions for packaging and film manufacturers:

1. What are the latest developments in red meat packaging that support sustainability objectives?
2. Are there new packaging formats under development for red meat e.g., moisture absorbing tray?
3. Do you have packaging formats that are recyclable in recognised existing recycling streams?
4. Is film development driving towards high-barrier mono materials and multilayer materials compatible with recycling streams?
5. Do you have packaging formats that are compostable or biodegradable and under what conditions / to what standard?
6. Is there innovation in areas of active and intelligent packaging?
7. What advances are there in the packing/processing of red meat including automation and labelling e.g., QR codes?
8. Do you have/are you involved with recycling developments around mechanical recycling?
9. Do you have/are you involved with recycling developments around chemical recycling?
10. What are your clients/customers asking for?

## 3.2 Sustainability assessment of surveyed packaging

Compliance to APCO guidelines was used to assess the packaging solutions. The packaging components were then grouped according to their status as part of linear, recycling, or circular economy, using the rationale adapted from MLA (2016) and APCO Sustainable Packaging Guidelines (2020).

Packaging materials at risk (as produced by the main material manufacturers or widely adopted by industry) were assessed for their sustainability benefits versus the challenges. An outlook towards national developments was included for context.

The survey results are presented and discussed in Section 4.6.2.2. The updated review of alternatives to single use polyolefin plastics and novel and new packaging are discussed in Section 4.6.2.3 and 4.6.2.4.

## 3.3 Review of export markets

The Australian and key export markets were reviewed for legislative changes and retailer commitments relevant to plastic in contact with food.

Table 4 shows the chosen markets. These were based on the State of the Industry Report (MLA, 2022) and were selected to be representative of volumes, regions and/or potentially noteworthy activity with regards to consumers or legislative approach to packaging sustainability.

A desktop review of key retail customer sustainability commitments used publicly available information from the company websites.

**Table 4: Markets and retailers assessed via desktop review**

| Region* | Country | Retailer | | | |
|---|---|---|---|---|---|
| Eastern Asia | China | RT-Mart & Auchan (SA) | Yonghui | CR Mart & CR Suguo (Vanguard) | |
| | Hong Kong | Wellcome | ParknShop (ASWG, CKHH) | | |
| | Japan | AEON | Ito-Yokado (Seven&i H) | Seiyu Group (85% KKR) | |
| | South Korea | Lotte Mart | Emart | Homeplus | |
| | Taiwan | Carrefour | PX Mart | | |
| South-eastern Asia | Indonesia | Hero | PT Lion Super (AD) | Carrefour | |
| | Malaysia | AEON | Hero Market | Jaya Grocer | The Food Purveyor |
| | Philippines | Robinsons | SM Supermarket | | |
| Oceania | Australia | ALDI | Coles | Woolworths | |
| | Papua New Guinea | RH Hypermarket | | | |
| Western Asia (MENA) | Kuwait | Carrefour | Geant | | |
| | Saudi Arabia | Al Othiam | Panda Supermarket | Farm Superstores | |
| | UAE | Carrefour | Choithram | Geant | |
| Northern Africa (MENA) | Egypt | Carrefour | Metro | | |
| Europe | France | E.Leclerc | Carrefour | Les Mousquetaires | |
| | Netherlands | Albert Heijn (AD) | Jumbo | Lidl | |
| | UK | Tesco | Waitrose | Sainsbury's | |
| Northern America | Canada | Walmart | Costco | Metro | |
| | USA | Walmart | Costco | Kroger | |

*Regions are classified according to UN Standard 49 (UN Stats, 2023)

### 3.3.2 Limitations of the research

This report does not constitute legal advice, nor should it be considered an exhaustive list of every application of laws and/or regulations in place and operation within the countries and regions under analysis.

The review undertaken focussed on the core regulatory approaches of each country or region and the identification of explicit, and readily accessible constraints or controls that would be relevant for further exploration to MLA should it wish to pursue the exportation of products to such countries and regions.

## 3.4 Implementation support

Websites of government, NGOs and trade organisations were reviewed to search for supporting technologies or tools. An updated summary with links to further reading is included in the results (see Table 12: Instruments to support sustainable packaging). A table with sustainability (APCO compliance) of packaging components is given (see Table 11: Packaging component sustainability guidance).

# 4.0 Results

## 4.1 Consumption of meat and packaging

As red meat consumption rises, so will the amount of packaging waste, unless there are changes in packaging design and disposal (MLA, 2021). In the current food system, plastic continues to play an important role in protecting and preserving food and helping to reduce food waste.

Substantial efforts have been made in recent years to reduce the amount of plastic used, change the type of plastic, and create recovery schemes to prevent it from going to landfill. However, badly managed plastic waste continues to impact negatively on the environment. Studies have found microplastics that contaminate soil and waterways, enter human blood, and tissue, and potentially act as biofilms that harbour pathogens (FAO, 2021).

Plastic packaging that ends up in landfill is a waste of resources, worth an estimated $419 million of economic value annually in Australia by not recovering all PET and HDPE (DAWE 2021). Following China's National Sword/Blue Sky program, a set of import restrictions placed on 24 streams of recyclable materials, there was a rush to develop recycling solutions in Australia. This has not scaled up sufficiently as indicated by the collapse of the soft plastics recycling scheme REDcycle due to a lack of processing capacity of waste soft plastic and a market for the output.

Australia's red meat and livestock industry turnover was $67.7 billion in 2020–2021.

While red meat consumption per capita has been declining, Australia remains one of the world's largest consumers of beef. Export markets account for 65-75% of Australia's red meat market and the outlook is positive, with an increasing focus on US and China (MLA, 2022).

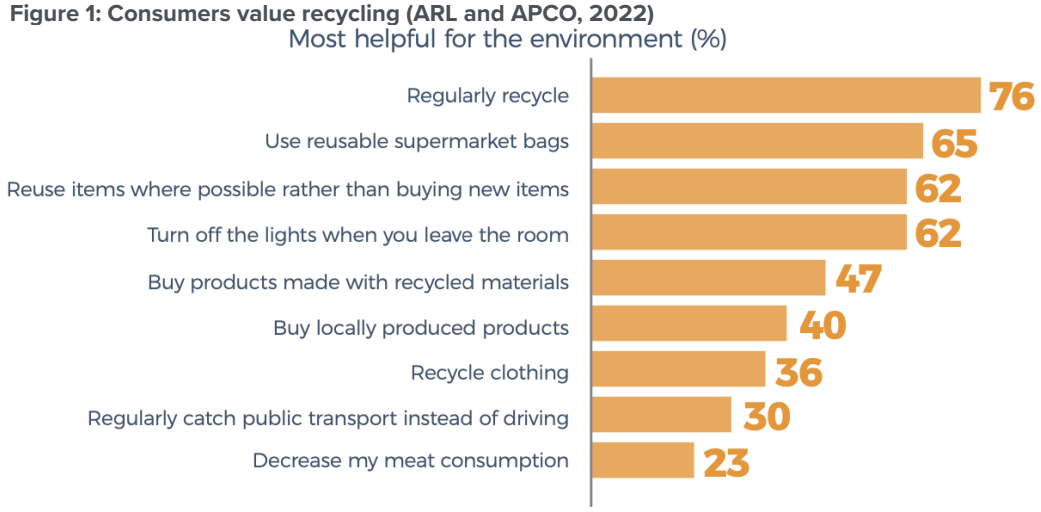
Approximately 60% of metropolitan Australians have a strong level of trust in the beef and sheep industry partly due to the perceived action farmers are taking to reduce environmental impact.

In 2022, when Australian consumers were asked what behaviours were most helpful for the environment, 76% said recycling regularly and 23% (vs 21% in 2021) said decreasing meat consumption (see Figure 1). More than 8 out of 10 Australians consider recycling at home to be easy but almost half are concerned that they are not recycling correctly and look to product packaging for information. Awareness of the Australian Recycling Label (ARL) is high at 75% and 50% of respondents said they were more likely to buy a product if it has this label.

There is confusion around handling soft plastic film with 76% of consumers saying they would put it in the general waste bin while more than half would return it to store (ARL and APCO 2022). This is a key point to consider in meat packaging which uses a large amount of soft plastic and where soft plastic schemes are either on hold (in store drop off - REDcycle) or piloting (kerbside collection – AFGC).

This missing link is crucial for rounding out trust with consumers – they want to do the right thing and are looking for guidance.

**Figure 1: Consumers value recycling (ARL and APCO, 2022)**




## 4.2 Disposal of meat packaging

The amount of packaging placed on the market in Australia in 2020-2021 increased by 5% (excluding wood and compared to the previous year) to an estimated 6.74 million tonnes. Paper and paperboard account for 50.3%, glass for 19%, plastic packaging for 17.5%, and metal for 3.8%. The amount of plastic packaging increased by 5%.

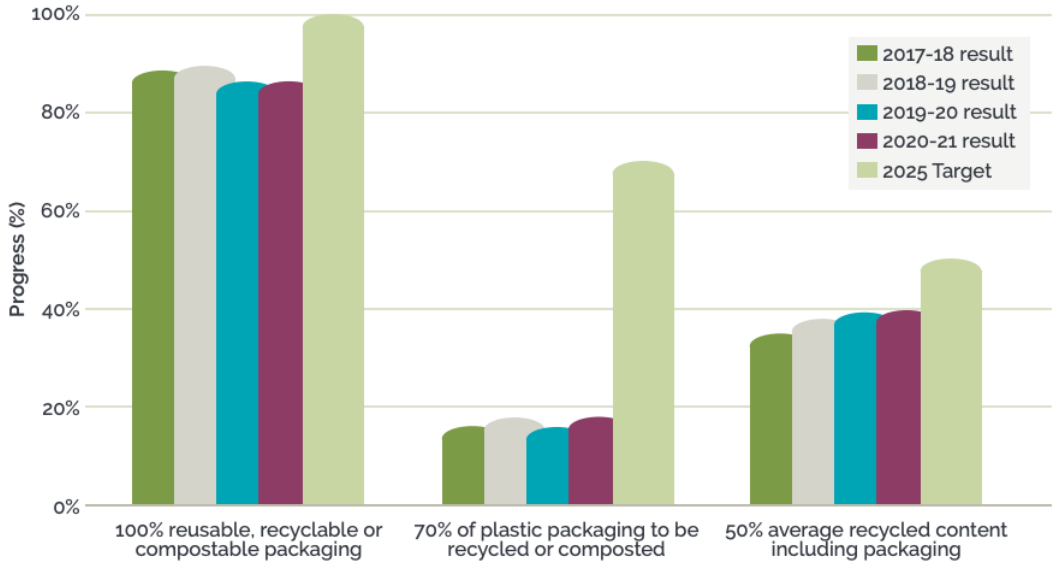
The amount of packaging that was recovered post-consumer in 2020-2021 also increased by 11% to an estimated 3.79 million tonnes. The recovery rate in 2020-21 is estimated at 56% with paper and paperboard being the most recovered, followed by glass, metal, wood, and plastic. According to APCO, the increases since 2017-2018, when monitoring started, are generally significant apart from plastic packaging which has a low recovery rate of 18%.

This is a lost opportunity and a risk because most plastic (95%) is sourced from virgin feedstock which is subject to volatile petrochemical prices and does not meet national requirements for use of recycled content. The value that is lost when plastic goes to landfill was estimated at AUS $390 million in 2020–2021, yet when plastic is recovered, it has a 60% recyclability rate. By recycling plastic, 652,040 tonnes of CO2 equivalent are avoided which is an important factor in mitigating climate impact.

APCO estimates that plastic reprocessing capacity will increase by 27.1% which is significant and marks a slow move towards circularity. Despite this projection, the total amount of packaging placed on the market is expected to increase towards 2025 and projections estimate that APCO targets will not be met (APCO, 2023) (See Figure 3). The lack of plastic recycling capability and low use of recycled content are two key factors.

While figures for meat packaging recovery are not yet available, the predictions cast by APCO signal an increasing concern about packaging waste, in particular plastic which is an essential enabler of the modern meat trade.

**Figure 2: 2025 packaging targets and progress to 2021 (APCO, 2023)**




A major setback for soft plastics recycling (a format common in red meat retail and foodservice), occurred in November 2022 when the soft plastics collection scheme, REDcycle, collapsed. Public support for the scheme was very high and the sheer quantities returned under REDcycle overwhelmed the storage and processing system – which was returning to normal after the pandemic. REDcycle's collapse highlighted the importance of having reliable and scalable processing and recycling facilities for materials like soft plastics (DCCEEW, 2023).

**Figure 3: REDcycle collection bin previously in retailers (Coles, n.d.)**


Two replacement schemes are being analysed currently. The Australian Competition and Consumer Commission (ACCC) has granted permission for supermarkets to collaborate on a scheme to replace the soft plastics collection. The permission is granted for one year (ACCC, 2023) and the Soft Plastics Taskforce (SPT) comprised of Coles, Woolworths and ALDI has issued a publicly available roadmap for in-store collection (ALDI, 2023).

In parallel, the National Plastics Recycling Scheme (NPRS), run by AFCG and a number of local councils, is trialling kerbside collection of soft (flexible) plastics which includes meat wrapping (See Figure 4). This is in selected areas and takes soft packaging previously collected in store under the REDcycle scheme. Households are provided a kit with a bag in which to put their soft plastics which aids in sorting at collection centres. The trial is checking how this works in practice with the goal being to separate food-origin soft plastics and direct them into advanced (chemical) recycling creating a food-grade recycled plastic not currently available in Australia (AFCG, n.d.). The technology is not firmly established in Australia, although it has been trialled. APR Plastics is receiving soft plastics during the trial period (AFCG, n.d. and APR, n.d.).

It is expected that this dual scheme will continue at least in the medium term. This allows options for consumers and to diversify the collection to prevent build up and potential backlog. In essence, it will create a more stable and resilient recycling system.

**Figure 4: A circular economy for soft plastic packaging (AFCG, n.d.)**


Packaging manufacturers, retailers, and meat processors are navigating this situation carefully. Certain plastic manufacturers are labelling their materials as “recycle ready” in preparation for the restart of a REDcycle replacement in September or roll out of the kerbside scheme. However, the restart will be staggered across the country to allow for a gradual build-up in collection, sorting, and processing capacity so as not to saturate the system and balance supply of soft plastic with demand for material for recycling.

Consumers want to recycle, and building capability for chemical recycling is critical if the food industry is to reduce its use of virgin plastic material. The UN’s latest report, “Turning off the tap”, cites chemical recycling as a key enabler to the circular plastics economy (UNEP, 2023).

Chemical recycling is increasingly acknowledged as a solution, however, challenges to be overcome include the environmental impact such as GHG emissions which are estimated to be ten times higher than with mechanical cycling, and lack of infrastructure. While it is estimated that chemical recycling will make up only around 5% of the global recycling market (UNEP, 2023), it is an important consideration for food, especially meat packaging.

## 4.3 Drivers of change in meat packaging

### 4.3.1 Non-Governmental Organisations

Globally, the Ellen MacArthur Foundation and UN Environment Programme partnership is instrumental in driving in packaging design to prevent packaging waste contributing to global sustainability goals for sustainable consumption and reducing reliance on fossil fuels (SDG Compass n.d.) The foundation’s 2022 progress report has raised the prospect of not meeting all targets set for 2025 and is urging businesses to move faster, particularly on reuse, flexible packaging, and decoupling business growth from packaging use (Ellen MacArthur Foundation, 2022). Governments are also urged to act, and it is expected that the recent UN Plastic Treaty negotiations will set the basis for binding commitments to stop plastic waste (see Section 4.3.3).

The Australian Packaging Covenant Organisation (APCO) is leading the development of a circular economy for packaging. The organisation facilitates and reports on the delivery of Australia's 2025 National Packaging Targets across the packaging ecosystem which includes collection and recycling.

Planet Ark continues to work with APCO on awareness and education about recycling. They have continued to promote the Australasian Recycling Label which helps consumers to dispose of packaging correctly.

### 4.3.2 Consumers

Despite the ongoing Poly crisis (a combination of events spanning the globe for example, pandemic after-effects, inflation, war in Ukraine, and climate change) which has impacted the spending habits of millions of people globally, consumers remain engaged in topics related to the environment. Momentum in brands helping consumers live sustainably has slowed in some areas due to elements of the Poly crisis, but it is expected that the number of highly engaged "eco-actives" will increase by 2027 (Kantar, 2022). 70% of people surveyed in 34 countries want global rules to stop plastic pollution (Ipsos, 2022).

More than half of Australian consumers consider sustainability an extremely or slightly important purchase criteria – many are increasingly buying local food products while at the same time cutting their meat consumption. They are also increasingly worried about green claims made on packaging (Statista, 2023).

As recycling is clearly important to consumers, environmental claims help them understand what they need to do. When recycling labels are accurate, consumers have a better perception of a brand (ACOR 2020). The pause in soft plastics recycling and unclear labelling, risks reversing the trust that has been built with consumers.

Container Deposit Schemes (CDS) can be part of the solution – by helping collect more material, including diverting it from landfill and litter by capturing away-from-home consumption also – but importantly by upgrading the collected material for higher value use. The containers are collected in pure (source separated) form making it possible not just to sell them for recycling but to sell for higher value closed-loop applications in which the material can be recycled repeatedly. By engaging directly with consumers and teaching the value of materials and the environmental benefits of keeping them clean and uncontaminated, CDS can also help change consumer behaviours in ways that positively impact all recycling programs (Parliament of Victoria, 2019).

Container deposit and reuse schemes are appearing in some countries and have had industry wide impact. For example, France's ban of unnecessary single use plastic in January 2023, some multinational brands have changed their operating model to comply, such as quick service restaurants who now serve reusable packaging. Investigative media questions why such schemes are not more widely available (Burrows, 2023) and with social media, consumers see what is possible elsewhere and demand change.

### 4.3.3 Legislation

#### 4.3.3.1 Australia

Currently, the National Plastics plan outlines a route towards achieving the National Packaging Targets for industry by 2025 (DAWE 2021) and APCO continues to lead the packaging strategy with regulatory framework and targets supported by the Australian Government (APCO, n.d.).

However, following UN Plastic Treaty negotiations in Paris in June 2023, the Australian government has committed to "shifting Australia toward a safer, circular economy". This means that a new packaging regulatory scheme will be introduced. While limited information is available on details and timeframes, the scheme will mandate packaging design and ensure that it minimises waste, and that packaging is recoverable, reusable, recycled and reprocessed (DCCEEW, 2023). The following developments are important:

- The government will lead the development of a national framework to direct Australia's transition to a circular economy.
- Mandated obligations will be issued for packaging design as part of a new packaging regulatory scheme based on international best practice and which will make industry responsible for packaging they place on the market. This scheme will also regulate out harmful chemicals and other contaminants in packaging. To support food waste recycling, a timeline will be set to remove contaminants from compostable food packaging.
- A national roadmap (ready in 2024) to harmonise kerbside collections.
- Further approaches will be progressed to improve waste and recycling reforms, including:
    - A national framework for recycled content traceability – allowing the use of quality recycled materials.
    - A framework to guide interjurisdictional efforts and drive action on problematic products. This will support packaging regulation and reform.

In essence, these developments reach wider than the packaging itself, but encompass circularity around reducing and eliminating waste. Developments will need to be followed closely to understand the impact of these frameworks and schemes on food companies' packaging sustainability efforts and their role in driving a circular economy.

The UN Plastic Treaty was created in 2022 and is currently under negotiation. The report "Turning off the Tap" cites numerous legislative interventions throughout the plastics system (UNEP, 2023). Emphasis is placed on establishing chemical recycling for plastics (UNEP, 2023). Developed with the Ellen MacArthur Foundation it is expected to emphasise the global implementation of targets in line with existing plastic pacts and frameworks such as APCO. It is also expected to issue guidelines for infrastructure to support the circular economy such as collection, sorting and processing facilities.

The DCCEEW announcement was welcomed by APCO, who continues to lead the packaging strategy with regulatory framework and targets supported by the Australian Government, (APCO, n.d.). Requirements are based on Ellen MacArthur Foundation (Ellen MacArthur Foundation, n.d.) and CEFLEX guidelines (CEFLEX, 2023). Notably, guidance previously issued by APCO has been removed, and advice is to consult the CEFLEX guidelines.

APCO targets continue to specify 2025 for establishing a circular packaging system where waste is designed out at product conception and where:

- 100% of all packaging is reusable, recyclable, or compostable.
- 70% of plastic packaging is recycled or composted.
- 50% average recycled content is included in packaging (revised from 30% in 2020).
- Problematic and unnecessary single-use plastic packaging is phased out through design, innovation, or the introduction of alternatives.

Producers are not legally responsible for managing packaging waste but those above a certain turnover must sign up to the packaging covenant or be subject to the National Environment Protection Measure (NEPM), which authorises local governments to recover the cost of waste management from the brand owner's consumer packaging (Lorax EPI, 2021).

While the legal responsibility is not with the packaging manufacturers, those producing plastic film in Australia are responding to customer demand. In addition, they want to ensure that stocks of suitable used plastic material can be recycled and eventually turned into food grade film. This relies on there being collection of such plastics and advanced (chemical) recycling facilities in place. Collection trials have commenced, but advanced recycling is yet to be established.

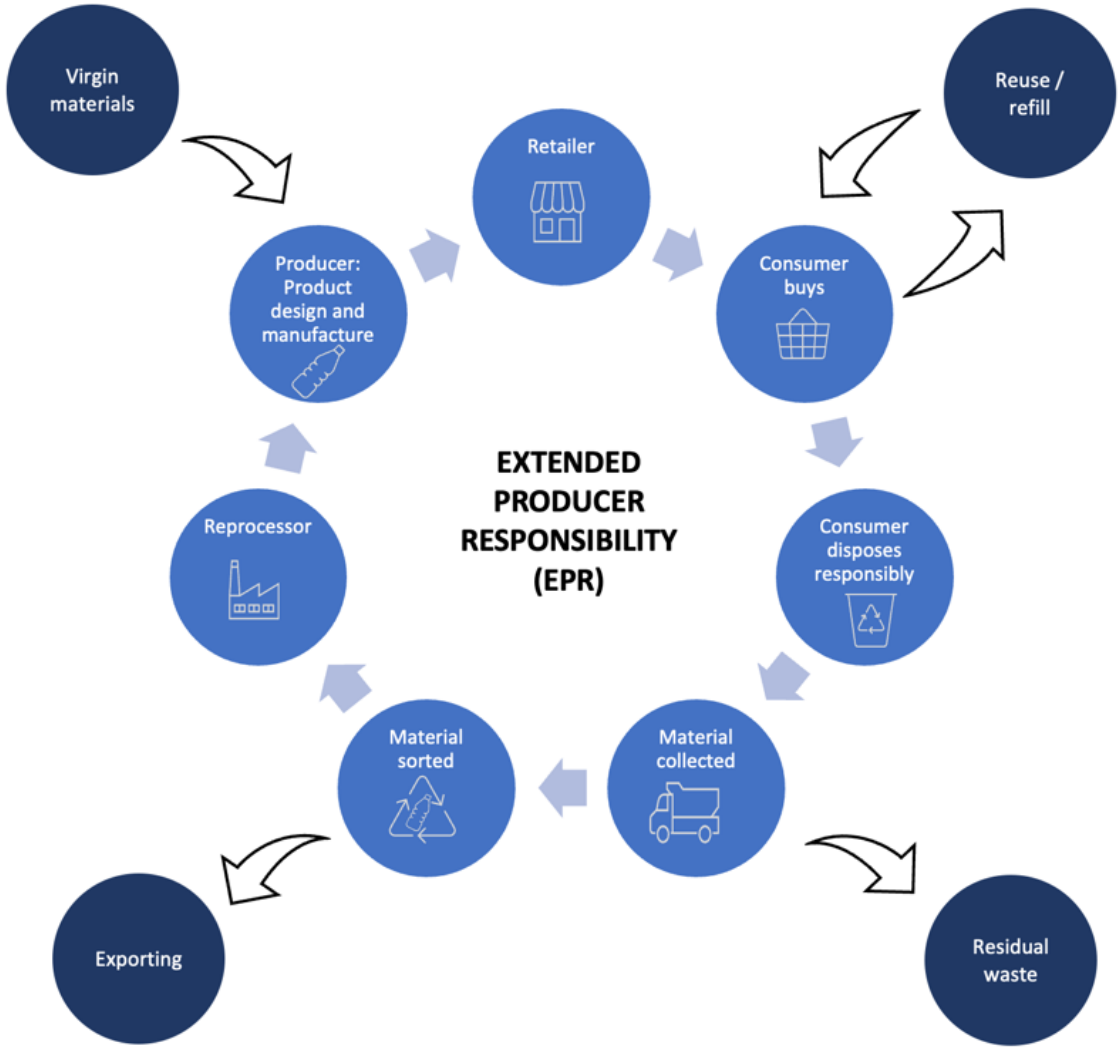
The latest government announcement regarding packaging will help to allay concerns that Australia is not on track to meet its packaging targets in 2025 (Guardian, April 2023). APCO's own review sites that while

change is moving in the right direction, Australia is unlikely to meet its targets in 2025. APCO's call for a longer-term vision together with collaboration across the entire packaging system with interventions on essential packaging material streams appears to be addressed by DCCEEW (APCO, 2023).

While Australia does not have Extended Producer Responsibility (EPR) regulations yet (these require businesses producing waste to cover the cost of managing it), EPR is developing in different countries (**UNEP, n.d.**) and this will ultimately impact the Australian meat processors who export. While the date for an Australian EPR is not known, it will impact packaging companies, the meat industry, and retailers.

The objective of EPR schemes is to reduce excessive packaging, increase recyclability, recycle more packaging, increase the quality of recycling material, and prevent litter (see Figure 5).

**Figure 5: Extended Producer Responsibility (adapted from FDF, n.d.)**



#### 4.3.3.2 Export Markets

**Legislation**

The research revealed key trends or insights that put the regulatory landscape in context, particularly from the perspective of key areas of focus and evolution of jurisdictional approaches to fostering and accelerating a circular economy. For ease of interpretation, the developments relevant to plastic packaging in key export markets are summarised below. Further details are within Table 17 in the Appendix and should be consulted in conjunction with legal advice when analysing the different market requirements.

Legislative trends follow certain patterns:

- **Broader waste reduction strategies** or focus areas into which packaging considerations fall, which may include avoidance of waste to landfill measures, producer responsibilities in design, and recovery through government established mechanisms.
    - Plastic is a key priority of waste management overall. There is a desire to reduce the use of plastic in every sector, not just packaging.
    - Increase rates of plastic collection. There is a drive to increase collection rates for plastics including packaging. Currently collection rates are not high at all which impacts on recycling.
    - Increased rates of plastic recycling. There is a drive to increase the quantity of collected plastics that are recycled. These rates should rise with the phase out of problematic plastics, which removes contaminants from the collection. Advanced New technologies in plastic recycling will be helpful in providing recycled plastics suitable for food contact applications.
- **Producer Responsibility Schemes** are encouraging market development and funding, which effectively shift the cost to those manufacturing the package or product.
    - Where EPR schemes are not already in place, there are strong hints that they are imminent. However, the timeframe and in what form they will be is unclear.
- **Phasing out and reducing single-use packaging** is increasingly prioritised.
    - Plastic shopping bags, disposable items such as cutlery or straws, and plastic beverage containers are core focus areas.
    - There is a push to eliminate or minimise plastic packaging while still maintaining food safety.
- **Focus on the circular economy** through emerging frameworks and approaches that re-frame the narrative and more expansively consider waste and recycling approaches in the context of market development, economic incentives, and placement of circular economy considerations within the broader SDG context.
- **New regulations or amended regulations that are additive** in their focus are increasing and more rapidly introduced. This is potentially an indicator that as regulations are introduced, and markets develop and consumer/businesses adapt, that future regulation could be developed to address specific areas.
- **Recycled plastic content in food-grade packaging** has mixed responses and appear to lean towards food quality and safety approaches which likely pre-date sustainability or circular economy concerns.
    - There is movement to increase the quantity of recycled content in packaging. Advanced recycling will assist here by allowing for addition into food contact applications. However, consumer groups and NGOs need reassurance of the technology's safety (within food and the environment).

- There is a push to set or increase minimum recycled material contents which is likely due to the shortage of recycled materials suitable for food contact applications.

- **Phasing out problematic plastics.** There is a push to eliminate these plastics which are considered problematic to food safety and recyclability. Polymers containing Vinyl Chloride are particularly targeted.

#### 4.3.3.3 Voluntary agreements

In addition to regulatory developments, global movements such as the Plastics Pact (WRAP, n.d.) are gaining pace.

The **European Plastics Pact** (EPP) (**European Plastics Pact, n.d.**), started by the Netherlands and France, includes over 80 signatories from governments, companies, non-governmental organisations, and industry associations who are driving towards better design, responsible use, recycling capacity, and use of recycled content to reduce the impact of plastics and plastic packaging on the environment.

The EPP includes the following targets:

- Target 1: Design all plastic packaging and single-use plastic products placed on the market to be reusable where possible and in any case recyclable by 2025.
- Target 2: Move towards a more responsible use of plastic packaging and single-use plastic products, aiming to reduce virgin plastic products and packaging by at least 20% (by weight) by 2025, with half of this reduction coming from an absolute reduction in plastics.
- Target 3: Increase the collection, sorting and recycling capacity by at least 25 percentage points by 2025 and reach a level that corresponds to market demand for recycled plastics.
- Target 4: Increase the use of recycled plastics in new products and packaging by 2025, with plastics user companies achieving an average of at least 30% recycled plastics (by weight) in their product and packaging range.

Further pacts of note are the Australia, New Zealand, and Pacific Islands Plastic Pact, Canada Plastics Pact, Malaysia Sustainable Plastic Alliance, and The US plastics pact (WRAP, n.d.).

**Figure 6: Evolving regulatory approaches relevant to packaging sustainability**

For rating refer to Table 5. Where 4 = most evolved, and 1 = early stages

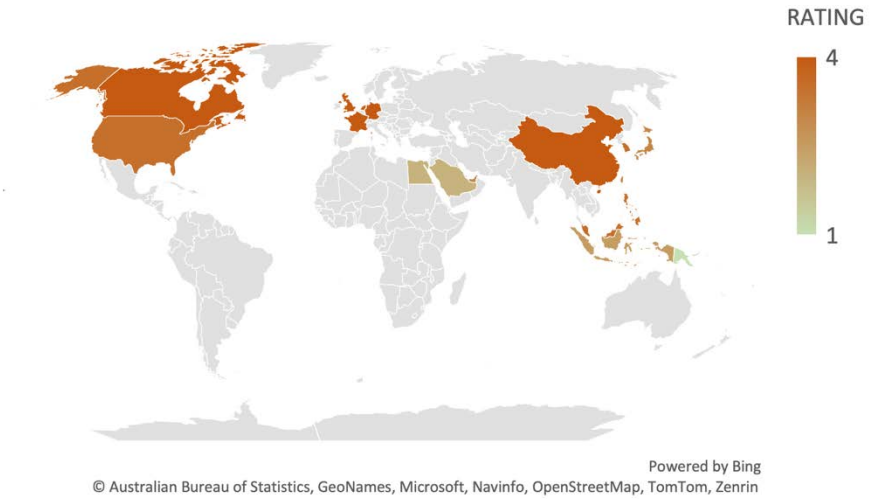


**Table 5: Evolving regulatory approaches relevant to packaging sustainability – detail**

| Region | Country | Rating |
|---|---|---|
| Eastern Asia | China | 4 |
| | Hong Kong | 3 |
| | Japan | 3 |
| | South Korea | 3.5 |
| | Taiwan | 3 |
| South-eastern Asia | Indonesia | 2.5 |
| | Malaysia | 3.5 |
| | Philippines | 3.5 |
| Oceania | Papua New Guinea | 1 |
| Western Asia (MENA) | Kuwait | 2 |
| | Saudi Arabia | 2 |
| | UAE | 3 |
| Northern Africa (MENA) | Egypt | 2 |
| Europe | EU | 4 |
| | EU: France | 4 |
| | EU: Netherlands | 4 |
| | EU: Germany | 4 |
| | UK | 4 |
| Northern America | Canada | 4 |
| | USA | 3.5 |

**KEY**

Ranking is based on degree of complexity and development in country approach to sustainable packaging requirements. It is a guide only. Specialist legal advice concerning material rules and extended producer responsibilities per country should be consulted.

| | |
|---|---|
| 1 | Regulatory approach is general in nature and most particularly angled towards broader environmental management. Limited to no specificity or focus on extended producer responsibility, packaging-related concerns or circular economy approaches. |
| 2 | Regulatory approach includes consideration of waste management and recycling (to some extent). Limited to early focus on packaging-related concerns and/or extended producer responsibilities. |
| 3 | Regulatory approach considers extended producer responsibility and packaging-related concerns, in addition to waste management and recycling approaches. |
| 4 | Regulatory approach is advanced and indicates an evolutionary and accelerated approach towards packaging and/or plastic-specific concerns, extended producer responsibilities across multiple categories and the circular economy. |

**Note**

USA is rated 3.5 due to the varying state-based nature of the regulation. Some states may rate a 4.
Regions are classified according to UN Standard 49

### 4.3.4 Retailers and Brands

Globally, 16 leading retailers have signed up to Ellen McArthur Foundation's plastic commitment and progress was reported in 2022. Most retail companies increased their virgin plastic packaging between 2020 and 2021, resulting in a 6.8% increase for the sector. The COVID pandemic rebound is one explanation given, for companies who have food services as well as an increase in sales. Packaging improvements have focussed on reuse pilots and models, but the foundation asks that non-recyclable plastic packaging remain a key priority to address – it makes up 57% of the signatories' portfolio on average and mostly includes flexible packaging. Companies are asked to innovate away from such packaging and invest in recycling infrastructure (EMF, 2022). This policy is likely to evolve following the outcome of the UN Plastic Treaty negotiations in June 2023.

#### 4.3.4.1 Australia

2025 is a common deadline for products to achieve recyclability, reusability, or composability, although the emphasis differs between retailers.

**ALDI's** sustainable packaging strategy continues under the 25by25 pledge and details of the status at the end of 2021 can be found in their Plastics Packaging Report (ALDI, n.d.). Key commitments are to use the Australian Recycling Label (ARL) on ALDI branded products by the end of 2022 and to educate customers on the importance of packaging waste reduction. By the end of 2021 the ARL was on 76% of products and the total commitment to reduce plastic packaging by 25% is against a 2019 baseline. Phasing out of Expanded Polystyrene (EPS) and Polyvinyl Chloride (PVC) packaging labels is part of an overall single use packaging reduction of 50%. The target has increased from 30% to 50% recycled materials across all packaging and specifically 30% in plastic which is as committed in 2021. ALDI has committed to remove black plastic packaging which as of 2021 was reduced by 51% and stands at an average of 28%. 84% of plastic packaging is recyclable, reusable or compostable (ALDI n.d.).

It is notable that Aldi has endorsed the Australian Dairy Sustainable Packaging Roadmap, an initiative between APCO and Australian Dairy Products Federation. The roadmap includes strategic actions, targets, and outcomes for 2025 and shows ALDI's commitment to collaboration in support of improvements in sustainable packaging. Further commitment is demonstrated through the retailer's engagement with the SPT.

**Coles** continues to operate its sustainable packaging strategy under its Together to Zero pillar and aims to make all its own brand packaging recyclable, reusable or compostable by 2025 and to carry the ARL on all private label products by 2025. Due to the collapse of the REDcycle scheme, Coles advises its customers on its website to dispose of soft plastics in their home rubbish bins and explains the situation regarding soft plastics recycling. The retailer is working with government, industry and sustainability partners to find an alternative solution through the SPT (Coles n.d).

**Woolworths** Sustainability Plan commits the supermarket to sourcing 100% sustainable own-brand packaging and has removed 4,262 tonnes of virgin packaging in 2022. The retailer has formed a Supermarkets Supplier Sustainability Council – Packaging and Recycling to engage suppliers in achieving the supermarket's 2025 commitments. The company continues to partner with a plastic recycling start-up, Samsara, to break down plastic with enzyme technology and has committed to using the first 5000 tonnes of recycled plastic in private label packaging. At least 60% of recycled plastic is used across the supermarkets red meat trays annually, equating to 3,681 tonnes of virgin plastic removed. The ARL is on 72% of products. Notably, Woolworths has invested significant efforts in building master data analytic capacities on private label products which have helped to re-create a baseline of 2018 against which to compare the impact of targeted packaging changes. Updated reporting is expected in 2023. (Woolworths, 2022).

#### 4.3.4.2 Export markets

Table 6 shows retailer approaches to sustainable packaging requirements in key export markets. This is a high-level review, focussing on the top 3 where information was available. Some retailers may sell into other markets, but their presence is not in the top 3. A niche retailer was examined in Malaysia to indicate potential influence on the packaging sustainability approach of other retailers locally.

The analysis is based on publicly available corporate information.

The ranking is organised in terms of the maturity of packaging sustainability requirements and ranges from no commitments and low complexity to high complexity and specific targets and commitments. Retailer's private label ranges were targeted as these tend to be where retailers focus and often lead trends in development.

Trends in packaging sustainability often follow the corporate country headquarters, therefore any analysis of a market needs to consider the B2B customer and if it is part of a larger group.

**Key observations and outlook**

12 out of 18 markets analysed have retailers present who are progressive in sustainability-related packaging targets and commitments and who have a mature and expansive approach to operational and supply chain sustainability requirements. Additionally, these retailers typically have high complexity and specificity. Every region has at least one active retailer, while some countries are not as mature as others. Generally, retailers who have strong corporate policies on sustainable packaging led by the home country tend to evolve the approach further in countries in which they operate. The approached can sometimes be stronger than local regulations require. The following is an overview of current activities with an outlook:

- **Eastern Asia**
    - In **China**, very little public information is available or readily accessible to assess the retailers' approach to packaging-related concerns, or broader sustainability.
    - In **Japan**, the two main retailer's approaches score a 3 indicating a medium level of maturity, and one retailer scores a 1, having limited sustainability information. A general approach to reducing packaging, particularly plastic would sit well alongside the two key retailers, AEON's and Seven & i Holdings' commitments. Similarly, vacuum-packed packaging for meat would complement existing carbon-reduction initiatives underway.
    - Major retailers in **South Korea** have very strong policies in relation to plastic packaging and recycling in place which is particularly reflected with Emart's commitments. The "less recyclable" factor that they are targeting, and their leadership across the retail sector could well set the trend for packaging moving forward.
    - **Hong Kong** has retailers with contrasting positions on sustainable packaging, scoring 2 and 4. However, given the increased focus on packaging and plastics at the regulatory level, it would be expected that retailers and brand owners will be required to advance their approaches (where immature) and maintain focus, for those that have set more ambitious targets.
    - **Taiwan** retailers have limited public disclosure of commitments, making it challenging to ascertain the implications of specific retailer commitments and whether they are in concert with, or vary from the legislative and regulatory approaches.

- **South-eastern Asia**
    - In **Indonesia** the retailer approach to sustainable packaging is driven heavily by those retailers that have a global focus and presence in markets with a more stringent regulatory landscape. How this extends or influences regional retailers is difficult to predict particularly against a backdrop of emerging local legislation and regulation.
    - **Malaysia** retailers had no identifiable information on sustainability. For one retailer, AEON, given much of the focus will sit at a corporate level, this information was captured under Japan's retailer assessment. A niche retailer (The Food Purveyor) showed a stronger ESG proposition with SDG alignment and publication of outcomes and initiatives.
    - Both retailers in the **Philippines** have some sustainability related packaging requirements although scoring a 2 due to the relatively low complexity. However, they demonstrate a solid approach to sustainability, and they are largely inward focussed, or, looking at a range of initiatives in the community to drive localised action. This approach sets them in good stead to commence extension of their program further to their supply chain.
- **Oceania**
    - No information was identified for the one retailer identified in Papua New Guinea.
- **Western Asia and Northern Africa (MENA)**
    - The approach to sustainability, plastics, and packaging in general vary across the MENA region, which includes **Kuwait, Saudi Arabia UA and Egypt**. Those retailers with a presence in more sustainability-mature markets have more defined commitments and strategies and are likely to lead the way. Those without this, may not have the same level of impetus and focus, or, it has not been disclosed publicly. Carrefour, for example, is present in Egypt, Kuwait and UAE and ranked at high maturity (score 4). 3/8 retailers present in the region as single entities (in this case Carrefour) scored a 4, 3/8 retailers scored a 2 with some sustainability related packaging requirements, one retailer had more detailed sustainability requirements which mostly centred on single use plastic reductions such as plastic bags and scored a 3. 3/8 retailers either had no information or did not specify an approach to packaging.
- **Europe**
    - **France, the Netherlands**, and **UK** all have leading retailers who are setting the pace in packaging sustainability and are ranked at a high maturity level (score 4). Citizen engagement is a trend in France as shown by Carrefour who runs consumer focus groups on packaging improvements and Les Mousquetaires who recently contributed data on 6,000 items to a government and NGO public database. The trends across EU countries regarding sustainability and particularly packaging and plastics is clear - they set the tone and the pace for other regions to follow. Their ambitions are extensive and their ability to shift change within the markets, globally is significant.
- **Northern America**
    - Retailers in Canada and the USA are at a high maturity level (score 4). The large US-led retailers are renowned for their commitments to sustainability and the extension of these commitments to their suppliers, through various codes of conduct, and contractual and performance-based requirements. Their ability to influence change across all jurisdictions in which they operate, when coupled with a regulatory landscape that is similarly invested in driving down the negative impacts of plastics, and particularly packaging, is high.

**Table 6: Retailer packaging sustainability commitments in export markets**

| REGION | COUNTRY | RETAILER | | | |
|---|---|---|---|---|---|
| Eastern Asia | China | RT-Mart & Auchan (SA) | Yonghui | CR Mart & CR Suguo (Vanguard) | |
| | Hong Kong | Wellcome | ParknShop (ASWG, CKHH) | | |
| | Japan | AEON | Ito-Yokado (Seven&i H) | Seiyu Group (85% KKR) | |
| | South Korea | Lotte Mart | Emart | Homeplus | |
| | Taiwan | Carrefour | PX Mart | | |
| South Eastern Asia | Indonesia | Hero | PT Lion Super (AD) | Carrefour | |
| | Malaysia | AEON | Hero Market | Jaya Grocer | The Food Purveyor |
| | Philippines | Robinsons | SM Supermarket | | |
| Oceania | Australia | ALDI | Coles | Woolworths | |
| | Papua New Guinea | RH Hypermarket | | | |
| Western Asia (MENA) | Kuwait | Carrefour | Geant | | |
| | Saudi Arabia | Al Othiam | Panda Supermarket | Farm Superstores | |
| | UAE | Carrefour | Choithram | Geant | |
| Northern Africa (MENA) | Egypt | Carrefour | Metro | | |
| Europe | France | E.Leclerc | Carrefour | Les Mousquetaires | |
| | Netherlands | Albert Heijn (AD) | Jumbo | Lidl | |
| | UK | Tesco | Waitrose | Sainsbury's | |
| Northern America | Canada | Walmart | Costco | Metro | |
| | USA | Walmart | Costco | Kroger | |

**KEY:** Ranking is based on degree of complexity and maturity in retailers' approach to sustainable packaging requirements and is a guide only.

| | |
|---|---|
| 1 | No commitments and/or low complexity and maturity, no to minimal specific sustainability-related packaging requirements. |
| 2 | Low to medium complexity, some sustainability-related packaging requirements that most likely fall within a broader environmental program which may be narrow in scope or emerging in application and maturity. |
| 3 | Medium to high complexity, detailed sustainability or Corporate Responsibility requirements and commitments evidencing a medium level of maturity, most likely centred on single-use plastics reductions. |
| 4 | High complexity and specificity, with sustainability-related packaging targets and commitments present, mature and expansive approach to operational and supply chain sustainability requirements. |

**NOTE:**

Regions are classified according to UN Standard 49 (UNStats, 2023)

Note: ASWG = AS Watson Group, CKHH = CK Hutchinson Holdings | SiH = Seven&i Holdings | SA = Sun Art

## 4.4. Drivers for current packaging design

Under the current retail and foodservice model, plastic packaging remains critically important in guaranteeing the supply of fresh, high quality, and affordable meat. While efforts can be made to reduce the amount of packaging and recycle it in Australia, packaging that is used for export is more complex to tackle due to its more robust nature and requirement to withstand transport and deliver a long shelf life.

Packaging must meet certain requirements along the value chain from industry through to consumers and it has different functions whether a single material, or a packaged product. It performs a number of

functions namely protecting products, retaining and/or enhancing quality, carrying information, facilitating ease of use and preservation (MLA, 2021).

After use, packaging must be recyclable and ideally be transformed into useful material for new packaging, therefore closing the loop (MLA, 2021). This is a key element in packaging design where recyclability must be included in the specification.

Increasing focus on companies' supply chain impact has brought greater scrutiny of greenhouse gas emissions through the packaging value chain. The data is being included in larger company sustainability reports and as more transparency is delivered, improvements in packaging are driven.

Food waste is responsible for approximately 3% of Australia's annual greenhouse gas emissions (DAWE n.d). 34% of all food waste in Australia is consumer food waste, and 92% of this waste goes to landfill (Langley et al. and Fight Food Waste CRC 2020).

Household red meat waste is a waste "warm spot" meaning that the climate impact is outsized, generating carbon dioxide equivalents (CO2-e) released during red meat production (FIAL 2021). The value of meat wasted in the home, in particular beef, is the highest amongst food that goes wasted, placing it at the focus of efforts to reduce household waste by Fight Food Waste CRC (Karunasensa, G.G. and Pearson, D, 2023). Advice for example, to buy and prepare just the right amount or smaller amounts of food emphasise the importance in meat of portion control and communication of value to the customer. Accurate information for packaging disposal is essential to align with the motivation not to waste.

## 4.5 Trends in packaging formats

### 4.5.1 Australia

The research confirmed the dominance of plastic packaging on the Australian fresh meat market. A new development is the commercialisation of barrier flow wrap used for mince which is in on shelf in one retailer. Aside from this development, there has not been a major change in the type of packaging used since reported by the MLA in 2016 and 2021.

What has changed is the end of the REDcycle soft plastics collection and recycling scheme in November 2022. A group of retailers, processors, government, and advisors are working on a new scheme which is expected in September 2023. This has unfortunately changed the recyclability of all soft plastics – upon which red meat relies. Instead of being returned to store, plastics go into the home rubbish bins.

Despite this setback, there is evidence of progress towards APCO's 2025 targets (APCO, n.d.):

- 100% of all packaging is reusable, recyclable, or compostable.
    - Continued use and extension of fibre-based trays and backing boards which are recyclable. The tray and film must be separated to be recycled – trays to kerbside, and film and tray lining to the home rubbish bin.
    - Compostable packaging has not made it onto the market due to uncertainty over its ability to withstand moisture.
    - Reusable containers have not made any inroads into fresh meat retail, partly because red meat sales are mostly self-service and where butcheries are present there may be hesitation due to practicality and food safety concerns.
    - Trend away from paper labels as they interfere with recycling.
- 70% of plastic packaging is recycled or composted.
    - Most of the rigid plastic packaging used in meat is recyclable. APCO is collating industry data, and a report is expected later in 2023.

- 50% average recycled content is included in packaging (revised from 30% in 2020).
    - APCO is assessing the status and will report later in 2023.
- Problematic and unnecessary single-use plastic packaging is phased out through design, innovation, or the introduction of alternatives.
    - EPS trays and PVC overwrap – used mainly in counter butcheries, EPS was banned in Australia in 2022. The main retailers are ahead in this aspect and EPS trays have disappeared from the market. Polyolefin-based (fossil fuel) overwrap and PET, Polypropylene (PP) or fibre-based trays are used instead. PVC overwrap is less used and is being phased out.
    - PVDC, required at a 10% limit is being phased out and plastics manufacturers are working on an alternative. PVDC is needed for export as it is highly effective in extending shelf life.

#### 4.5.2 Global

Retailers overseas are developing their approaches to sustainable packaging in a similar way to that seen in Australia, albeit at different pace and where collection and recycling schemes are at different stages of development. Increasingly, reusable and returnable containers are being introduced in Europe, and in France single use plastic has been banned, forcing some international foodservice brands to change their business model and adapt. The effect is that consumers are increasingly sensitised to wasteful packaging and packaging waste and becoming further engaged in demanding change.

## 4.6 A review of plastic packaging in Australia

#### 4.6.1 Packaging formats used for red meat - a recap

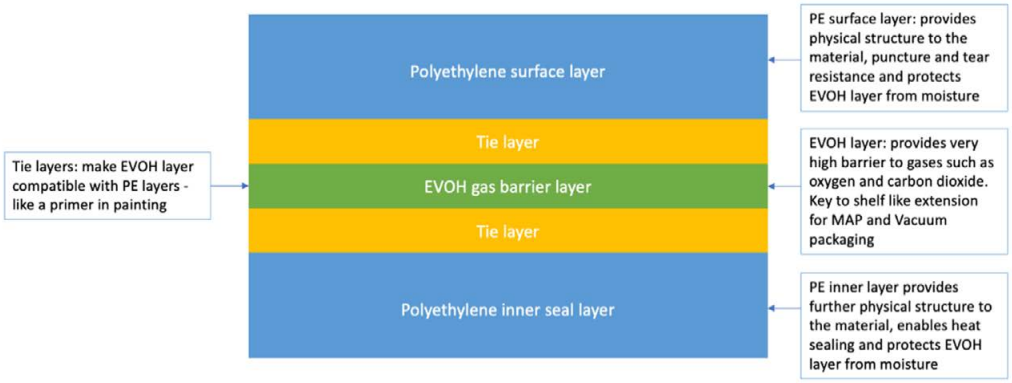
Plastic continues to be used for meat and remains essential under the current retail model due to its crucial role in preservation and preventing food waste. Plastic is composed of several layers, including barriers to prevent gas from moving through the film and causing meat spoilage (MLA 2016). Primal cuts are placed on retail-ready trays (known as case ready), flushed with a mixture of gases to remove the oxygen and covered with plastic film (type). The packs are impermeable and retain the modified gas atmosphere around the meat to preserve meat quality and shelf life by restricting bacteria growth.

Plastic is made of polyolefin (consisting of polyethylene and polypropylene) and derived from petrochemical or non-petrochemical sources. There are four main plastic packaging formats and five barriers used in meat. Each format and combination have a different function according to the desired shelf life and quality. Their ability to seal and not puncture is critical. Further details on the mechanics of this process can be found in V.RMH.0127 (MLA, 2021).

**Table 7: Plastic packaging formats (Adapted V.RMH.0127) (MLA, 2021))**

<table>
<tr><td colspan="4">     <br>All pictures MLA 2016</td></tr>
<tr><td>Modified Atmosphere Packaging (MAP) with a barrier film for high or low oxygen environment</td><td>Vacuum Packaging (VP) with a barrier film</td><td>Vacuum Skin Packaging (VSP) with a barrier film</td><td>Tray and overwrap with no barrier film</td></tr>
<tr><td colspan="3">MAP, VP and VSP films are very similar and have a high gas barrier to prevent gas molecules rapidly permeating through the film. Typical barriers are Ethylene Vinyl Alcohol (EVOH), PVDC and PLANTIC™.<br><br>Apart from PVdC, the barriers have been modified to be “Recycle Ready”.<br><br>PVdC is being investigated in Phase 2 of the CEFLEX recyclability evaluations. It was not permitted in APCO guidelines which have been withdrawn.</td><td rowspan="2"></td></tr>
<tr><td colspan="3">EVOH has a gas barrier several thousand times more effective than Polyethylene, a common flexible packaging material. An EVOH barrier (invisible to the naked eye) add significant shelf life - a few days versus six or more weeks of shelf life.<br><br>Common gas barrier materials used in meat packaging are:<br><br>• High barrier - PVdC, EVOH, PLANTIC™<br>• Medium barrier - PET – Polyester, Nylon – Polyamide (MLA, 2021)<br><br>Some barriers are detrimental to efficient recycling and current barrier structures are being reengineered to fit to best practice guidelines for mechanical recycling. This is allowing for the phase out of problematic structures because they contaminate the recycling process.<br><br>PVdC will be allowed in amounts up to 10% in flexible plastics schemes, but its ongoing use is under review with CEFLEX. It is essential in export due to it being highly effective in extending shelf life.</td></tr>
</table>

**Figure 7: Typical (coextruded) plastic multilayer plastic structure (MLA, 2021)**



### 4.6.2 Review of packaging formats

To assess the status of packaging since 2021, and to understand its development towards a circular economy, three elements were reviewed: A physical assessment of packaging placed on the Australian retail market, a light desktop review of alternatives to single use polyolefin based plastic material, and a light desktop review of new or novel plastic formats.

The results are shown in Tables 8, 9 and 10.

Conversations with a global packaging film manufacturer and a red meat processor gave additional insights.

#### 4.6.2.1 Soft plastics spotlight

A specific spotlight is on soft plastics as there is now no nationwide collection scheme for soft plastics in Australia. Because of this, companies can no longer classify soft plastics as being recyclable. The REDcycle Scheme for the collection of soft plastics (ended in November 2022) was the only nationwide for collection of soft plastics for recycling.

APCO has withdrawn the “Designing for Recyclability - Household Consumer Soft Plastics, Version 2 Published April 2022” guidelines for soft plastics design and recommends that CEFLEX D4ACE guidelines be followed.

Because there is no nationwide scheme, packaging manufacturers now describe packaging as “Recycle Ready”. This means that “Recycle Ready” products are within the best practice guidelines for recyclability within the CEFLEX guidelines. “Recycle Ready” packaging will become recyclable once a nationwide collection scheme for soft plastics resumes.

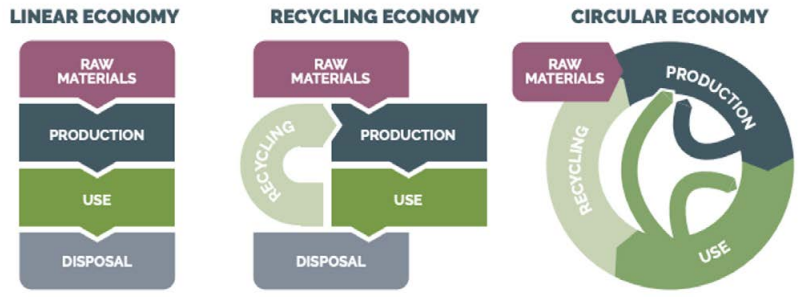
At this point, it will be possible to change the classification of products currently classed “Recycle Ready” to “Recyclable”.

The lack of a soft plastics collection scheme is the reason why these products are currently classified as not recyclable, not the makeup or design of the product.

#### 4.6.2.2 Assessment of packaging solutions placed on the market

The meat cabinets of four retailers were surveyed. The results of compliance with APCO and Australian packaging guidelines are mapped in **Table 8.** The packaging solution classification is shown in Table 7. In addition, their position in a linear, recycle or circular economy is noted (see Figure 8). The rationale for the plastics economy position is in Table 13, Appendix.

**Figure 8: The transition to a circular economy: Our Packaging Future (APCO, 2020)**




In our assessment of the current packaging status, we have accounted for the temporary absence of a soft plastics recycling scheme. Where previously soft plastic (used in packaging films) would be judged as part of a recycling economy, it now is judged as a linear economy product because it cannot be collected and recycled. This status will change to a recycling economy when soft plastic recycling schemes roll out nationwide.

A circular economy is hindered by the need for high level investment for infrastructure to deliver advanced (chemical) recycling at scale and return of food grade polymers into the packaging film system.

Most of the plastic seen complied with APCO guidelines (including CEFLEX guidelines for soft plastics) and ARL guidelines.

Results in Table 8 can be interpreted as follows: formats that include soft plastic for example, VSP film with plastic tray, comply with APCO and ARL. They are judged as ARL compliant because they have label instructions. The plastic tray can be recycled via kerbside collection and is part of the recycling economy. The film must be thrown into the home rubbish bin and is therefore linear economy. When soft plastics collection restarts, the packaging solution will move into a recycling economy. When collected plastic is processed into food grade material it will be follow a circular economy model.

Overall, the survey showed a positive development in packaging and compliance with APCO guidelines.

**Packaging that complied with the APCO guidelines were:**

- Barrier vacuum bags (non-shrink).
- Barrier vacuum shrink bags with EVOH barrier (it is not possible to know the level of EVOH).
- Barrier vacuum thermoform, fill and seal films.
- Barrier vacuum skin packaging (VSP) film with plastic tray.
- Barrier vacuum skin packaging (VSP) film with fibre tray.
- Plastic tray with barrier lidding film – modified atmosphere.

**Packaging that did not comply with APCO guidelines were:**

- Clear trays with PVC overwrap – seen in one out of four retailers. The tray can be recycled kerbside, but the PVC overwrap must go in the rubbish bin. PVC is classed as a problematic material that must be phased out completely.
- Trays containing carbon black with PVC overwrap – seen in one out of four retailers. Neither the tray nor film can be recycled.
- Plastic coloured with carbon black – seen in one out of four retailers. This plastic cannot be recycled as it cannot be detected by Near Infra Red (NIR) spectroscopy used to analyse or sort plastic in the recycling process.

**Packaging accessories that did not comply with APCO guidelines (none can be recycled) were:**

- Bone guard protectors – seen in two our of four retailers.
- Soaker pads or liners – seen in all four retailers.
    - Retailers and packaging film and tray manufacturers are working to remove unnecessary accessories and have had some success for example SEE's (formerly Sealed Air) HydroLoQ tray removed 750 million soaker pads which would otherwise have gone to landfill (SEE, n.d.).
- Netting – seen in three out four retailers.
- Paper labels – in one out of four retailers
    - The lack of collection scheme has meant inconsistency in product labels. Brands have been advised to remove the REDcycle icon and instructions updated to dispose of the plastic in the regular rubbish bin. Some packs still have the REDcycle icon and others have been updated. Meanwhile brand owners are at different statuses running down their stocks and updating labels with the right disposal instructions. We are not aware of an icon that communicates the possibility of kerbside collection and instore drop off – to cater for the parallel schemes.

**The following problematic packaging that does not comply with APCO guidelines was not seen:**

- Trays coloured with carbon black and with polyolefin overwrap.
- Barrier vacuum shrink bags with PVdC barrier (while not on retail shelves these might be found in food service).

**Table 8: Consolidated findings of meat packaging solutions in 4 Australian retailers**

| Packaging solutions | Market presence | Complies with existing guidelines | | Plastics economy position (linear, recycling, circular) May 2023 | | Recycle ready | Value chain application | |
|---|---|---|---|---|---|---|---|---|
| **Packaging formats:** | | APCO | ARL | Rigid component | Soft component | Soft component | Abbattoir | Consumer Ready |
| Clear trays with PVC overwrap | | ⚠ | ✗ | Recycle | Linear | no | | |
| Black trays with PVC overwrap | | ✗ | ✗ | Linear | Linear | no | | |
| Clear trays with Polyolefin overwrap | | ✓ | NA | Recycle | Linear | yes | | |
| Black trays with Polyolefin overwrap | | ⚠ | NA | Linear | Linear | yes | | |
| Barrier vacuum bags (non shrink) | | ✓ | ✓ | NA | Linear | yes | small quantities (AUS). | common in retail (AUS). EVOH barrier. |
| Barrier vacuum shrink bags (PVDC barrier) | | ✗ | ✓ | NA | Linear | no | predominant format for export. | small quantities used in retail (AUS) |
| Barrier vacuum shrink bags (EVOH barrier) | | ✓ | ✓ | NA | Linear | yes | format (AUS). Primal cuts. | common in retail (AUS). |
| Barrier vacuum thermoform, fill, & seal films | | ✓ | ✓ | NA | Linear | yes | | common in retail (AUS). EVOH barrier. |
| Barrier vacuum skin packaging (VSP) film with plastic tray | | ✓ | ✓ | Recycle | Linear | yes | | common in retail (AUS). |
| Barrier vacuum skin packaging (VSP) film with fibre tray | | ✓ | ✓ | Recycle | Linear | yes | | common in retail (AUS). EVOH barrier. |
| Barrier film flow wrapped cuts - modified atmosphere | | ✓ | ✓ | NA | Linear | yes | | common in retail (AUS). Shrunk or gas flushed. EVOH barrier |
| Barrier film flow wrapped trays - modified atmosphere | | ✓ | ✓ | Recycle | Linear | yes | | |
| Plastic tray with barrier lidding film - modified atmosphere | | ✓ | ✓ | Recycle | Linear | yes | | common in retail (AUS). EVOH barrier. Trays are PP or mono PET solutions and gas flushed. |
| Black coloured packaging | | ✗ | ✗ | Linear | Linear | no | | |
| **Packaging accessories:** | | | | | | | | |
| Bone guard protectors - woven | | ✗ | ✗ | - | Linear | no | | |
| Bone guard protectors - plastic films | | NA | NA | - | Linear | yes | | |
| Soaker pads or liners | | ✗ | ✓ | - | Linear | no | | |
| Sachets e.g. oxygen scavengers | | NA | NA | - | Linear | no | | |
| Netting | | ✗ | ✓ | - | Linear | no | | |
| Labels - plastic | | ✓ | ✓ | - | Linear | yes | | |
| Labels - paper | | ✗ | ✗ | - | Linear | no | | |
| Paper board cartons - one way | - | - | - | Circular | - | - | | |
| Paper board cartons - reusable | - | - | - | Circular | - | - | | |
| Plastic cartons - one way | - | - | - | Recycle | - | - | | |
| Plastic cartons - reusable | - | - | - | Circular | - | - | | |

**KEY**

| | |
|---|---|
| Format is not used or seen | NA |
| Not surveyed | - |
| Recycle ready | When soft plastics collection scheme resumes. >80%polyolefin >10%PA, EVOH. |
| Presence in 1,2,3,or 4 retailers surveyed | |

| Compliance with APCO guidelines | | Australian recycling label is present (contains disposal instructions) | |
|---|---|---|---|
| Compliant | ✓ | Present | ✓ |
| Part compliant (1 component) | ⚠ | Not present | ✗ |
| Not compliant | ✗ | | |

#### 4.6.2.3 Review of alternative materials to single use polyolefin-based (fossil fuel) plastic

Materials presented in V.RMH.0127 (MLA, 2021) were reviewed and an update given (see Table 9).
In summary:

- Recyclable plastic trays with plastic vacuum skin packaging are increasingly visible. While the tray can be recycled kerbside, the film must go into the regular rubbish bin (previously REDcycle).
- Recyclable fibre board trays with plastic vacuum skin packaging are also more visible, although less so than plastic trays with VSP. The trays are recyclable kerbside, the film in the rubbish bin (previously REDcycle).
- Compostable materials are yet to make an appearance on shelf.
- Smooth wall aluminium trays are not in the pipeline and are unlikely to be due to difficulty in removing the plastic coating.
- Butcher's paper or reusable packaging was not seen in the main retailers.

**Table 9: Alternative materials to single use polyolefin-based (fossil fuel) plastic for red meat (MLA 2021, adapted)**

<table>
<tr><td>  </td><td>PP and PET tray – currently available (Woolworths, n.d.). Trays are recyclable kerbside.<br>➔ 2023: Barrier film is not recyclable – it cannot be returned to instore collection points. This is temporary.</td></tr>
<tr><td>  </td><td>Fibre board – currently available (Woolworths, n.d.). Tray (fibre) is recyclable kerbside.<br>➔ 2023: Barrier film is not recyclable – it cannot be returned to instore collection points. This is temporary.</td></tr>
<tr><td>  </td><td>Compostable and biodegradable plastic – plastic made from plant-based materials.<br>➔ 2023: Not seen on the market. Packaging recovery and recycling systems are not yet established to take these materials.<br>The Corumat tray is made from food waste, is compostable and is 20% cheaper that plastic meat trays (MLA, 2020).<br>Use in meat is impeded by the moisture content which can trigger degradation of the plastic.<br>Compostable and biodegradable products remain low in the preferred hierarchy of options as they are easily confused with regular plastics and disrupt plastics recycling systems (APCO 2020). However, Polyethylene manufactured from renewables is available and this can go through the conventional recycle stream.</td></tr>
<tr><td>  </td><td>Smooth wall aluminium trays for example:<br>Waitrose beef grill steaks (Waitrose 2021).<br>Aluminium is an exceptional barrier but still requires a plastic barrier.<br>➔ 2023: Without a collection scheme this option remains unfeasible.</td></tr>
</table>

Butcher's paper (uncoated)

Glass + plastic lid

**Butchers' paper or reusable packaging** such as metal, glass, or rigid plastic offer physical protection but no shelf-life advantage.

➔ 2023: formats were not seen in the survey.

Steel + bamboo lid

Stainless steel

Plastic

Pictures from (left to right): Brenmarco n.d., IKEA n.d., Life Without Plastic n.d., Life Without Plastic n.d., Walmart n.d.

Note that butcher's paper when uncoated is recyclable but when wax or silicon coated it is not. In certain Deli departments products are placed into HDPE bags and are sometimes wrapped in uncoated paper. LDPE coated papers are made into pouches and sealed. When these are recycled through the paper stream the LDPE coating ends in waste and is not recycled.

#### 4.6.2.4 Review of new or novel plastic packaging formats for red meat

Formats identified in V.RMH 0127 (MLA, 2021) that are in line with a circular model and commercially available were reviewed for developments.

One of the formats in Table 10 was seen. In summary:

- The missing flexible plastic collection scheme is a challenge to overcome for paperboard and film combination, flow wraps and multipacks.
- Barrier film flow wrap format has recently been launched in Australia.
- Reusable packaging such as bring your own and deposit are yet to make a mark in Australia.

For any of these formats to move towards a circular system, adequate consumer information, recovery and recycling systems must be in place (MLA 2021).

**Table 10: "New or novel" plastic packaging formats for red meat, adapted V.RMH 0127 (MLA, 2021)**

| | |
|---|---|
|  | **Corrugated tray** for example from GEA (GEA, n.d.) Corrugated paperboard and plastic film which can be easily separated.<br>➔ 2023: Not seen. While these formats reduce the amount of plastic used and the fibre can be recycled, the soft plastic has no recycling solution currently in Australia. |
|  | **Flow-wrap** for example, in UK and the Netherlands (Albert Heijn, 2021). Suitable for MAP, recyclable, tear open.<br>➔ 2023: Available in ALDI (7news, 2023). While these formats reduce the amount of plastic used, the soft plastic has no recycling solution currently in Australia. SEE (formerly Sealed Air) is working on a solution for thinner film and shrink and non-shrink applications. |

| | |
|---|---|
|  | **Multipacks** for steaks and other cuts for example Woolworths SA (Woolworths, 2021).<br>➔ 2023: Not seen. While these formats reduce the amount of plastic used, the soft plastic has no recycling solution currently in Australia. |
|  | **Returnable or reusable containers** for example Woolworths, Australia (7 news 2021). Customers bring their own clean containers to use for deli counter service.<br>➔ 2023: Not seen and no evidence of the service in either deli or meat on Woolworths' website. |
|  | **Returnable containers with deposit scheme** for example Intermarché in France (LCI 2021). Customers pay a deposit for the glass container with plastic lid. Empty containers are returned to the store and cleaned on site. The customer gets their money back when they scan the empty container (Noww n.d.).<br>➔ 2023: Not seen. |

## 4.7 Complementary technologies that interact with packaging

Technologies exist which enhance packaging's function in preservation, traceability, and communication. These technologies play a role in achieving wider sustainability goals of reducing food waste and providing transparency of, for example, origin. Certain technologies can also support consumer education (MLA, 2021). When considering a technology care must be taken to ensure it fits within a circular economy system and where accessories are involved, they do not disrupt recycling, for example, time-temperature indicators. A light review of technologies listed in V.RMH. 0127 was carried out and developments are outlined. Where feasibility remains uncertain or unlikely this has been mentioned.

The terms active, intelligent, and smart are sometimes used interchangeably (MLA, 2021). As a recap:

- **Intelligent packaging** – gives information on the storage conditions of the food which might affect the food's quality or safety. Examples are temperature time indicators (TTI), and leak detectors. Intelligent packaging has not made inroads into meat yet due to cost and because metal chips interfere with recycling. Robust supply chain collaboration is needed to make this a success.
    - In Australia we have seen that supply chain cooperation is possible through the previous soft plastics recycling scheme and this may encourage further collaboration to use complementary technologies.
    - Time temperature indicators might be feasible in secondary packaging when sensors can be removed easily.
    - Innovation is underway in oxygen-absorbing films for example, SEE's (formerly Sealed Air) has developed a range of Oxygen Scavenging Films for packing oxygen-sensitive products.
- **Smart packaging** – QR codes or digitally printed unique codes allow tracking of individual packs through the supply chain. When linked to supply chain data such as temperature and time, these technologies allow a real-time view of a product's performance and can enable efficient quality control procedures and targeted product withdrawals and recalls.

- Digital watermarks for example Holy Grail 2.0, can be printed on packaging which is easily sorted in MRFs. The watermark carries information on the plastic type and food contact status. The European Commission is likely to introduce legislation for the mandatory use of digital watermarking by 2030 (Holy Grail 2.0). To date, this technology looks to be the most promising for meat packaging (MLA, 2021).
- Other smart technologies support the growing number of EPR schemes. Polytag in the UK (**Polytag, n.d.**) is a new development where packaging is scanned as it enters a rubbish bin. The "consumer owner" of this packaging receives a refund. The focus is on legislators and brands to implement deposit return schemes and to support Extended Producer Responsibility requirements and is piloting in the UK. Smart-Borne (**Smart-Borne, n.d.**) is a mobile deposit machine that collects plastic and aluminium drinks cans and scans their bar code. A QR code appears on the screen of the machine which can be scanned, and digital vouchers are issued for a various shop. Due to its mobile nature, the service is also common in events such as sports tournaments and festivals.

- **Active Packaging** – compounds such as antioxidants and anti-microbial in packaging materials absorb substances from the food or environment to release agents from the packaging into the environment or food. Active packaging helps to preserve food for example ethylene absorbers in fruit and vegetables. The technology remains unfeasible for meat as it impacts recycling (McMillan, K, 2017).

## 4.8 Outlook

As posed in V.RMH 0127 (MLA, 2021), the prevailing retail self-service model and the need to achieve the longest possible shelf life, together with the handling required, there remain few practical alternatives to plastic for fresh meat.

The use of plastic in the food industry remains a point of contention amongst consumers and campaigners and the meat category is not immune. Sustainability drivers, namely carbon footprint and plastic waste pollution, continue to be in focus. The need for plastic packaging to deliver fresh, nutritious, and safe products at an affordable price must be balanced with environmental concerns about waste and emissions. The ongoing economic crisis which has put many products out of the reach of certain economic groups will continue to put pressure on retail, foodservice and meat processors. Given this changing landscape there are nine key developments:

- **Extended Producer Responsibility**

  EPR will most likely be introduced in Australia by 2025. Producers will also need to prepare for EPR in export countries such as the UK – as outlined in Table 17.

- **Alternatives to virgin polyolefins**

  The increase in fuel prices will put pressure on plastic feedstock producers to source alternatives to petroleum-based materials in particular virgin materials. Possibilities are shown in Table 9.

- **Acceleration of advanced recycling**

  Plastic film suppliers are aiming for all packaging to be recyclable, renewable or compostable to meet APCO targets in 2025. Sealed Air for example is developing films with recycled content and has a global aspiration of 50% recycled or renewable content. The company is actively involved and investing Advanced Recycling Technologies believing it is the best way to provide quality of recycled polymers to remanufacture into food contact packaging. The availability of direct food contact grades of recycled polymer is a major obstacle to incorporating recycled content into direct food contact packaging. There is a suitable stream of polymers available, but demand is much greater than supply. Until the supply of food contact recycled materials substantially increases, recycled content will remain stagnant.

  Negotiations around the UN Plastics Treaty and growing acceptance of chemical recycling will encourage the development of the national infrastructure. At the same time processors must prepare to answer concerns from NGOs about pollution from chemical recycling and output being diverted for use as combustion fuel (Asher, C, 2022).

  Prepare for enzyme recycling to make inroads as the start-up Samsara increases its portfolio and large investors back the technology. The start-up is supported by Woolworths (Samsara n.d.)

- **Nationwide soft plastics recycling**

  Consumer support for recycling is strong and care is needed to ensure they remain engaged and that trial programmes for example National Plastics Recycling Scheme (NPRS), are communicated well and given support during their rollout. Due to the staggered rollout, nationwide coverage will take time and soft plastics disposal options must be explained clearly.

- **Innovative soft plastics formats**

  Developments are underway, for example, flow wraps, and are expected soon to be offered to retailers and brands. Developments are centred around material minimisation and elimination of materials that hinder recycling.

- **Foodservice packaging**

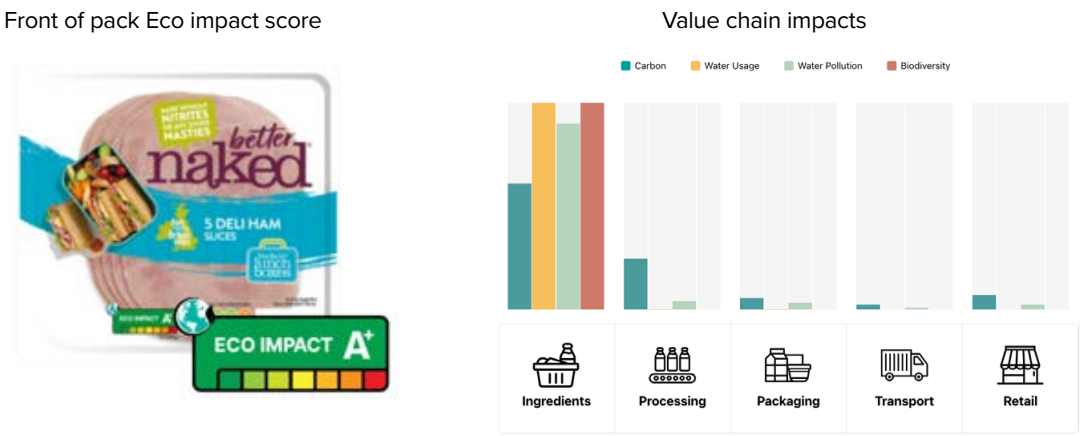
Plastic will remain a key aspect of packaging whole cuts and part primal for delivery into counter service and foodservice models. A solution for foodservice packaging which is primarily based on flexible films and often PVDC is being worked on by plastic manufacturers. The current packaging is highly effective, and a replacement is not expected in the short term. Any replacement will require a collection service.

- **Data and transparency**

Detailed information on the quantities and type of packaging will be required to support brands and retailers' sustainability reporting requirements (Woolworths, 2023), consumer information and product development. Reporting in part will be driven by new disclosure standards such as those issued by the International Sustainability Standards Board (ISSB, 2023).

To engage with consumers and create transparency, leading brands are placing their carbon count or environmental status (a score or traffic light) on their products, and several show the impact across the value chain, including packaging (see Figure 9).

**Figure 9: Foundation Earth Eco Impact Score (Foundation Earth, n.d.)**




Responding to the increasing desire for transparency, labelling schemes are making product impact publicly available – with or without the brand's involvement. For example, the citizen-run project Open Food Facts (OFF) in France uses publicly available data to calculate a product's environmental impact and awards positive and penalty points according to information such as certification and recyclability of packaging. Penalty points are given for missing information. Scores are accessed online or by scanning the product's barcode. Brands are encouraged to update their information and where this is missing, consumers can fill out the information. The app is being used in Australia (Open Food Facts, n.d.). OFF has completed a project with ADEME (The French Agency for Ecological Transition) where citizens and industry have recorded details of food packaging, adding to the 10,000 held on the database. The goal is to have details of packaging design to facilitate transparency and awareness of eco-design in order to bring change to packaging and limit its environmental impact (OFF, 2023).

- **Intensified collaboration**

Packaging is part of a system, and collaboration between all industry actors and government is needed to create a circular economy and value used packaging (waste). An entire infrastructure to support its sustainable use including instructions for disposal, collection, sorting, and recycling systems is needed. The collaboration between retailers in the Soft Plastics Taskforce is a good example of being solution driven and enabled by the legislator to act. This may accelerate action in other sustainability impact areas related to packaging or red meat.

- **Multi-functional machinery**

  Equipment that can handle multiple products and sizes on one line are in development and hold the potential to streamline packing operations and plastic films used (Ulma, n.d.).

## 4.9 Instruments to support sustainable packaging development

On June 9th the Australian Government announced their position on a circular economy and regulations are expected to be developed in the coming months and years that support packaging development, collection and recycling.

Meanwhile, until a nationwide soft plastics collection scheme is reintroduced, adjustments have been made to existing APCO guidelines.

Existing or proposed regulations imposed by importing countries are outlined in Table 17 in the Appendix. Highlights and trends are outlined in Section 4.3.3.2.

Several tools are available to support the food industry in developing sustainable packaging. The tools (legislation, roadmap, tools, schemes, pledges) listed in Table 12 are publicly available. However, navigating the requirements to understand specifics for meat packers is complex. Table 11, therefore, lists what is compliant with APCO by packaging component.

## Table 11: Packaging component sustainability guidance

| Red meat packaging component | Linnear, Recycle, Circular Economy models. May 2023. | Recycle ready | APCO guidelines | Comments |
|---|---|---|---|---|
| **Rigid** | | | | |
| Clear trays - PET | Recycle | NA | ✓ | No EVOH |
| Clear trays - PP | Recycle | NA | ✓ | EVOH <10% |
| Black trays | Linear | No | ✗ | Carbon black not allowed |
| Fibre Trays | Recycle | NA | ✓ | With any plastic film removed. Recycled through paper stream |
| **Soft Plastics** | | | | |
| Overwrap - PVC | Linear | No | ✗ | PVC not allowed |
| Overwrap - PE | Linear | Yes | ✓ | |
| Barrier vacuum shrink bags (PVDC barrier) | Linear | No | ✗ | PVDC not allowed. |
| Barrier vacuum shrink bags (EVOH barrier) | Linear | Yes | ✓ | Polyolefin >80%, EVOH <10%, Nylon <10% |
| Barrier vacuum bags (non shrink) | Linear | Yes | ✓ | Polyolefin >80%, EVOH <10%, Nylon <10% |
| Barrier vacuum thermoform, fill, & seal films | Linear | Yes | ✓ | Polyolefin >80%, EVOH <10%, Nylon <10% |
| Barrier vacuum skin packaging (VSP) films | Linear | Yes | ✓ | Polyolefin >80%, EVOH <10%, Nylon <10% |
| Barrier flow wrap Films | Linear | Yes | ✓ | Polyolefin >80%, EVOH <10%, Nylon <10% |
| Barrier Tray lidding films. | Linear | Yes | ✓ | Polyolefin >80%, EVOH <10%, Nylon <10% |
| Black coloured packaging | Linear | No | ✗ | Carbon black not allowed |
| **Packaging accessories** | | | | |
| Bone guard protectors - woven | Linear | No | ✗ | |
| Bone guard protectors - plastic films | Linear | Yes | NA | Physical size may be an issue. |
| Soaker pads or liners | Linear | No | ✗ | |
| Sachets e.g. oxygen scavengers | Linear | No | NA | |
| Netting | Linear | No | ✗ | |
| Labels - plastic (PE & PP) | Linear | Yes | ✓ | When adhered to plastic film or plastic tray. |
| Labels - paper | Linear | No | ✗ | When adhered to plastic film or plastic tray. |
| **Secondary Components** | | | | |
| Paper board cartons - one way | Circular | NA | ✓ | |
| Paper board cartons - reusable | Circular | NA | ✓ | |
| Plastic cartons - one way | Recycle | NA | ✓ | |
| Plastic cartons - reusable | Circular | NA | ✓ | |

**KEY**

NA: format is not used or seen

-: not surveyed

Recycle ready:
When soft plastics collection scheme resumes.
* Polyolefin >80%
* EVOH <10%
* Nylon <10%

✓ Compliant with APCO guidelines

✗ Not compliant with APCO guidelines

**Table 12: Instruments to support sustainable packaging development**

| Instrument | Name | Good to know |
|---|---|---|
| Legislation and legally binding targets | National Waste Policy + Action Plan (DAWE 2018) | National framework for waste and resource recovery. |
| | National Plastics Plan (DAWE 2021) | A government plan designed to address issues associated with plastics use and disposal. Strategies 4 & 5 are specific to plastics and packaging (DCCEW, 2022). |
| Roadmap | Our Packaging Future – Australia's Roadmap to 2025 (APCO 2020) | Defines a framework for the achievement of the 2025 National Packaging Targets. |
| Tools | Sustainable Packaging Guidelines, APCO (AUS) (APCO 2020) | Guidance in the form of a 10-step process leading to sustainable packaging design outcomes. This is not legally binding and with the demise of REDcycle, the soft plastic guidance has been withdrawn and replaced with CEFLEX guidelines. APCO was based on the CEFLEX guidelines. |
| | Design Smart Material Guide, APCO (AUS) (APCO n.d.) | Offers guidance to enable the design of more sustainable flexible packaging. Status May 2023: withdrawn and replaced by CEFLEX. |
| | The Packaging Recyclability Evaluation Portal (PREP), APCO (AUS) (PREP n.d.) | Verify if packaging is or isn't recyclable in Australian and New Zealand kerbside collections. Use when changing tray design. |
| | ANZPAC Specifications (AUS, NZ) (ANZPAC n.d.) | Packaging suppliers can be asked to work with these templates developed specifically for food. |
| | CEFLEX Project Barrier guidelines (EU) (CEFLEX 2020) | Use to check recyclability of plastic-based flexible barrier packaging. |
| | REDcycle / SPRS Recyclability Guidelines (AUS) (REDcycle n.d.) | This site provides a good reference for the types of soft plastic that will and won't be accepted by the REDcycle program. Status May 2023: On hold temporarily. |
| | CEFLEX Guidelines (EU) (CEFLEX n.d.) | Use to design flexible packaging. |
| | APCO QuickStart Guide – Designing for Recyclability (APCO, 2022) | Design guidelines for soft plastics. Status May 2023: this guide is not available on APCO's website, yet it remains relevant. |
| | Ellen McArthur Guidelines (Global) (Ellen McArthur Foundation 2021) | APCO guidelines take these into account although the limits for recycled material are slightly higher than REDcycle and SPRS. May be relevant for exports. |
| | Consumer Goods Forum Golden Design Rules (Global) (CGF n.d.) | Another useful guide to the design of sustainable packaging. |
| Scheme | Australasian Recycling Label (RecyclingNearYou and Planet Ark) (APCO n.d.) | On-pack labelling to help consumers recycle correctly. Supports brand owners to design packaging that is recyclable at its end of life. Producers exporting meat should consult relevant label schemes for importing countries. |
| | National Plastics Recycling Scheme (NPRS) (NPRS, n.d.) | Information on the kerbside collection scheme by location. |

| | | |
|---|---|---|
| Pledges | ANZPAC Plastics Pact Targets (AUS, NZ) (ANZPAC n.d.) | Eliminate unnecessary and problematic plastic packaging through redesign, innovation and alternative (reuse) delivery models. |
| | National Compostable Packaging Strategy, APCO (AUS) (APCO 2021) | A national strategy for the appropriate use of compostable packaging. |
| | Considerations for Compostable Plastic Packaging, APCO (AUS) (APCO n.d.) | Note that composting should be last on the waste hierarchy – see decision-making guide p14. |

# 5.0 Conclusion

## 5.1 Key findings

- **Progress is being made towards national targets but is not fast enough.**
    - Sustainable packaging helps to enhance Australian red meat's reputation and secure its clean, green, and safe image. Consumers continue to look for ways to reduce their impact on the environment and recycling continues to be their priority. The success of soft plastics recycling programmes shows how consumers are committed to disposing of packaging in the right way.
    - Retailers' sustainability commitments for packaging are all based on APCO targets of 2025 and there has been good progress towards achieving the APCO sustainability guidelines for red meat packaging placed on the market.
    - Despite progress since 2017, the industry is not expected to meet APCO targets, and this has spurred the Australian Government's commitment to introducing a form of Extended Producer Responsibility regulations – the timeframe is unknown, but it is likely to be introduced by 2025 and will impact the food industry. Additional plans for driving a circular plastic economy which includes mandating the composition of plastic packaging, the amount of recycled material and its recyclability are expected.
- **Most rigid and plastic components surveyed complied with APCO guidelines.**
    - 75% of our samples for rigid plastic formats and 70% of soft plastic components complied with APCO guidelines. However, only 20% of packaging accessories complied with the guidelines.
    - Plastic red meat packaging has been reduced, fibre-based materials are more established and problematic packaging (containing chemicals harmful to the environment and black packaging) are very limited on shelf. Packaging accessories (such as bone guards, netting etc) continue to be unrecyclable although progress is being made to convert paper labels to plastic which is better for recycling.
    - Flexible plastic used for foodservice and export (larger cuts and primal) is not part of (and previously was excluded from) instore soft plastics collection schemes and the current kerbside scheme pilots. This poses a particular risk for the domestic industry and likely will result in penalties for export products.
    - Packaging with reduced petrochemical-based plastic alternatives are on the shelf, however complete elimination of plastic remains unfeasible under the current consumption model which requires a robust shelf-life performance. Reusable containers have not made a mark on the domestic market.
- **Red meat packaging while moving towards recyclability, is not yet fully circular which risks disengaging consumers, limiting innovation and potential financial penalties under future EPR schemes.**
    - For plastic use to be sustainable, it requires a complete system to collect and reprocess it into materials that can be used again for food packaging. While recycling of the rigid plastic red meat packaging kerbside has been successful, processing of plastic into food grade material (advanced or chemical recycling) is not happening at the required scale. Without this capability, the Australian plastics economy does not benefit from full circularity and red meat risks economic penalties if an EPR is introduced.

- The absence of a nationwide soft plastics scheme since November 2022 has set back sustainability of flexible red meat packaging which is now disposed of in household rubbish bins.
- The Soft Plastics Taskforce, which is a collaboration of retailers is working to find a solution for instore soft / flexible) plastics collection. The Australian Food and Grocery Council is piloting a kerbside soft plastics scheme.
- The absence of a soft plastics recycling scheme is impeding the launch of innovative soft plastic packaging which is considered a risk regarding consumer acceptance of packaging and future Extended Producer Responsibility regulations.
- The absence of a nationwide soft plastics recycling scheme, packaging film manufacturers are marketing their films as "recycle ready" – the films have not changed but they are no longer recyclable. Red meat packaged in soft plastic must remove the previous REDcycle label and contain instructions to be placed in the household rubbish bin. While this is a temporary situation the new schemes will have a staged rollout before they are available nationwide. This risks damaging trust that has been built up with consumers. Red meat brands and retailers will need to ensure their communication for packaging disposal is accurate, timely and transparent.
- It is highly likely that the ARL label will become mandated for all packaging.

- **There is an opportunity to help meat processors make better decisions when choosing sustainable packaging.**
  - While there are several tools to support the development of sustainable packaging it is not straightforward for meat processors to find the appropriate information. Therefore, a simple table to help chose the packaging components that meet APCO requirements has been compiled (see Table 11: Packaging component sustainability guidance).
  - Providing these tools can help processors to be proactive in improving their packaging sustainability and be ready to meet their B2B customer demands.

- **Expectations for accurate data on packaging are growing.**
  - As supermarkets improve their product master data analytic capabilities and review their baseline against which targets are made, we are likely to see changes in the ambition of commitments due to the increase in accuracy and transparency in reporting for example, Woolworths (**Woolworths, 2022**). Packaging suppliers and meat processors will need to have this data readily available to support their customers as well as potential EPR regulation.

- **Export markets are increasingly developing requirements for packaging sustainability and extending focus towards a circular plastic economy.**
  - Developments are driven by either/or regulation, retailer requirements, regional and local plastic pact agreements, and citizen engagement. Certain markets have strong retailer packaging sustainability requirements which are similar to those required by Australian retailers. Further developments are expected to evolve out of the UN Plastic Treaty negotiations which occurred in June in Paris.

## 5.2 Benefits to industry

- Sustainable packaging is an opportunity. It helps processors to comply with national commitments, gain consumer trust, contribute to the reputation of red meat brands and be ready for likely developments in regulations such as plastic taxes.

- An updated guide to choosing sustainable packaging components can be adopted by the industry to make better decisions in packaging and mitigate the risk of financial penalties, reputation damage, key customer, and consumer distrust.
- A future path with upcoming developments in the packaging ecosystem (machinery, advanced recycling, data transparency) shows how the industry is moving towards a circular economy and where collaboration between different stakeholders across the value chain brings benefits and minimises risks from impending regulation and customer requirements.
- With a sharpened global focus on plastic pollution and greenhouse gas emissions, driven by the UN Plastic Treaty and Paris Agreement respectively, the report shows how sustainable red meat packaging can contribute to reducing plastics pollution, greenhouse gas emissions, and food waste.

# 6.0 References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|---|
| A Sustainable Village (n.d.), *A Sustainable Village* [Accessed 12 June 2023] [online] Available at: **https://www.asustainablevillagenyc.com/** |
| ACCC (2023), *Cooperation proposed to continue on soft plastics recycling after REDcycle liquidation*, [Accessed 28 May 2023] [online] Available at: **https://www.accc.gov.au/media-release/cooperation-proposed-to-continue-on-soft-plastics-recycling-after-redcycle-liquidation** |
| Accor (2020), Aud*it and review of packaging environmental labelling and claims* [Accessed 28 May 2023] [online] Available at: |
| AEON Company (2021), *FY2020 AEON Sustainable Management Briefing* [Accessed 10 June 2023] [online] Available at: **https://www.aeon.info/export/sites/default/en/investors/policy/pdf/AEON_Sutainable_Mangement_Briefing_Virsion2_20210219_1613.pdf** |
| AEON Company (n.d.), *Aeon Sustainable Procurement Principles* [Accessed 10 June 2023] [online] Available at: **https://www.aeon.info/en/sustainability/procurement/** |
| AFCG (n.d.), *A new path for soft plastic packaging in Australia* [Accessed 20 June 2023] [online] Available at: **https://www.afgc.org.au/industry-resources/national-plastics-recycling-scheme#nprs%7C2** |
| Albert Heijn (n.d.), *AH Rundergehakt* [Accessed 28 May 2023] [online] Available at: **https://www.ah.nl/producten/product/wi4011/ah-rundergehakt** |
| ALDI (2023), *Soft Plastics Taskforce* [Accessed 28 May 2023] [online] Available at: **https://www.aldiunpacked.com.au/storage/2023/03/Soft-Plastics-Taskforce-Roadmap-20230307.pdf** |
| ALDI (n.d.), *ALDI Australia's commitments to reduce plastics and packaging* [Accessed 28 May 2023] [online] Available at: **https://corporate.aldi.com.au/en/corporate-responsibility/environment/plastics-packaging/** |
| ALDI (n.d.), *ALDI Australia's Plastics and Packaging Progress Report 2021* [Accessed 28 May 2023] [online] Available at: **https://corporate.aldi.com.au/fileadmin/fm-dam/pdf/Suppliers/2022/ALDI_Plastics_Packaging_report_2021.pdf** |
| ALDI (n.d.), *Plastics and Packaging* [Accessed 18 Nov 2021] [online] Available at: **https://corporate.aldi.com.au/en/corporate-responsibility/environment/plastics-packaging/** |
| ANZPAC *Plastics Pact* (n.d.), Resources [Accessed 28 May 2023] [online] Available at: **https://anzpacplasticspact.org.au/resources/** |
| ANZPAC *Plastics Pact* (n.d.), Targets [Accessed 28 May 2023] [online] Available at: **https://anzpacplasticspact.org.au/resources/** |
| APCO (2020), *Our Packaging Future* [Accessed 28 May 2023] [online] Available at: **https://documents.packagingcovenant.org.au/public-documents/Our%20Packaging%20Future** |
| APCO (2020), *Sustainable Packaging Guidelines* [Accessed 28 May 2023] [online] Available at: **https://documents.packagingcovenant.org.au/public-documents/Sustainable%20Packaging%20Guidelines%20(SPGs)** |
| APCO (2021), *Australian Dairy Sustainable Packaging Roadmap to 2025* [Accessed 18 Nov 2021] [online] Available at: **https://documents.packagingcovenant.org.au/public-documents/Australian%20Dairy%20Sustainable%20Packaging%20Roadmap%20to%202025** |
| APCO (2023), *Packaging targets driving change but more is needed* [Accessed 28 May 2023] [online] Available at: **https://apco.org.au/news/20Y9e00000004WXEAY** |
| APCO (2023), *The Australasian Recycling Label Program* [Accessed 28 May 2023] [online] Available at: **https://apco.org.au/the-australasian-recycling-label** |
| APCO (n.d.), *Australia's 2025 National Packaging Targets* [Accessed 28 May 2023] [online] Available at: **https://apco.org.au/national-packaging-targets** |
| APCO (n.d.), *Australian Packaging Consumption Recovery Data 2020-21* [Accessed 28 May 2023] [online] Available at: **https://documents.packagingcovenant.org.au/public-documents/Australian%20Packaging%20Consumption%20And%20Recovery%20Data%202020-21** |
| APCO (n.d.), *Considerations for Compostable Plastic Packaging* [Accessed 28 May 2023] [online] Available at: **https://documents.packagingcovenant.org.au/public-documents/Considerations%20for%20Compostable%20Packaging** |

| |
|---|
| APCO (n.d.), *National Compostable Packaging Strategy* [Accessed 28 May 2023] [online] Available at: **https://documents.packagingcovenant.org.au/public-documents/National%20Compostable%20Packaging%20Strategy** |
| APR Plastics (n.d.), *APR Plastics* [Accessed 28 May 2023] [online] Available at: **https://www.aprplastics.com.au/** |
| ARL and APCO (2022), *Australasian Recycling Label Consumer Insights Report 2022* [Accessed 28 May 2023] [online] Available at: **https://recyclingnearyou.com.au/arl/** |
| Arowana (2023), *What the Extended Producer Responsibility Act means for the Philippines* [Accessed 12 June 2023] [online] Available at: **https://arowanaco.com/2023/01/20/extended-producer-responsibility-act-philippines/#:~:text=The%20Extended%20Producer%20Responsibility%20Act%20is%20a%20law%20that%20requires,law%20on%2023%20July%202022**. |
| Asher, C (2022), *Chemical recycling: 'Green' plastics solution makes more pollution: Report* [Accessed 28 May 2023] [online] Available at: **https://news.mongabay.com/2022/03/chemical-recycling-green-plastics-solution-makes-more-pollution-report/** |
| Bremar (n.d.), *Freezer Paper 18 inch White – 1 roll of 18" x 1000'* [Accessed 28 May 2023x] [online] Available at: **https://www.brenmarco.com/product/freezer-paper-18-inch-white/** |
| Brennan, L et al (2023), *Consumer perceptions of the role of packaging in reducing food waste* [Accessed 28 May 2023] [online] Available at: **https://fightfoodwastecrc.com.au/wp-content/uploads/2023/02/Consumer_Perceptions_final_report.pdf** |
| Burrows, D (2023), *Plastics Package: Single-use supporters shoot silver bullets* [Accessed 28 May 2023] [online] Available at: **https://www.foodservicefootprint.com/plastics-package-single-use-supporters-shoot-silver-bullets/** |
| Businesswire (2020), *Global $4+ Billion Edible Films and Coating Market Outlook* [Accessed 12 June 2023] [online] Available at: **https://www.businesswire.com/news/home/20201027005538/en/Global-4-Billion-Edible-Films-and-Coating-Market-Outlook-to-2027-with-Cargill-Dohler-DuPont-de-Nemours-Ingredion-Koninklijke-DSM-Lactips-Nagase-America-and-Tate-Lyle-Dominating---ResearchAndMarkets.com** |
| Canada.ca (n.d.), *Single-use Plastics Prohibition Regulations* (SOR/2022-138) [Accessed 18 June 2023] [online] Available at: **https://laws-lois.justice.gc.ca/eng/regulations/SOR-2022-138/** |
| Carrefour (2022), *Carrefour CSR and Food Transition Index in 2022* [Accessed 12 June 2023] [online] Available at: **https://www.carrefour.com/en/csr/performance** |
| Carrefour (n.d.), *Carrefour Objectives and performance* [Accessed 12 June 2023] [online] Available at: **https://www.carrefour.com/en/csr/commitment/committing-ecodesign-and-circular-economy-packaging** |
| CCME (2009), *A Canada-Wide Strategy For Sustainable Packaging* [Accessed 12 June 2023] [online] Available at: **https://www.canada.ca/en/public-services-procurement/services/acquisitions/green-procurement-tools/mandatory-criteria.html** |
| CCME (2019), *Canada-Wide Action Plan On Zero Plastic Waste Phase 1* [Accessed 12 June 2023] [online] Available at: **https://ccme.ca/en/res/1589_ccmecanada-wideactionplanonzeroplasticwaste_en-secured.pdf** |
| CEFLEX (2020), *Pioneer Project Barrier Summary Table* [Accessed 28 May 2023] [online] Available at: **https://ceflex.eu/public_downloads/Worksheet_Project_Barrier_final_Nov_2020_a.pdf** |
| CEFLEX (2023), *Designing for a Circular Economy* [Accessed 28 May 2023] [online] Available at: **https://guidelines.ceflex.eu/** |
| CEFLEX (n.d.), *Designing for a Circular Economy* [Accessed 28 May 2023] [online] Available at: **https://guidelines.ceflex.eu/** |
| CMS (n.d.), *Plastics and Packaging Law in France* [Accessed 18 June 2023] [online] Available at: **https://cms.law/en/int/expert-guides/plastics-and-packaging-laws/france** |
| CMS (n.d.), *Plastics and Packaging Law in the Netherlands* [Accessed 18 June 2023] [online] Available at: **https://cms.law/en/int/expert-guides/plastics-and-packaging-laws/the-netherlands** |
| CMS (n.d.), *Plastics and Packaging Laws in China* [Accessed 18 June 2023] [online] Available at: **https://cms.law/en/int/expert-guides/plastics-and-packaging-laws/china** |
| CNBC (2018), *Zero-waste stores pop up in the US, targeting shoppers tired of all the waste* [Accessed 12 June 2023] [online] Available at: **https://www.cnbc.com/2018/10/19/zero-waste-markets-want-to-shake-up-grocery-shelves-and-your-shopping.html** |

| |
|---|
| Coles (n.d.), *Together to Zero Waste* [Accessed 28 May 2023] [online] Available at: **https://www.coles.com.au/about-coles/sustainability/environment/together-to-zero-waste** |
| Compliance and Risks (2020), *Compliance & Risks: South Korea Implements Mandatory Measures on Evaluation of Packaging* [Accessed 11 June 2023] [online] Available at: **https://www.complianceandrisks.com/blog/south-korea-implements-mandatory-measures-on-evaluation-of-packaging/** |
| Congress of the Philippines (2021), *Republic Act No. 11898* [Accessed 18 June 2023] [online] Available at: **https://legacy.senate.gov.ph/republic_acts/ra%2011898.pdf** |
| Customs Support (2019), *Plastic Packaging Regulations in Saudi Arabia Postponed to September* [Accessed 18 June 2023] [online] Available at: **https://www.customssupport.com/insights/plastic-packaging-regulations-saudi-arabia-postponed-september** |
| DAWE (2021), *National Plastics Plan 2021*, Department of Agriculture, Water and the Environment, Canberra, December. CC BY 4.0. [Accessed 28 May 2023] [online] Available at: **https://www.awe.gov.au/sites/default/files/documents/national-plastics-plan-2021.pdf** |
| DCCEEW (2023), *Industry steps up on national soft plastics recycling* [Accessed 27 June 2023] [online] Available at: **https://minister.dcceew.gov.au/plibersek/media-releases/industry-steps-soft-plastics-recycling** |
| DCCEEW (n.d.), *National Waste Policy* [Accessed 28 May 2023] [online] Available at: **https://www.dcceew.gov.au/environment/protection/waste/how-we-manage-waste/national-waste-policy** |
| DCCEEW (n.d.), *National Waste Policy Action Plan* [Accessed 28 May 2023] [online] Available at: **https://www.dcceew.gov.au/sites/default/files/documents/national-waste-policy-action-plan-annexure-2022.pdf** |
| DCCEEW (n.d.), *Tackling Australia's food waste* [Accessed 28 May 2023] [online] Available at: **https://www.dcceew.gov.au/environment/protection/waste/food-waste** |
| Department for Business Innovation & Skills (2015), *Packaging (Essential Requirements) Regulations – Government Guidance Notes* [Accessed 18 June 2023] [online] Available at: **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/460891/BIS-15-460-packaging-essential-requirements-regulations-gov-guidance-notes.pdf** |
| Department of Climate Change, Energy, the Environment and Water (2023), *Environment Ministers' Meeting Agreed Communique* [Accessed 17 June 2023] [online] Available at: **https://www.dcceew.gov.au/sites/default/files/documents/emm-communique-09-june-2023.pdf** |
| Deutsche Gesellschaf für Internatonale Zusammenarbeit (GIZ) GmbH (2021), *Global Project "Support of the Export Initiative for Green Technologies" (BMU) – Extended Producer Responsibility Scheme for Packaging Waste in Egypt* [Accessed 18 June 2023] [online] Available at: **https://www.giz.de/de/downloads/20210602_EPR%20Scheme%20for%20Packaging%20Waste%20in%20Egypt_barrierefrei.pdf** |
| Ellen MacArthur Foundation (2021), *France's Antiwaste and Circular Economy Law: eliminating waste and promoting social inclusion* [Accessed 18 June 2023] [online] Available at: **https://emf.thirdlight.com/file/24/kLSzgopkL.2CJxQkLb3XkLQlS7_/Case%20Studies%20-%20French%20Anti%20Waste%20Law.pdf** |
| Ellen MacArthur Foundation (2022), *Retail insights: Plastic packaging* [Accessed 28 May 2023] [online] Available at: **https://ellenmacarthurfoundation.org/global-commitment-2022-retail-insights** |
| Ellen MacArthur Foundation (2022), *The Global Commitment 2022* [Accessed 28 May 2023] [online] Available at: **https://ellenmacarthurfoundation.org/global-commitment-2022/overview** |
| Emart (2022), 2021 *Sustainability Report* [Accessed 11 June 2023] [online] Available at: **https://company.emart.com/en/ethic/sustainability_report.do** |
| ENV (2022), *The Plastic Resource Circulation Act* (Act No. 60 of 2021) [Accessed 1x June 2023] [online] Available at: **https://www.env.go.jp/en/focus/jeq/issue/vol29/The%20Plastic%20Resource%20Circulation%20Act_0128%20final.pdf** |
| ENV (n.d.), *The Plastic Resource Circulation Act* [Accessed 10 June 2023] [online] Available at: **https://www.env.go.jp/en/laws/recycle/14.pdf** |
| Enviliance Asia (2021), *Saudi Arabia introduces new waste management law* [Accessed 18 June 2023] [online] Available at: **https://enviliance.com/regions/west-asia/sa/report_4447** |
| Envliance (2022), *Article: Malaysia sets plastic roadmap with sustainability targets up to 2030* [Accessed 11 June 2023] [online] Available at: **https://enviliance.com/regions/southeast-asia/my/report_5716** |

EPA (2012), *Recycling Regulations in Taiwan and the 4-in-1 Recycling Program* [Accessed 12 June 2023] [online] Available at: **www.epa.gov/sites/default/files/2014-05/documents/handout-1a-regulations.pdf**

EPA (n.d.), *Draft National Strategy to Prevent Plastic Pollution* [Accessed 18 June 2023] [online] Available at: **https://www.epa.gov/circulareconomy/draft-national-strategy-prevent-plastic-pollution**

EPA (n.d.), *Laws and Regulations*

EPD (n.d.), *Producer Responsibility Schemes* [Accessed 10 June 2023] [online] Available at: **https://www.epd.gov.hk/epd/english/environmentinhk/waste/pro_responsibility/index.html**

EPR Indonesia (n.d.), *EPR Indonesia – The legal framework in Indonesia* [Accessed 11 June 2023] [online] Available at: **https://www.epr-indonesia.id/the-legal-framework-in-indonesia**

Eurlex (2008), *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives* (Text with EEA relevance) [Accessed 14 June 2023] [online] Available at: **https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098**

Eurlex (2015), *Closing the loop – An EU action plan for the Circular Economy* [Accessed 14 June 2023] [online] Available at: **https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614**

Eurlex (2018), *Directive (Eu) 2018/852 Of The European Parliament And Of The Council of 30 May 2018 amending Directive 94/62/EC on packaging and packaging waste*

Eurlex (2020), *Packaging and packaging waste – Summary of Directive 94/62/EC* [Accessed 13 June 2023] [online] Available at: **https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM:l21207**

European Commission (n.d.), *A European Green Deal* [Accessed 18 June 2023] [online] Available at: **https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en**

European Commission (n.d.), *Packaging Waste* [Accessed 14 June 2023] [online] Available at: **https://environment.ec.europa.eu/topics/waste-and-recycling/packaging-waste_en**

European Commission (n.d.), *Plastics* [Accessed 18 June 2023] [online] Available at: **https://environment.ec.europa.eu/topics/plastics_en**

European Plastics Pact (n.d.), *Targets* [Accessed 16 June 2023] [online] Available at: **https://europeanplasticspact.org/targets/**

European Plastics Pact (n.d.), *Targets* [Accessed 18 June 2023] [online] Available at: **https://europeanplasticspact.org/targets/**

FAO (2021), *Assessment Of Agricultural Plastics And Their Sustainability* [Accessed 28 May 2023] [online] Available at: **https://www.fao.org/3/cb7856en/cb7856en.pdf**

FIAL (2021), *The National Food Waste Strategy Feasibility Study – Final Report.* [Accessed 28 May 2023] [online] Available at: **https://workdrive.zohopublic.com.au/external/06152b9ff5971843391f39fc4d32a847e56fb907c167a4a645887b0a4bc43000**

Food Packaging Forum (2022), *Taiwan bans PVC in food packaging* [Accessed 12 June 2023] [online] Available at: **https://www.foodpackagingforum.org/news/taiwan-bans-pvc-in-food-packaging**

Food Packaging Forum (2022), *Taiwan starts rPET review process to support circular food packaging* [Accessed 1 June 2023] [online] Available at: **https://www.foodpackagingforum.org/news/taiwan-starts-rpet-review-process-to-support-circular-food-packaging**

Foundation Earth (n.d.), *Naked Ham Ecological Impact* [Accessed 28 May 2023] [online] Available at: **https://www.foundation-earth.org/product/FB72/**

GEA (n.d.), *FoodTray, the newest innovation in Food Packaging* [Accessed 28 May 2023] [online] Available at: **https://www.gea.com/en/articles/foodtray/index.jsp**

GOV.UK (2014), *Guidance – Packaging waste: producer responsibilities* [Accessed 18 June 2023] [online] Available at: **https://www.gov.uk/guidance/packaging-producer-responsibilities**

GOV.UK (n.d.), *The Producer Responsibility Obligations (Packaging Waste) Regulations 2007* [Accessed 18 June 2023] [online] Available at: **https://www.legislation.gov.uk/uksi/2007/871/schedule/2/made**

Government of Canada (n.d.), *Mandatory criteria for green procurement* [Accessed 12 June 2023] [online] Available at: **https://www.canada.ca/en/public-services-procurement/services/acquisitions/green-procurement-tools/mandatory-criteria.html**

Government of Hong Kong e-Legislation (2015), *An Ordinance to introduce measures to minimize the environmental impact of certain types of products; and to provide for related matters* [Accessed 18 June 2023] [online] Available at: **https://www.elegislation.gov.hk/hk/603!en?INDEX_CS=N**

Grantham Research Institute on Climate Change and the Environment (1995), *Law No 21/1995 Kuwait Environment Public Authority. Further amended: Law No 16/1996* [Accessed 18 June 2023] [online] Available at: **https://www.climate-laws.org/document/law-no-21-1995-kuwait-environment-public-authority-further-amended-law-no-16-1996_50f2**

Green Queen (2021), *Aeon Launches Products with Loop's Reusable Packaging in 19 Stores Across Japan* [Accessed 10 June 2023] [online] Available at: **https://www.greenqueen.com.hk/aeon-launches-products-with-loops-reusable-packaging-in-19-stores-across-japan/**

GVW (2022), *German Packaging Act: further changes since 1 July 2022* [Accessed 13 June 2023] [online] Available at: **https://www.gvw.com/en/news/blog/detail/german-packaging-act-further-changes-since-1-july-2022**

Hero Group (n.d.), *CSR Programs* [Accessed 12 June 2023] [online] Available at: **https://www.hero.co.id/csr/detail/environmental_friendly#environmental_friendly**

Holy Grail 2.0 (n.d.), *Digital Watermarks* [Accessed 28 May 2023] [online] Available at: **https://www.digitalwatermarks.eu/**

Hu (2021), *Existing EPR policies in Asia Pacific, LORAX EPI* [Accessed 28 May 2023] [online] Available at: **https://www.lorax-epi.com/blog/env/2021/07/05/Existing_EPR_policies_in_Asia_Pacific.html**

IFRS (2023), *General Sustainability-related Disclosures* [Accessed 28 May 2023] [online] Available at: **https://www.ifrs.org/projects/work-plan/general-sustainability-related-disclosures/**

IKEA (n.d.), I*KEA 365+ Food container with lid, square glass/plastic 600 ml* [Accessed 28 May 2023] [online] Available at: **https://www.ikea.com/gb/en/p/ikea-365-food-container-with-lid-square-glass-plastic-s39269120/**

International Labour Organisation (2014), *Law No. 42 of 2014 on Environmental Protection.* [Accessed 18 June 2023] [online] Available at: **https://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=99818**

Ipsos (2022), *Seven in 10 people in 34 countries support global rules to stop plastic pollution* [Accessed 28 May 2023] [online] Available at: **https://www.ipsos.com/en/global-advisor-plastic-pollution-2022**

iQRenew (2021), *The KITKAT that's the sign of a break in Australia's waste challenge* [Accessed 18 Nov 2021] [online] Available at: **https://www.iqrenew.com/news/the-kitkat-thats-the-sign-of-a-break-in-australias-waste-challenge/**

Kantar (2022), *Who Cares, Who Does* [Accessed 28 May 2023] [online] Available at: **https://kantar.turtl.co/story/whocares-who-does-2022-p/page/2/1**

Karunasensa, G.G. and Pearson, (2023), *Household food waste reduction toolkit* [Accessed 28 May 2023] [online] Available at: **https://fightfoodwastecrc.com.au/wp-content/uploads/2023/03/Practitioners-Toolkit-Final.pdf**

Keys (2020), *ACOR audit highlights packaging recyclability claim confusion, Waste Management Review* [Accessed 18 Nov 2021] [online] Available at: **https://wastemanagementreview.com.au/acor-audit-highlights-packaging-recyclability-claim-confusion/**

Kim & Chang (2022), A*mendment to the Ministry of Environment's Standards for Evaluating Recyclability of Packaging Materials* [Accessed 11 June 2023] [online] Available at: **https://www.kimchang.com/en/insights/detail.kc?sch_section=4&idx=25265**

Kumar et al., (2021), *Edible films and coatings for food packaging applications: a review* [Accessed 12 June 2023] [online] Available at: **https://www.researchgate.net/publication/355395655_Edible_films_and_coatings_for_food_packaging_applications_a_review**

Kuwait Ministry of Communications(n.d.), C*ircular No. 8/2109* [Accessed 18 June 2023] [online] Available at: **https://www.classnk.or.jp/hp/pdf/activities/statutory/ism/flag/kuwait/ism_kuwait_circ-08-2019.pdf**

Langley et al. And Fight Food Waste CRC (2020), *Consumer Perceptions of the Role of Packaging in Reducing Food Waste, Baseline Industry Report* [Accessed 28 May 2023] [online] Available at: **https://fightfoodwastecrc.com.au/wp-content/uploads/2020/07/FFWCRC_IndustryReport_TEXT_FINAL_low-res-july2020.pdf**

Langley et al. And Fight Food Waste CRC (2021), *Consumer Perceptions of the Role of Packaging in Reducing Food Waste, Pack Information Interviews* [Accessed 28 May 2023] [online] Available at: **https://fightfoodwastecrc.com.au/wp-content/uploads/2021/08/PII_PackInformationInterviews_20-July-21-final-optimized.pdf**

| |
|---|
| Leg Info (2022), *California Legislative Information: Bill Text - SB 54 Solid Waste: reporting, packaging, and plastic food service ware* [Accessed 11 June 2023] [online] Available at: **https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB54** |
| Lorax EPI and Amcor (2021), *EPR around the world* |
| Lorax EPI and Amcor (2021), *Existing EPR policies in Asia Pacific* [Accessed 28 May 2023] [online] Available at: **https://www.lorax-epi.com/blog/env/2021/07/05/Existing_EPR_policies_in_Asia_Pacific.html** |
| Lotte Mart (2023), *Lotte Mart significantly expands eco-friendly packaging – taking the lead in activating green consumption* [Accessed 11 June 2023] [online] Available at: **https://company.lottemart.com/esg/esg_news_view.asp?seq=107&page=1&list_num=10&schType=&schWord=&code=NOTICE** |
| Lotte Mart (n.d.), *Company ESG Overview* [Accessed 11 June 2023] [online] Available at: **https://company.lottemart.com/esg/esg_brand.asp** |
| Lynx Strategic Business Advisors (2020), *Egypt's Waste Management Law* [Accessed 18 June 2023] [online] Available at: **https://www.lynxegypt.com/assets/pdfs/Waste-Management-Law.pdf** |
| Malaysia Kini (2022), *Article: Circular economy for plastic in Malaysia – are we on track?* [Accessed 11 June 2023] [online] Available at: **https://www.malaysiakini.com/announcement/626174** |
| McMillan, K (2017) *Advancements in Meat Packaging Meat Science* Volume 132, October 2017, Pages 153-162 [Accessed 28 May 2023] [online] Available at: **https://www.sciencedirect.com/science/article/abs/pii/S0309174017302127?via%3Dihub** |
| MLA (2016), *Sustainable packaging value chain opportunities in the Australian red meat industry* [Accessed 28 May 2023] [online] Available at: **https://www.mla.com.au/contentassets/42cb342ce204413190f2883796a7d929/v.scs.0002_final_report.pdf** |
| MLA (2020), *Red meat joins the war on waste* [Accessed 28 May 2023] [online] Available at: **https://www.mla.com.au/news-and-events/industry-news/red-meat-joins-the-war-on-waste/** |
| MLA (2021), *A horizon scan of Sustainable Red Meat Packaging: what's new, innovative, and ready to market* [Accessed 28 May 2023] [online] Available at: **https://www.mla.com.au/research-and-development/reports/2023/a-horizon-scan-of-sustainable-red-meat-packaging-whats-new-innovative-and-ready-to-market/** |
| MLA (2022), *Community sentiment research* [Accessed 28 May 2023] [online] Available at: **https://www.mla.com.au/marketing-beef-and-lamb/consumer-sentiment-research/** |
| MLA (2022), *State of the Industry Report 2022* [Accessed 28 May 2023] [online] Available at: **https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/trends--analysis/soti-report/2879-mla-state-of-industry-report-2022_d6_low-res_spreads.pdf** |
| MLA (n.d.) *Carbon Neutral 2030* [Accessed 28 May 2023] [online] Available at: **https://www.mla.com.au/research-and-development/Environment-sustainability/carbon-neutral-2030-rd/** |
| MLA (n.d.), *Australian Beef Sustainability Framework* [Accessed 17 June 2023] [online] Available at: **https://www.sustainableaustralianbeef.com.au/the-framework/six-key-priorities/** |
| Morrisons (2018), *Bring Your Own Containers to Market Street* [Accessed 18 Nov 2021] [online] Available at: **https://my.morrisons.com/blog/community/bring-your-own-container/** |
| National Law Review (2023), *China Food Packaging Year-in-Review: Looking Back on the Ox and Forward to the Tiger* [Accessed 18 June 2023] [online] Available at: **https://www.natlawreview.com/article/china-food-packaging-year-review-looking-back-ox-and-forward-to-tiger** |
| Netherland Chamber of Commerce (n.d.), *Ban on plastic straws, plates, and other single-use plastics* [Accessed 18 June 2023] [online] Available at: **https://business.gov.nl/running-your-business/environmental-impact/making-your-business-sustainable/ban-on-plastic-straws-plates-and-other-single-use-plastics/** |
| NoWW (n.d.), *The NoWW solution* [Accessed 28 May 2023 [online] Available at: **https://noww.fr/solution-consigne-cle-en-main-vente-alimentaire/** |
| NPC (n.d.), *Standardization Law of the People's Republic of China* [Accessed 18 June 2023] [online] Available at: **http://www.npc.gov.cn/zgrdw/englishnpc/Law/2007-12/12/content_1383927.htm** |
| NPC (n.d.), *Law of the People's Republic of China on Promoting the Development of a Recycling Economy* [Accessed 18 June 2023] [online] Available at: **http://www.npc.gov.cn/zgrdw/englishnpc/Law/2011-02/14/content_1620415.htm** |

| |
|---|
| Oakley-Newell (2021), *Coca-Cola announces first ever plant-based bottle* [Accessed 18 Nov 2021] [online] Available at: **https://www.c-store.com.au/coca-cola-announces-first-ever-plant-based-bottle/** |
| Open Food Facts (2023), *Data on over 10,000 packagings to explore!* [Accessed 16 June 2023] [online] Available at: **https://blog.openfoodfacts.org/en/news/data-on-over-10000-packagings-to-explore** |
| Open Food Facts (n.d.), *Beef Mince* [Accessed 28 May 2023] [online] Available at: **https://au.openfoodfacts.org/product/9332218001014/beef-mince-cw-farms** |
| Packaging Insights (2021), *China imposes regulation on excessive consumer packaging to combat domestic waste issues* [Accessed 18 June 2023] [online] Available at: **https://www.packaginginsights.com/news/china-imposes-regulations-on-excessive-consumer-packaging-to-combat-domestic-waste-issues.html** |
| ParknShop(n.d.), *Sustainable Choices* [Accessed 12 June 2023] [online] Available at: https://www.pns.hk/en/promo/Sustainability |
| Parliament of Victoria (n.d.), *Inquiry into Recycling and Waste Management* [Accessed 27 June 2023] [online] Available at: https://new.parliament.vic.gov.au/492f2e/contentassets/0595436c167e4fa1bd7979564de06fb6/submission-documents/s682---tomra-collection-solutions_redacted.pdf |
| PLANTICTM (n.d.), *Fresh Red Meat* [Accessed 18 Nov 2021] [online] Available at: **https://plantic.com.au/markets/fresh-red-meat** |
| PNG Data Portal (2021), *Papua New Guinea National Environmental Management Strategy 2021–2025* [Accessed 11 June 2023] [online] Available at: **https://png-data.sprep.org/resource/national-environment-management-strategy-2021-2025** |
| Polytag (n.d.), *Our technology* [Accessed 28 May 2023] [online] Available at: **https://www.polytag.co.uk/about-us/how-polytag-technology-works/** |
| PREP (n.d.), *The Packaging Recyclability Evaluation Portal* [Accessed 28 May 2023] [online] Available at: **https://prep.org.au/main/content/home** |
| *Rebound – Global Recycled Plastic Exchange* (n.d.), [Accessed 18 June 2023] [online] Available at: **https://www.thenationalnews.com/opinion/2023/04/11/recycling-in-the-uae-waste-segregation/** |
| REDcycle (2022), *What to Recycle* |
| REDcycle (2023) |
| RNZ (2019), *PNG bans plastic bag imports* [Accessed 12 June 2023] [online] Available at: **https://www.rnz.co.nz/international/pacific-news/402533/png-bans-plastic-bag-imports** |
| Robin Greenfield (n.d.), *Zero Waste Shops* [Accessed 12 June 2023] [online] Available at: **https://www.robingreenfield.org/zerowasteshops/** |
| Samsara (n.d.) [Accessed 28 May 2023] [online] Available at: **https://www.samsaraeco.com/** |
| SDG Compass (n.d.), *SDG 12: Ensure sustainable consumption and production patterns* [Accessed 28 May 2023] [online] Available at: **https://sdgcompass.org/sdgs/sdg-12/** |
| SEE (n.d.), *Preformed trays* [Accessed 28 May 2023] [online] Available at: **https://www.sealedair.com/products/food-packaging/preformed-trays#productLines** |
| Seven & i Holdings (2022), *Sustainability Data Book 2022* [Accessed 11 June 2023] [online] Available at: **https://www.7andi.com/library/dbps_data/_template_/_res/en/sustainability/sustainabilityreport/2022/pdf/2022_all_01.pdf** |
| Seven & i Holdings (n.d.), *Seven & i Holdings – Sustainability* [Accessed 11 June 2023] [online] Available at: **https://www.7andi.com/en/sustainability/** |
| Sinclair (2021), *Woolworths supermarket rolls out new BYO CONTAINER initiative* [Accessed 28 May 2023] [online] Available at: **https://7news.com.au/lifestyle/food/woolworths-supermarket-rolls-out-new-byo-container-initiative-c-4500909** |
| Smart-borne (n.d.), [Accessed 28 May 2023] [online] Available at: **https://smart-borne.fr/** |
| Statista (2023), *Sustainable consumption in Australia – statistics & facts* [Accessed 28 May 2023] [online] Available at: **https://www.statista.com/topics/10534/sustainable-consumption-in-australia/#topicOverview** |
| Sun Art Retail Group (2022), *2021/2022 Environmental, Social & Governance Report* [Accessed 11 June 2023] [online] Available at: **https://doc.irasia.com/view/index.php?id=YNopLZKe&lang=en** |

| |
|---|
| Sustainable Plastics (2020), *Dow and Aeon sign Carbon Project Agreement to reduce greenhouse gas emissions through food packaging solutions* [Accessed 10 June 2023] [online] Available at: **https://www.sustainableplastics.com/news/dow-and-aeon-sign-carbon-project-agreement-reduce-greenhouse-gas-emissions-through-food** |
| Swiftpack (2023), *UK and European shifts in sustainable packaging* [Accessed 18 June 2023] [online] Available at: **https://www.swiftpak.co.uk/insights/uk-and-european-shifts-in-sustainable-packaging#:~:text=In%20the%20UK%2C%20the%20government,amount%20of%20plastic%20waste%20generated)** |
| Switzerland Global Enterprise (n.d.), *New Regulations For Plastics In Saudi Arabia* [Accessed 18 June 2023] [online] Available at: **https://www.s-ge.com/en/article/news/20173-saudi-arabia-clean-plastic-legislation?ct** |
| TF1 (2021) [Accessed 28 May 2023] [online] Available at: **https://www.lci.fr/environnement-ecologie/impact-positif-plastique-le-reemploi-des-emballages-trace-son-sillon-dans-les-supermarches-2200770.html** |
| The Consumer Goods Forum (n.d.), *Packaging Design* [Accessed 28 May 2023] [online] Available at: **https://www.theconsumergoodsforum.com/environmental-sustainability/plastic-waste/key-projects/packaging-design/** |
| The Economist (2021), *Boosting Circularity Across Saudi Arabia* [Accessed 18 June 2023] [online] Available at: **https://impact.economist.com/perspectives/sites/default/files/08112020_eiu_boosting_circularity_across_saudi_arabia_march_2021.pdf** |
| The Guardian (2023), *Australia recycles just 18% of plastic packaging and will not reach 2025 target, review finds* [Accessed 28 May 2023] [online] Available at: **https://www.theguardian.com/australia-news/2023/apr/20/australia-recycles-just-18-of-plastic-packaging-and-will-not-reach-2025-target-review-finds** |
| The Japan Containers & Packaging Recycling Association (n.d.), article [Accessed 10 June 2023] [online] Available at: **https://www.jcpra.or.jp/english/tabid/613/index.php#Tab613** |
| The Japan Containers & Packaging Recycling Association (n.d.), *The Containers and Packaging Recycling Act* [Accessed 10 June 2023] [online] Available at: **https://www.jcpra.or.jp/english/tabid/613/index.php#Tab613** |
| The Kuwait Times (2023), *Environment authority to combat plastic pollution through circular economy: Official* [Accessed 18 June 2023] [online] Available at: **https://www.kuwaittimes.com/environment-authority-to-combat-plastic-pollution-through-circular-economy-official/** |
| The National News (2023), *Climate – What does the UAE's ban on single-use plastics mean for the environment?* [Accessed 18 June 2023] [online] Available at: **https://www.thenationalnews.com/climate/environment/2023/01/12/what-does-the-uaes-ban-on-single-use-plastics-mean-for-the-environment/#:~:text=Plastic%20bags%20to%20be%20banned,types%20** |
| The National News (2023), *The UAE is on its way to becoming a hub for plastic recycling* [Accessed 18 June 2023] [online] Available at: **https://www.thenationalnews.com/opinion/2023/04/11/recycling-in-the-uae-waste-segregation/** |
| The Source Bulk Foods (n.d.), [Accessed 12 June 2023] [online] Available at: **https://www.thesourcebulkfoods.ca/** |
| UAE Government Portal (2023), *UAE Circular Economy Policy* [Accessed 18 June 2023] [online] Available at: **https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/policies/economy/uae-circular-economy-policy** |
| Ulma (n.d.), *Meat vacuum packaging with Flow-vac* [Accessed 28 May 2023] [online] Available at: **https://www.youtube.com/watch?v=2Pdeh_Vg4kc** |
| UN Statistics (n.d.), *M49 standard* [Accessed 15 June 2023] [online] Available at: **https://unstats.un.org/unsd/methodology/m49/** |
| UNEP (2023), *Chemical Recycling* [Accessed 28 May 2023] [online] Available at: **https://wedocs.unep.org/bitstream/handle/20.500.11822/42232/chemical_recycling_sheet.pdf?sequence=3&isAllowed=y** |
| UNEP (2023), *Turning off the Tap* [Accessed 28 May 2023] [online] Available at: **https://wedocs.unep.org/bitstream/handle/20.500.11822/42277/Plastic_pollution.pdf?sequence=4** |
| UNEP (2023), *Turning off the Tap: How the world can end plastic pollution and create a circular economy* [Accessed 28 May 2023] [online] Available at: **https://www.unep.org/resources/turning-off-tap-end-plastic-pollution-create-circular-economy** |
| UNEP (n.d.), *Plastics legislation explorer* [Accessed 28 May 2023] [online] Available at: **https://leap.unep.org/knowledge/toolkits/plastic/legislation-explorer?f%5B0%5D=plastic_tags%3A5797&f%5B1%5D=regulatory_approach%3A5257&search_api_fulltext=epr&sort_by=aggregated_date&sort_order=DESC** |

| |
|---|
| United Nations Industrial Development Organisation (2021), *A Study on Plastic Value Chain in Egypt* [Accessed 18 June 2023] [online] Available at: **https://www.unido.org/sites/default/files/files/2022-01/Plastic_value_chain_in_Egypt.pdf** |
| Verive (n.d.), *What to expect from the SUP Directive in the Netherlands* [Accessed 18 June 2023] [online] Available at: **https://verive.eu/en/articles/what-to-expect-from-the-sup-directive-in-the-netherlands-en** |
| Waitrose and Partners (n.d.), E*asy to Cook Beef Grillsteaks with Cheddar* [Accessed 28 May 2023] [online] Available at: **https://www.waitrose.com/ecom/products/easy-to-cook-beef-grillsteaks-with-cheddar/737613-740843-740844** |
| Walmart (n.d.), *LOCK&LOCK Easy Essentials Rectangular Food Storage Container, 88-Ounce* [Accessed 28 May 2023] [online] Available at: **https://www.walmart.com/ip/LOCK-LOCK-Easy-Essentials-Rectangular-Food-Storage-Container-88-Ounce/50213803** |
| Walmart (n.d.), W*aste: Circular Economy* [Accessed 13 June 2023] [online] Available at: **https://corporate.walmart.com/esgreport/environmental/waste-plastics#endnotes** |
| Wellcome (n.d.), *Wellcome Corporate Responsibility* [Accessed 11 June 2023] [online] Available at: **https://www.wellcome.com.hk/en/green-initiatives-list** |
| Will Agri (2020), *A spray-on edible coating to replace plastic packaging* [Accessed 12 June 2023] [online] Available at: **https://www.willagri.com/2020/02/13/a-spray-on-edible-coating-to-replace-plastic-packaging/?lang=en** |
| Woolworths (2022), *2022 Sustainability Report* [Accessed 28 May 2023] [online] Available at: **https://www.woolworthsgroup.com.au/content/dam/wwg/investors/reports/2022/full-year/Woolworths%20Group%20Sustainability%20Report%202022%20print%20friendly.pdf** |
| Woolworths (n.d.), *Macro Grass Fed Australian Beef* [Accessed 28 May 2023] [online] Available at: **https://bunch.woolworths.com.au/s/product/a0N2y000008UwzbEAC/175592-macro-grass-fed-australian-beef-eye-fillet-320g?rating=none&pgnum=1&sortby** |
| Woolworths SA (n.d.), *Sirloin Steaks* [Accessed 28 May 2023] [online] Available at: **https://www.woolworths.co.za/prod/Food/Meat-Poultry-Fish/Beef/Steaks/8-Matured-Beef-Sirloin-Steaks-Avg-1-2-kg/_/A-2029920000004** |
| WRAP (2022), *A Roadmap to 2025 – The UK Plastics Pact* |
| WRAP (n.d.), *Collaborative Partnerships* [Accessed 16 June 2023] [online] Available at: **https://wrap.org.uk/taking-action/plastic-packaging/initiatives/collaborative-partnerships** |
| WRAP (n.d.), *European Plastics Pact* [Accessed 18 June 2023] [online] Available at: **https://wrap.org.uk/taking-action/plastic-packaging/initiatives/european-plastics-pact** |
| Zenbird (2022), *Food packaging & New Plastic Recycling Law in Japan* [Accessed 10 June 2023] [online] Available at: **https://zenbird.media/food-packaging-new-plastic-recycling-law-in-japan/** |
| Zenbird (2022), *Zenbird – Food packaging & New Plastic Recycling Law in Japan* [Accessed 10 June 2023] [online] Available at: **https://zenbird.media/food-packaging-new-plastic-recycling-law-in-japan/** |
| Food Navigator Asia (2023), *Calling for collaboration: UAE makes big moves to lure investments for sustainable economic development* [Accessed 22 June 2023] [online] Available at: **https://www.foodnavigator-asia.com/Article/2023/02/21/uae-makes-big-moves-to-lure-investments-for-sustainable-economic-development#** |
| Government of UAE (2021), *UAE Circular Economy Policy* [Accessed 22 June 2023] [online] Available at: **https://www.moccae.gov.ae/assets/download/d15b52b/UAE Circular Economy Policy.pdf.aspx#:~:text=By%20adopting%20circular%20economy%20strategies,and%20not%20lost%20or%20wasted** |
| Government of Canada (2023), *Single-use Plastics Prohibition Regulations* [Accessed 22 June 2023] [online] Available at: **https://www.canada.ca/en/environment-climate-change/services/sustainable-development/strategic-environmental-assessment/public-statements/single-use-plastics-prohibition-regulations.html** |


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# 7.0 Appendix

## 7.1 Data used to support sustainability assessment of packaging

### 7.1.2 Packaging sustainability assessment

**Table 13: Summary of 3 economy models relevant to meat packaging (MLA, 2021), updated 2023.**

|  |  |  |
|---|---|---|
| **Model 1: Linear Economy: remove, reduce, renew** | **Model 2: Recycling Economy: recycle, reuse, renew** | **Model 3: Circular Economy** |
| Ongoing improvements are being made to reduce the amount of plastic used, the removal of chemicals considered harmful to the environment and the introduction of fibre-based material. | Materials are being designed with Model 1 + recyclability and reusability embedded. However, the current mechanical recycling technology remains limited for producing food contact material due to the inability to separate mixed plastic streams and multilayer structures. | Model 1 + Model 2 + advanced recycling technologies (see Fig 8 Appendix 8.1.1), biopolymers and effective labelling-collection-sorting. |
| **MAP moving to VSP and VT.** | **Plastic designed to be recycled.** | **Chemical recycling of Polyolefins.** |
| **Exports** of primals use PVdC shrink bags due to superior barrier properties and longer shelf life. Work is underway to develop EVOH shrink bags to eliminate PVdC and replace with a structure which is more readily recycled. | **Recyclable plastic trays** containing mono PET, PET PLANTIC™, PP. | Hydro-thermal liquefaction. |
| **PVC and PVDC plastics** phasing out. | **Recyclable plastic trays** containing recycled plastic | **Depolymerisation of Polyesters (PET)** |
| **EPS trays** phasing out | **Fibre based** packaging. | **Biopolymers** |
| | | **Label information** gives consumer advice on disposal streams. |
| | | **Kerb-side collection** of flexible packaging. |
| | | **Advanced plastics sorting** at Material Recovery Facilities (MRFs). |

**Table 14: Examples of packaging mapped to linear economy model (MLA, 2021), updated 2023**

|  | **Model 1: Linear economy: remove, reduce, renew**<br><br>Ongoing improvements are being made to reduce the amount of plastic used, the removal of chemicals considered harmful to the environment and the introduction of fibre-based material. |
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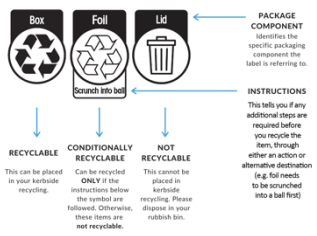
|  <br>MLA 2016 |  <br>  <br>MLA 2016 | **MAP is moving to Vacuum Skin Pack (VSP) and VacuumThermoform (VT)** due to space efficiency and quality drivers. VSP and VT use less plastic and enable more products to be transported per given space (secondary packaging, pallet, container), take up less shelf space and use less energy to keep chilled in transport/storage/shelf display. MAP has a negative effect on beef and lamb tenderness (Condon 2016). |
|  | | **PVC and PVDC plastics** are being phased out due to environmental and perceived environmental concerns (DAWE 2021). |
|  <br>MLA 2016 | | **EPS trays** are being phased out to meet regulation in 2022 (DAWE 2021). |
| NOTE: Rapid progress is being made on the Australian market by the large retailers in line with government packaging targets for 2025. All materials that are required to achieve the 2025 packaging targets are available for example rPET and recyclable PET trays, and films for vacuum-shrink and lidding films that are REDcycle compatible.<br><br>However, it's likely that not all meat processors' packaging machines can run the materials and to make a rapid change has a cost implication. Films compatible with the REDcycle program would be available at the scale required at a reasonably short ramp up time. A move of current trays to recycled PET may put a strain on rPET supplies. The rPET trays are at a premium and REDcycle compatible films are assumed a premium. | | |

**Table 15: Examples of packaging mapped to Recycling economy models (MLA, 2021)**

| | |
|---|---|
|  | **Model 2: Recycling Economy: recycle, reuse, renew**<br><br>Materials are being designed with Phase 1 + recyclability and reusability embedded. However, the current mechanical recycling technology remains limited for producing food contact material due to the inability to separate mixed plastic streams and multilayer structures. |
|  <br>Planet Ark n.d. | **Plastic designed to be recycled**. Soft plastic recycling schemes (REDcycle was a former scheme) take mono plastics which meet the criteria of the ARL PREP tool.<br><br>The previous scheme required consumers to take plastic to store deposit bins. Now, some councils are trialling kerbside collection, others ask for soft plastic to be disposed of in the regular rubbish. |
| NOTE: Foodservice (whole or part carcase) packaging is not included in the soft plastics recycling schemes which limits the ability for operators as well as meat processors and packaging suppliers to achieve the 2025 targets. While packaging suppliers are working with the foodservice industry, there currently is no B2B collection and recycling solution. Recycling company Replas currently recycle retail mixed soft plastics however a cleaning and collection scheme is yet to be established. The landscape is rapidly changing, however. Previously iQRenew was a nominated primary supplier to the plant, which opens the opportunity to include recovery of material from other sectors, potentially foodservice (Bate 2021). | |

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|  <br>PLANTIC™ n.d. | **Recyclable plastic trays** containing mono PET, PET, PLANTICTM (PLANTICT n.d.), PP. PLANTICTM is used as a barrier and is suitable for a circular economy system. However, in a chemical recycling system (see model 3), it is not as necessary. If more shelf life is needed than can be offered by mono rPET trays, PLANTICTM is a sustainable way to increase this. The barrier is produced from renewable industrial crops including corn and tapioca. The material is said to use 50% less energy to produce and creates 70% less greenhouse gases (FIAL 2021). |
|  <br>Martogg n.d. | **Recyclable plastic trays** containing recycled plastic. In Australia there is a local supply of rPET for example: Martogg's "MarPET" (Martogg n.d). |
| NOTE: Recycled material can only come from clear PET that has been used for food contact for example PET bottles to prevent contamination from non-food contact chemicals. There is the possibility to use more recycled material however the plastic's appearance is cloudy and may impact consumer perception. Chemical recycling (discussed in phase 3) would remove the issue. | |
|  <br>Woolworths n.d. | **Fibre based** packaging is being used where possible.<br><br>For example, Woolworth's fibre backing and skin pack steaks. Note that although fibre is renewable the water footprint is generally larger than the plastic equivalent. It is however light weight, uses less plastic and optimises space on shelf and transport. Shelf life is longer than MAP equivalent. The board is recyclable through the paper stream when separated. The film is not recyclable into food contact but is downcycled. |

**Table 16: Examples of packaging, technologies and approaches mapped to a Circular economy (MLA, 2021)**

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|  | **Phase 3: Circular Economy**<br><br>Phase 1 + Phase 2 + advanced recycling technologies (see Fig 8, Appendix 8.1.1), biopolymers and effective labelling-collection-sorting. |

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|---|---|
|  <br>Packaging Europe 2021<br>  <br>Packaging Europe 2021 | **Chemical recycling of Polyolefins** (Polyethylene, Polypropylene) breaks down polymers into monomers which are transformed into new plastic suitable for food contact. The process emits approximately 1.5 tonnes of CO2 per tonne less per plastic recycled than the equivalent incinerated (Dow 2021).<br><br>For example, Dow and Bolloré's pilot which creates recyclable food contact film from recycled plastic, retrieved from mixed plastic waste (Skoda 2021).<br><br>SEE's (formerly Sealed Air) food contact film which uses recycled soft plastic from instore deposit (Packaging Europe 2020). |
|  <br>Licella n.d. | **Hydro-thermal liquefaction** transforms plastic into oil using water at high temperatures.<br><br>For example, Cat-HTR™ (Licella n.d.) uses water at near or supercritical temperatures to transform plastic at a chemical level back to the oil from which it originally came. This recycled oil is a direct substitute for fossil oil, reducing the demand for natural resources and transforming waste plastic into a truly circular resource. |
|  <br>Samsara n.d. | **Depolymerisation** of Polyesters (PET) breaks down long chain polymers into component monomers. The process allows the monomers to be reclaimed to make new polymers that have properties which match the original material.<br><br>For example, Woolworths' and Samsara's project which uses the start-up's enzyme technology to break down plastic into its monomers so that it can be continuously recycled. The goal is to create an infinite loop to replace the need for new plastic. The process can break down coloured plastic into clear plastic which would be applicable to premade and thermoformed plastic trays. The technology is being trialled on Own Brand packaging and will use the first 5,000 tonnes of Samsara plastic. First products are expected by end 2023 (Woolworths Group 2021). |
|  <br>The Coca Cola Company 2021 | **Biopolymers** – plant based PET is available as announced by Coke who has developed a limited run prototype using sugar from a corn feedstock (Oakley-Newell, 2021).<br><br>Polyethylene and polypropylene manufactured from renewable sources is commercially available but command a price premium. |

NOTE: Biodegradable biopolymers are either protein (for example, bovine gelatine, catfish skin, soy protein) or starch-based (for example from corn). Protein-based polymers are not as effective as PO-based film for meat. Starch-based polymers allow oxygen transfer so are also not suitable for meat. However, PLANTIC™'s new technology provides low oxygen transmission and is a suitable replacement for EVOH (as discussed in model 2).

Biodegradable polymers made from plants and will biodegrade in the right conditions.

Polyethylene can be made from plants and is identical to petrochemical-derived PE. These will not biodegrade.

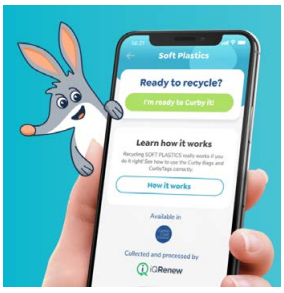
Sustainable sourcing of bio feedstock for biopolymers and ensuring they are recycled will be critical to ensure circularity and avoid unintended consequences for example, environmental damage from pesticides used in growing the plants or removing a potential food or feed source.


Planet Ark n.d.

Planet ark n.d.

**Label information** to support consumer advice on collection, sorting and recycling.

APCO and Planet Ark promote the use of ARL on packaging so that consumers know how to dispose of it correctly (RecyclingNearYou n.d.).




Curby n.d.


iQRenew 2021

**Kerbside collection** of flexible packaging.

For example, a supply chain collection and recycling collaboration with different actors who represent the process – CurbCycle (soft plastic collection), iQ Renew (MRF operator), Licella (feedstock recycler who uses Cat-HTR technology), Nestlé, material, and packaging manufacturers. The trial is a feasibility test to assess the collecting and recycling of household soft plastics at scale. The collaborative partnership project is running a kerbside collection trial on the NSW Central Coast of soft plastics from 2,000 homes. Bags are manually separated from mixed recyclable plastics at iQRenew. Soft plastics from the trial were reprocessed into PP to make a prototype for a KitKat chocolate bar with 30% recycled content (iQRenew 2021).


Digital Watermarks n.d.

**Advanced plastics sorting** at Material Recovery Facilities (MRFs), for example:

The Holy Grail 2.0 program is developing digital watermarks that can be printed on the packaging which is easily seen and sorted in MRFs. The watermark carries information on the plastic type and food contact status. The first prototype sorting detection unit has been validated in Denmark and digitally watermarked products could be introduced to stores in Denmark, France and Germany by June 2022 for demonstrations and industrial-scale trials. The European Commission is likely to introduce legislation for the mandatory use of digital watermarking by 2030 (Holy Grail n.d.).

## 7.2 Export market developments

**Table 17: Regulations and developments of note in export markets**

**KEY**

Ranking is based on degree of complexity and development in country approach to sustainable packaging requirements. It is a guide only. Specialist legal advice concerning material rules and extended producer responsibilities per country should be consulted.

| | |
|---|---|
| 1 | Regulatory approach is general in nature and most particularly angled towards broader environmental management. Limited to no specificity or focus on extended producer responsibility, packaging-related concerns or circular economy approaches. |
| 2 | Regulatory approach includes consideration of waste management and recycling (to some extent). Limited to early focus on packaging-related concerns and/or extended producer responsibilities. |
| 3 | Regulatory approach considers extended producer responsibility and packaging-related concerns, in addition to waste management and recycling approaches. |
| 4 | Regulatory approach is advanced and indicates an evolutionary and accelerated approach towards packaging and/or plastic-specific concerns, extended producer responsibilities across multiple categories and the circular economy. |

**Note**
USA is rated 3.5 due to the varying state-based nature of the regulation. Some states may rate a 4.
Regions are classified according to UN Standard 49

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**Note**
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Regions are classified according to UN Standard 49

| | | |
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| **Eastern Asia** | **China** | **4** |
| | Regulation: Standardisation Law of the People's Republic of China (NPC, n.d.)<br>• Announced in ~ Aug 2021 to come into effect Sept 2023 China has adopted regulations that limit excessive packaging on targeted food and cosmetics packaging that will require producers to adhere to specific guidelines restricting the volume of packaging allowed in proportion to a product.<br>• Will impact 31 food and beverage categories, including meat, and 16 cosmetic categories<br>• The legislating body(s): Ministry for Industry and Information Technology and State Administration for Market Regulation (SAMR).<br>• Commencement period: Sept 2023 (industry-given transition period from 2021)<br>• What the regulation targets:<br>  ◦ Number of packaging layers permitted. Food categories are allowed a maximum of 4 layers, whereby layer 1 is the first layer that touches the actual product.<br>  ◦ Packaging Void Ratio: volume of the product: total volume of the package.<br>Empty space volume, which looks at varying coefficients by percentage of packaging per product (based on weight). The greater the weight the less the "empty space" allowed. Spatial coefficients (k) for specific commodities are provided, to enable correct calculation. For meat products k = 7<br>  ◦ Packaging Cost: cannot be more than 20% of the product price | |

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| | Regulation: The Law on Prevention and Control of Environmental Pollution Caused by Solid Waste<br>• Focusses on single-use plastics such as non-degradable plastic bags and other disposable plastic products. (Included here for completeness – although less relevant to the meat sector). |
| | Regulation: Law of the People's Republic of China on Promoting the Development of a Recycling Economy<br>• Article 15 relates to enterprises manufacturing products or packages which are included in the catalogue for compulsory recovery. (NPC, n.d.).<br>• They shall be responsible for recovering the products or packages discharged.<br>• The catalogue for compulsory recovery includes:<br>° Electronics: Computers, televisions, refrigerators, washing machines, etc.<br>° Automotive parts: Batteries, tires, etc.<br>° Construction materials: Concrete, bricks, etc.<br>° Packaging materials: Plastic, paper, etc.<br>° Hazardous waste: Batteries, paints, etc. |
| | 14th Five-Year Plan Plastic Pollution Control Action Plan (National Law Review, 2023).<br>• Core tenant is to " improve the entire chain of plastic pollution Governance system, compact local, departmental and corporate responsibilities, focus on key links, key areas, and key areas, actively promote the reduction of plastic production and use at the source, scientifically and steadily promote plastic substitute products, accelerate the promotion of standardised recycling of plastic waste, and strive to improve the level of safe disposal of plastic waste at the end, vigorously carry out special cleaning and rectification of plastic waste, greatly reduce the amount of plastic waste landfill and environmental leakage, and promote white pollution control to achieve remarkable results"<br>• No direct application currently to food-related packaging. Refers to the laws already focussing on the reduction of excessive packaging.<br>• Does mention green design principles, which may then drive further requirements.<br>• Does also mention end-of-life considerations and the establishment of recycling infrastructure in varying locals, noting that incineration also is in use in China for waste disposal.<br>• In terms of taxes on plastics or packaging – since 2015 taxpayers who sell self-produced renewable resource products including plastic-waste products or composite paper packaging materials waste are potentially eligible for 50% a VAT rebate ration (may not be relevant to MLA as they may not be considered a taxpayer) (CMS, n.d.) |

| Eastern Asia | Hong Kong | 3 |
|---|---|---|
| | Regulation: Product Eco-responsibility Ordinance (Cap. 603) (PERO). (Government of Hong Kong e-Legislation, 2015).<br>• Introduced July 2008<br>• Focuses on the producer's responsibility of packaging by shifting the end-of-life responsibilities to the producers.<br>• Key requirements include:<br>  ◦ Producers must register with the Environmental Protection Department (EPD) and pay an annual registration fee.<br>  ◦ Producers must develop a PRS plan that outlines how they will collect, recycle, and treat end-of-life products.<br>  ◦ Producers must meet certain performance targets for the collection and recycling of end-of-life products.<br>  ◦ Producers must report to the EPD on their performance under the PRS.<br>• Plastic shopping bags have been the first target area of the Ordinance.<br>• Regulation targeting a Producer Responsibility Scheme for waste electrical and electronic equipment (WEEE) came into effect in 2018 - Product Eco-responsibility (Regulated Electrical Equipment) Regulation (Cap. 603B)<br>• A Producer Responsibility Scheme for Glass beverage packaging containers is now also in effect as at May 2023 via the Producer Responsibility Scheme (PRS) on Glass Beverage Containers.<br>• Similar extensions to plastic beverage containers have also occurred, with public consultation open from Feb 2021 to May 2021.<br>• The Product Eco-responsibility Ordinance (Cap. 603) was amended in 2023 to include a ban on the use of PVC in packaging. The ban will take effect on December 31, 2023. | |
| **Eastern Asia** | **Japan** | **3** |
| | Regulation: Containers and Packaging Recycling Act (formal name – Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging) (JCPRA, n.d.)<br>• The Act was established in 1995 to address the then 35 million tonnes of waste discarded by households.<br>• Containers and wrapping are the primary focus of the Act – defined as "the items that become unnecessary when the contents have been consumed or removed".<br>• Focus on fees paid by manufacturers, wholesalers, retailers, and importers of products using packaging within scope (glass bottles, PET bottles, paper containers and wrapping and non-PET plastic containers and wrapping) to the JCPRA (a government-designated organisation, which operates the recycling business on behalf of those that pay the fees.<br>• Of relevance to MLA would be the application of the law to the importation of packaged products in Japan and any associated costs. | |

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| | The Plastic Resource Circulation Act (2022) – Ministry of the Environment. (ENV, n.d.) and (ENV, 2022).<br>• Introduced 1 April 2022<br>• Encourages companies to reduce the production of single-use plastics and develop and adopt more circular product designs and systems.<br>• The Ministry is rewarding those companies that conform to the principles by providing 150,000 yen. (AUD $1570.00)<br>• Dual focus on design for the environment and certifying products that are designed in accordance with the guidelines, and reduction of specific single-use plastics (including plastic cutlery, health and beauty and hangers and clothes covers in dry-cleaners)<br>• (reference: Zenbird 2022 https://zenbird.media/food-packaging-new-plastic-recycling-law-in-japan/)<br>• Plastic packaging will be captured in the current Containers and Packaging Recycling Act. | |
| **Eastern Asia** | **South Korea** | **3.5** |
| | Regulation: The Act on the Promotion of Saving and Recycling of Resources (Recycling Act) (Compliance and Risks, 2020).<br>• Strong focus on food and beverage packaging recycling and recyclability.<br>• 2008 introduced The Act on the Promotion of Saving and Recycling of Resources (Recycling Act) – amended in 2019.<br>• Act requires packaging producers to self-evaluate the quality, structure and ease of recycling of the packaging material.<br>• Materials are then classified according to the 4-tier scale ranging from best through to most difficult to recycle.<br>• The evaluations are reviewed by the Korean Environmental Corporation<br>• Packaging is labelled with the resulting classification.<br>• Of relevance are the packaging types that fall within this requirement including paper packaging, glass bottles, metal cans, packaging materials of synthetic resin including containers, packing materials, and trays in film or sheet.<br>• Significant movements in South Korea with additional inclusions and reviews of the Act.<br>• South Korea's plastic ban has an exemption for Food and Meat packaging containing PVdC. | |

| Eastern Asia | Taiwan | 3 |
|---|---|---|
| | Waste Disposal Act<br>• Taiwan operates an Extended Producer Responsibility concept under the Waste Disposal Act that requires manufacturers and importers of new products to fund recycling. This approach was adopted in 1988 upon amendment of the Waste Disposal Act.<br>• The EPR system requires manufacturers and importers to now pay a recycling fee to the Environmental Protection Administration, Taiwan.<br>• The Act focuses on regulated recyclable waste and is defined to include 13 categories and 33 items, including metal containers, aluminium containers, glass, and plastic containers.<br>• Collection points are required at certain locations, including supermarkets and convenience stores.<br>• The system also focuses on a four-in-one recycling programme that sees community residents, the recycling industry, the local authority and the recycling fund, to operate in a coordinated fashion to advance recycling in Taiwan.<br>(EPA, 2012) and (EPA, n.d.)<br>The Taiwanese Environmental Protection Administration (EPA) has banned the use of PVC in food packaging. This ban commences in July 2023. This will affect any Packaging containing PVC. PVdC is not included. MLA and key stakeholders are monitoring ongoing regulations.<br>Single-use plastic cups are also targeted under a new rule which will require all stores to provide a discount for those customers that bring their own cups. (Food Packaging Forum, 2022).<br>The Taiwanese Food and Drug Administrator into a new application procedure for the use of recycled PET in food contact materials. (Food Packaging Forum, 2022). | |
| **South-eastern Asia** | **Indonesia** | **2.5** |
| | Regulation: Waste Management Law 2008:<br>• Extended producer responsibility requirements noted in Article 15, but compliance by business is not fully detailed, resulting in little to no impact.<br>• Regulations 81/2012 and 97/2017 further expand upon waste reduction targets and how these might be delivered.<br>• Targets: by 2025 household waste should reduce by 30% and 70% of the remaining should go through a treatment process.<br>• Focus is at the household level and requires municipalities to develop waste reduction and treatment plans to deliver against the targets.<br>Regulation 75/2019: Road map of Waste Reduction by Producer:<br>• Sectors under focus:<br>° Manufacturing including the food and beverage industry, consumer goods industry and cosmetics and personal care industry<br>° Food and beverage services including diners, cafes, restaurants, catering services and hotels.<br>° Retail, including shopping centres. Modern stores and traditional markets.<br>• Target is that those sectors in focus must reduce the waste generated by their own products by 30% by 2029 through the recycling and reuse of resources.<br>(EPR Indonesia, n.d.) | |

| South-eastern Asia | Malaysia | 3.5 |
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| | The Malaysia Plastics Sustainability Roadmap 2021 – 2030 was published in Dec 2021, launched by the Ministry of Environment and Water (KASA). (Enviliance, 2022) and (Malaysia Kini, 2022)<br><br>Key features of the plan include:<br><br>• Phasing out problematic single-use plastics (e.g., plastics that are not recyclable, reusable, or compostable, or that contain hazardous chemicals)<br>• Achieving 25% recycling rate for plastic packaging by 2025 and 100% by 2050<br>• Achieving 15% average recycled content for various products by 2030<br>• Achieving 76% average collected-for-recycling (CFR) rate by 2030<br>• Developing halal certification standards for recycled PET (rPET) materials by 2022<br>• Implementing a mandatory EPR scheme for plastic packaging by 2026<br>• Setting a minimum threshold of recycled content for plastic packaging by 2026<br>• Setting a minimum threshold of recycled content for automotive by 2029<br><br>Malaysia is also understood to be developing a governance framework and implementation plan that would look at extended producer responsibilities, first supporting voluntary transition by industry from 2023, ahead of a nationwide mandatory scheme from 2026.<br><br>Malaysia has also adopted a voluntary Sustainable Packaging Labelling Scheme that allows manufacturers and importers of packaging to label their products with a sustainable packaging label. The label is administered by the Malaysian Standards Institute (SIRIM). Criteria have been established for a number of products including food-grade lubricants, paper-based packaging products and recycled plastic products. | |

| South-eastern Asia | Philippines | 3.5 |
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| | Extended Producer Responsibility Act (Congress of the Philippines, 2021) and (Arowana, 2023)<br>• Extended Producer Responsibility Act requires companies to manage their own packaging waste, also known as the Republic Act No. 11898.<br>• This commenced in July 2022.<br>• Enterprises with over P1 billion worth of total assets must recover a portion of their waste, otherwise they will be subject to a fine.<br>• The Act targets tingi-tingi, which is where items are individually wrapped in disposable packaging.<br>• The EPRA promotes the creation of product refilling systems for retailers.<br>• Plastic packaging covered by the act includes:<br>° Food and beverage containers.<br>° Labels.<br>° Laminates.<br>° Lids and caps.<br>° Plastic single Use cutlery.<br>° Polystyrene. Single and multi-layered plastics.<br>• The act also includes a range of targets for companies. These targets for plastic packaging "recovery" start at a recovery rate of 20% by December 2023, 40% by 2024, 50% by 2025, 60% by 2026, 70% by 2027 and 80% by 2028 and every year thereafter.<br>• The Act requires companies to develop their own EPR Plan, which is to be registered with the Department of Environment and Natural Resources.<br>• Organisations need to include key information such as whoever is responsible for the organisations EPR plan, the type of plastic packaging used, verifiable volumes and weights over a certain time period, target volume or weight of plastic packaging for recovery and how packaging materials are labelled for recovery and disposal. | |
| **Oceania** | **Papua New Guinea** | **1** |
| | • The Environment Act 2000 in PNG is the primary legislative instrument governing waste management in PNG. It largely addresses waste from an "environmental harm" perspective, less so from a circular economy or sustainability perspective.<br>• Some focus has been given to a ban on plastic bag imports, reported to be introduced in 2020. (RNZ, 2019).<br>• There is very little in the way of packaging-specific legislation or regulation.<br>• PNG has developed a National Environment Management Strategy 2021 – 2025 comprising 8 themes. Theme 7 – Built Environment - Consumption & Waste addresses key waste issues including:<br>° The enactment of a Waste Management Act which also targets regulations to address the sources, entry points, recycling, biodegradable and reusable materials. Manufacturers, producers, and users of large quantities of non-biodegradable products are responsible for awareness, and management or recycling of wastes (e.g., plastic bags, bottles, wrappers).<br>° Provisions for an extended producer responsibility system whereby the producer or importer is required to support product returns, collection, and recovery systems.<br>° The timeline for the introduction of this Waste Management Act is 2024. This stated timeline of the Extended Producer Responsibility Programme is 2022 although information on whether this had evolved was not readily available. (PNG Data Portal, 2021). | |

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| **Western Asia (MENA)** | **Kuwait** | **2** |
| | • Waste regulations seem quite embryonic in Kuwait, with scarce detail available and accessible regarding governmental policies, and packaging-specific regulations or targets.<br>• In 2019 Kuwait banned single-use plastic items on ships (Kuwait Ministry of Communications, n.d.)<br>• Law No. 21/1995 Kuwait Environment Public Authority. Further amended: Law No. 16/1996. This is the main environmental law in operation in Kuwait and establishes the Kuwait Environmental Public Authority with powers to regulate practices that pollute the environment. (GRICCE, 1995).<br>• The Environmental Protection Law (Law No. 42 of 2014). This law sets out the general principles of environmental protection in Kuwait, including the need to reduce pollution and waste. (ILO, 2014).<br>• Kuwait's EPA in June 2023 was reported as looking into a circular economy approach for Kuwait. This would be a significant step forward and focus heavily on technology, reuse, manufacturing and recycling, and longer-term behaviour change to "eradicate" plastic pollution. (The Kuwait Times, 2023). | |
| **Western Asia (MENA)** | **Saudi Arabia** | **2** |
| | • The Waste Management Law of 2021: This law establishes a comprehensive waste management system in Saudi Arabia. It includes provisions on the collection, transportation, treatment, and disposal of waste, as well as on the promotion of recycling and reuse. (Enviliance Asia, 2021).<br>• The Technical Regulation for Packaging of 2017 specifies that plastic products need to be OXO-biodegradable and came into effect for limited range of products (such as shopping, clothing, and grocery bags) in April 2017. (Customs Support, 2019).<br>Initial plans were to then extend the scope of the regulation to cover additional packaging including stretch films, overwraps, shrink and cling films in Phase 2 and in Phase 3 extend this to plastic liners for cartons and food packaging bags. However, reports indicate that these plans have now been suspended, and the Regulation will only apply to those items first targeted. (Switzerland Global Enterprise).<br>Should monitor this on an ongoing basis as this may affect packaging in the future.<br>• Under Saudi Arabia's Vision 2030 "Achieving Environmental Sustainability", intentions to establish recycling facilities and improve the efficiency of waste management are noted. (The Economist, 2021). | |
| **Western Asia (MENA)** | **UAE** | **3** |
| | • The UAE has said it will ban plastic bags from January 2024, and the importation of plastic cutlery, drinking cups, Styrofoam, and boxes from January 2026. (The National News, 2023).<br>• In the lead up to Cop28 the UAE are reporting significant strides towards comprehensive sustainability policies, including establishing themselves as a plastics recycling hub through construction of in-country recycling facilities and market development through trading platforms like Rebound Plastic Exchange (Rebound - GRPE, n.d.) for which trades recycled plastics. (The National News, 2023).<br>• The UAE is looking to build its first food-grade plastics recycling plant (Food Navigator Asia, 2023).<br>• In January 2021 the UAE Cabinet approved UAE Circular Economy Policy 2021 - 2031. This framework is designed to oversee sustainable governance and the use of natural resources in the country. It will identify priorities across infrastructure and sustainable transportation, manufacturing, food production and consumption advancing the circular economy. The Policy does not specific packaging targets but does refer to the concept with reference to quantities of waste generated and proportions of waste recycled or converted to energy. (UAE Government Portal, 2023). Policy details are in a separate document (MOCCAE, 2021). | |

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| **Northern Africa (MENA)** | **Egypt** | **2** |
| | • In October 2020 Egypt's new waste management law (#202/2020) was ratified. The law oversees waste management and recycling practices, and the development of a national strategy to improve waste disposal and recycling.<br>• This law will limit the use of single-use plastic bags. (Lynx Strategic Business Advisors, 2020).<br>• The legislative landscape in Egypt for concerning plastics is varied with a number of decrees and laws targeting various segments of the value chain. An overview of these are provided below and expanded upon in more detail in the report "Study on Plastic Value Chain in Egypt" (United Nations Industrial Development Organisation, 2021).<br><br>1. Article 27 in Waste Management Regulatory Law No. 202 of 2020 concerning limit the manufacturing, import, export, use and free distribution of single-use plastic bags in Egypt.<br>2. Governor Decree No. 167 of 2019 concerning banning single-use or disposable plastics in the Red Sea governorate<br>3. Presidential Decree No. 419 of 2018 concerning conformity with the latest version of the international Harmonised System (HS)<br>4. Ministerial Decree No. 489 of 2017 concerning factories importing and recycling plastic waste<br>5. Ministerial Decree No. 43 of 2016 concerning specific conditions for some HS codes<br>6. Ministerial Decree No. 121 of 2016 concerning export fees on plastic waste<br>7. Presidential Decree No. 25 of 2016 concerning raising import tariffs on plastics among other products<br>8. Presidential Decree no. 2 of 1957 concerning the establishment of the Egyptian Organisation for Standards<br><br>• An investigation into the establishment of an EPR scheme in Egypt was commissioned in 2000 in response to support for such a system by The Ministry of Environment in Egypt. (DGIZ, 2021). | |
| **Europe** | **EU** | **4** |
| | • Directive 2008/98/EC as amended (the Waste Framework Directive) (EUR-Lex 2008) – describes the legal framework in addressing waste including definitions, end-of waste criteria, and the concepts of the waste hierarchy and extended producer responsibility.<br><br>The directive was last amended in 2018 by Directive (EU) 2018/851 (EUR-Lex 2018) which introduced general minimum requirements for EPR schemes and outlining measures for waste generation prevention including measures to prevent the production of packaging waste and the promotion of alternative pathways for packaging (such as its reuse, recycling and other forms of recovery) more explicitly driving a circular economy approach. | |

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| | • Directive 94/62/EC as amended, known as the Packaging and Packaging Waste Directive (EUR-Lex 2020), looks to harmonise the management of packaging waste and reduce its impact by setting recovery and recycling targets. This covers all packaging placed on the European market and all packaging waste from all sources (including commercial) regardless of the material used.<br><br>The Directive requires EU countries to adopt measures to prevent the generation of packaging waste and reduce the environmental impact of packaging. Measures may be in the form of national programs, extended producer responsibility schemes or other economic instruments.<br><br>The Directive includes a range of specific targets, for delivery in two distinct tranches:<br><br>• Tranche 1 – By 31 December 2025, at least 65% by weight of all packaging waste must be recycled. The recycling targets per material are:<br>  ◦ 50% of plastic<br>  ◦ 25% of wood<br>  ◦ 70% of ferrous metals<br>  ◦ 50% of aluminium<br>  ◦ 70% of glass, and<br>  ◦ 75% of paper and cardboard.<br>• Tranche 2 – By 31 December 2030, at least 70% by weight of all packaging waste must be recycled. This includes:<br>  ◦ 55% of plastic<br>  ◦ 30% of wood<br>  ◦ 80% of ferrous metals<br>  ◦ 60% of aluminium<br>  ◦ 75% of glass and<br>  ◦ 85% of paper and cardboard. |
| | • The EU Action Plan for a Circular Economy in 2015 (EUR-Lex 2015) identified plastics as a key priority, and the Plastics Strategy in 2018 set out its vision for a circular plastics economy. |
| | • The European Green Deal in 2019 aimed for no net emissions of greenhouse gases by 2050, and the Commission will focus on implementing new legislation, targets, and measures to tackle over-packaging and waste generation. (European Commission, n.d.) |
| | • Nov 2022 the Commission proposed to revise the Packaging and Packaging Waste Directive. This review will support delivery of the European Green Deal, the new circular economy action plan to ensure all packaging on the EU market is reusable or recyclable in an economically viable way by 2030 and the 2018 Plastics Strategy to ensure that all plastic packaging on the market can be reused or recycled in a cost-effective manner by 2030. (European Commission n.d.) |
| | • The New Circular Economy Action Plan enacts the EU's objectives to:<br>  ◦ transform the way plastic products are designed, produced, used and recycled in the EU<br>  ◦ transition to a sustainable plastics economy<br>  ◦ support more sustainable and safer consumption and production patterns for plastics<br>  ◦ create new opportunities for innovation, competitiveness and jobs<br>  ◦ spur change and set an example at the global level<br>• Specific policies covering bio based, biodegradable and compostable plastics, global action on plastics, microplastics, plastic bags, plastic packaging (under the Packaging Directive), plastic waste shipments, and single use plastics are referenced within the Action Plan. (European Commission, n.d.) |

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| | The European Single-Use Plastic's Directive, which has been in effect from July 2021 bans a range of single-use plastic including plates, cutlery, straws, balloon sticks, and cotton buds from the EU market. It also cups, food and drinks containers made of expanded polystyrene, and products made of oxo-degradable plastic.<br><br>Further the regulation also required that plastic bottles were to be made with at least 30% recycled content by 2030. (Swiftpak, 2023).<br><br>• There are no specific regulations governing the inclusion of recycled materials in food packaging. However, to avoid the contamination of food with hazardous materials, the European Food Safety Authority has advised that 95% of recycled materials for food packaging, be from food packaging.<br>• Biodegradable and compossible packaging is governed by EN 13432 standard, which is used by the EU and the UK. There is currently no EU law in place applying to biobased, biodegradable and compostable plastics in a comprehensive manner.<br><br>Such packaging material should be made from renewable materials including plant-based starches, cellulose, another natural fibres<br><br>The packaging should break down into harmless substances within a reasonable time and under composting conditions. The EU standard requires that at least 90% of the material should break down within 6 months, while the UK standard says that at least 90% should break down within 12 weeks.<br><br>(Swiftpak, 2023). |
| **Europe** | **The European Plastic Pact** |
| | While not a regulation, The European Plastics Pact is of note. Started by the Netherlands and France, it now includes over 80 signatories from governments, companies, non-governmental organisations and industry associations) driving towards better design, responsible use, recycling capacity and use of recycled content to reduce the impact of plastics and plastic packaging on the environment.<br><br>The Pact includes a number of targets detailed below:<br>Target 1- Design all plastic packaging and single-use plastic products placed on the market to be reusable where possible and in any case recyclable by 2025;<br>Target 2 - Move towards a more responsible use of plastic packaging and single-use plastic products, aiming to reduce virgin plastic products and packaging by at least 20% (by weight) by 2025, with half of this reduction coming from an absolute reduction in plastics;<br>Target 3 - Increase the collection, sorting and recycling capacity by at least 25 percentage points by 2025 and reach a level that corresponds to market demand for recycled plastics;<br>Target 4 - Increase the use of recycled plastics in new products and packaging by 2025, with plastics user companies achieving an average of at least 30% recycled plastics (by weight) in their product and packaging range. (WRAP, 2022) and (European Plastics Pact, n.d.)<br><br>Signatories of note identified from the website:<br>Retail: Carrefour – listed as TBC, Auchan Retail is listed as a signatory, and looks to be the only retail signatory.<br>Consumer Product Signatories: Colgate – Palmolive, Henkel, Hilton Food Group, Nestle |

| Europe | France | 4 |
|---|---|---|
| | The Law on Circular Economy (Law No. 2020 – 105) also known as the Anti-Waste Law, introduced in February 2020 has brought with it a range of new obligations on plastic waste. (CMS, n.d.)<br><br>These are:<br>1. new obligations to inform consumers about the environmental characteristics of products, their recyclability as well as their repairability;<br>2. measures against the waste of food and non-food products, including bans on the destruction of un-sold non-food products (https://ellenmacarthurfoundation.org/circular-examples/frances-anti-waste-and-circular-economy-law);<br>3. reinforcement and extension of the extended producer responsibility (EPR);<br>4. reinforcement of waste management obligations and sanctions against illegal dumping of waste;<br>5. objective of ending all single-use plastic packaging on the French market by 2040.<br><br>• Extended Producer Responsibilities - from Jan 2022 the EPR requirements previously in place have been extended to several new categories, including textiles, toys, sporting goods, cars). Producers of products captured under an EPR scheme are required to develop and implement a 5-year prevention and eco-design plan.<br>• To support the 2040 target ban of single-use plastic packaging from the French market reduction, reuse and recycling targets for 2021-2025 have been set. Additionally, the Circular Economy Law establishes that by:<br>  ◦ 2023: 5% of reused packaging put on the market (10% in 2027)<br>  ◦ 2025: 100% of plastics must be recycled and 77% of plastic bottles for beverages will have to be collected (90% in 2029)<br>• France's approach is viewed as world leading – particularly in their approach to unused product destruction and disposal, and their repairability index (Ellen MacArthur Foundation, 2021). | |

| Europe | Netherlands | 4 |
|---|---|---|
| | Several laws and decrees regulate packaging and plastics waste, which include:<br>i. General rules can be found in the Environmental Management Act.<br>ii. The following Decrees outline further obligations and duties:<br>a. the (draft) Decree single-use plastic products;<br>b. the Decree extended producer responsibility;<br>c. the Decree packaging 2014;<br>d. the Decree plastic drinking bottles; and<br>e. the Decree metal beverage packaging.<br>(CMS, n.d.)<br><br>Under the EU's Single Use Plastic Directive, which comes into effective January 2023 – the Netherlands have enacted a number of commitments, introduced over the course of 2023, 2024 and 2025:<br>1) From January 2023, extended producer responsibility will apply to a number of products including single-use food packaging, beverage packaging, drinking cups.<br>2) From July 2023 providing single-use plastic cups and food packaging (where food can be eaten directly from the package) to customers free of charge is banned. Instead, they must charge customers for the packaging, or offer a reusable alternative (including BYO). Food products where heating cooking or roasting is required (such as meat) is excluded.<br>(Netherland Chamber of Commerce, n.d.)<br>3) From Jan 2024 reduction measures for the on-site use of disposable plastic drinking cups and food packaging comes into effect and<br>4) From July 2024 plastic lids and caps must be attached to plastic bottles or beverage containers.<br>5) From December 2024, the EPR scheme will also include wet wipes and balloons.<br>6) From 2025, PET bottles much contain at least 25% recycled plastics, and 30% by 2030 and 77% of plastic drinking bottles (up to 3L) must be collected by 2025, increasing to 90% by 2029.<br>(Verive, n.d).<br><br>Whilst these are not directly impacting meat related packaging, it is indicative of a general trend and concern over plastic packaging which will likely continue to expand, particularly as alternative packaging markets and mechanisms for collection and reprocessing evolve. | |
| **Europe** | **Germany** | **4** |
| | While not a key export market, Germany is included as regulation of note:<br><br>The German Packaging Act:<br>As of July 2022, packaged goods in Germany cannot be distributed unless the manufacturer is registered on the LUCID Register. Similarly stringent measures have also been established for downstream distributors, online marketplaces and fulfilment service providers who are now required to monitor compliance under the Packaging Act.<br><br>(GVW, 2022) | |

| Europe | UK | 4 |
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| | • Producer Responsibility Obligations (Packaging Waste) Regulations 2007 (GOV.UK, 2014). These regulations establish a system of extended producer responsibility (EPR) for packaging waste in the UK.<br><br>The regulations define obligated packaging producers (as those that handle (also defined and inclusive of those that supply packaging or packaging materials at any stage of the chain or to the final user) 50 tonnes of packaging materials or packaging and have a turnover greater than 2M pounds a year), which fall under a range of requirements, including registration, joining a compliance scheme and providing required packaging data.<br><br>The regulation also defines an overall packaging recycling target of 77% in 2022 and 2023, which is broken down by material. Business specific recycling obligations are then determined for the producer via Schedule 2 of the Packaging Waste Regulations 2007 (GOV.UK, n.d.)<br><br>• Packaging (Essential Requirements) Regulations 2015 (DBIS, 2015) : These regulations set out the essential requirements for packaging placed on the market in the UK. The regulations cover a range of issues, including the use of recycled materials, the design of packaging for easy recycling, and the provision of information on the environmental impact of packaging. | |
| | • The UK Plastic Pact (WRAP, 2022).<br>The core goals of the UK Plastic Pact are to eliminate problematic or unnecessary single-use packaging through redesign, innovation or alternative (reuse) delivery model.<br>Specific targets to support the overarching objectives are:<br>◦ 100% of plastics packaging to be reusable, recyclable or compostable<br>◦ 70% of plastics packaging effectively recycled or composted<br>◦ 30% average recycled content across all plastic packaging. | |

| Northern America | Canada | 4 |
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| | • Strong Extended Producer Responsibility Framework and specific strategy targeting sustainable packaging through the Canada-wide Strategy for Sustainable Packaging (2009) which fosters collaboration across the Federal Government, provinces and territories, municipalities, waste managers, producers, retailers, consumers, and non-governmental organisations to drive towards a zero-waste future. (CCME, 2009).<br>• Prohibition Regulations were enacted under section 93 of the Canadian Environmental Protection Act. 1999 in 2020. (Canada.ca, n.d.).<br>• The Regulations prohibit or restrict six categories of single-use plastics: checkout bags, cutlery, foodservice ware made from problematic plastics, ring carriers, stir sticks and straws. The regulations include some exemptions for flexible single use plastic straws so that they can be available for people who require them for health or accessibility reasons (Government of Canada, 2023).<br>• Overall, a strong focus on Zero Plastic Waste through the Strategy on Zero Plastic Waste which includes a range of measures across the plastic lifecycle including design, collection, recovery and market development.<br>• The Strategy aligns with the Ocean Plastics Charter championed by Canada during its G7 Presidency in 2018 which targets:<br>° 100% reusable, recyclable, or, where viable alternatives do not exist, recoverable plastics by 2030<br>° at least 50% recycled content in plastic products where applicable by 2030<br>° with other orders of government, recycling and reuse of at least 55% of plastic packaging by 2030 and the recovery of 100% of all plastics by 2040<br>° the reduction in the use of plastic microbeads in rinse-off cosmetic and personal care consumer products to the extent possible by 2020, and to address other sources of microplastics.<br>• The Primary action areas under the Strategy are:<br>1) extended producer responsibility<br>2) single-use and disposable products<br>3) national performance requirements and standards<br>4) incentives for a circular economy<br>5) infrastructure and innovation investments<br>6) public procurement and green operations.<br>• Zero Plastic project funding is also in place targeting a range of initiatives that seek to reduce plastic waste and pollution in Canada. | |
| | • In June 2019 environment ministers approved the Canada-wide Action Plan on Zero Plastic Waste: Phase 1, which focuses on: product design, single-use plastics, collection systems, recycling capacity and domestic markets. (CCME, 2019).<br>• In July 2020 environment ministers approved the Canada-wide Action Plan on Zero Plastic Waste: Phase 2, which focuses on: consumer awareness, aquatic activities, research and monitoring, clean-up and global action<br>• With the introduction of the policy on green procurement in 2006 Public Services and Procurement Canada have also included environmental criteria in their shared procurement instruments. These requirements cover both non-commodity specific and commodity specific green procurement criteria. Of note are the requirements to disclose greenhouse gas emissions and the setting of reduction targets for non-commodity specific products, and a trend towards environmentally preferable packaging, which is reported to be coming in summer 2023. (Government of Canada, n.d.) | |

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| | • The Canadian government are looking to embed further regulations concerning plastic packaging within the Canadian Environmental Protection Act 1999. These requirements would look to implement rules to further drive the circular economy goals and achieve the zero plastic waste by 2030 objective.<br>• The three key elements are:<br>  ◦ Recycled content requirements mandating minimum levels of post-consumer recycled plastic in packaging.<br>  ◦ Recyclability labels to communicate the recyclability of packaging and<br>  ◦ Composability labelling rules prohibiting the terms biodegradable or degradable on plastic packaging.<br>• Canada has a goal to include at least 50% recycled content in plastic packaging by 2030. | |
| **Northern America** | **USA** | **3.5** |
| | Fair Packaging and Labelling Act (FPLA)<br>• Section 4(c)(2) of the Fair Packaging and Labelling Act (FPLA) in the USA mentions the requirement to disclose the recycling content of packaging.<br>• This section states that:<br>  ◦ The label of any consumer commodity that is packaged in material made, in whole or in part, of recycled materials shall bear the following statement:<br>  Contains x% recycled material, where x is the percentage of recycled material in the packaging material.<br>• Individual states also have a number of state-level packaging restrictions. Most focus on banning of PFAS in food-based packaging, single use plastics (shopping bags etc..) with some states also introducing extended producer responsibility schemes targeting packaging producers. (Leg Info, 2022).<br>• California has introduced strict targets under California SG 54: | |
| | On June 30, 2022, Governor Gavin Newsom signed SB 54 (Allen, Chapter 75, Statutes of 2022), a landmark new packaging law that requires that by 2032:<br>  ◦ 100% of packaging in the state to be recyclable or compostable<br>  ◦ 25% cut in plastic packaging<br>  ◦ 65% of all single-use plastic packaging be recycled | |
| | • PFAS Regulations: Effective January 1, 2023.<br>On October 5, 2021, Governor Newson signed Assembly Bill (AB) 1200 into law. This bill bans all plant fiber-based food packaging containing PFASs that are either intentionally added or present at levels exceeding 100 parts per million total fluorine, beginning January 1, 2023 | |

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| | • The USA EPA has also released a “Draft National Strategy to Prevent Plastic Pollution” which is currently open for comment. (EPA, n.d.)<br>Three key objectives have been identified for this strategy:<br>◦ Objective A reduce pollution during plastic production.<br>◦ Objective B improved post use materials management.<br>◦ Objective C prevent trash and micro or nano plastics from entering waterways and remove escaped trash from the environment.<br>• The strategy provides and overview of approaches and seeks feedback from stakeholders on a range of aspects of the Strategy including:<br>◦ Those actions that have the greatest positive impact<br>◦ The important roles and actions for federal agencies.<br>◦ Unintended consequences,<br>◦ Key metrics and indicators the EPA should use to measure progress.<br>◦ Other actions that should be included in the strategy. |
| KEY<br>USA is rated 3.5 due to the varying state-based nature of the regulation. Some states may rate a 4. | |

## Acronyms and Glossary

| | |
|---|---|
| ACCC | Australian Competition and Consumer Commission |
| AFCG | Australian Food and Grocery Council |
| ARL | Australian Recycling Label |
| APCO | Australian Packaging Covenant Organisation |
| CEFLEX | The Circular Economy for Flexible Packaging |
| EPR | Extended Producer Responsibility |
| EPS | Expanded Polystyrene |
| GHG | Greenhouse Gas Emissions |
| MAP | Modified Atmosphere Packaging |
| Mono | Mono material |
| MRF | Materials Recovery Facilities |
| NPRS | National Plastics Recycling Scheme |
| PE | Polyethylene polymer |
| PP | Polypropylene polymer |
| PET | Polyethylene terephthalate |
| rPET | Recycled Polyethylene terephthalate |
| PFAS | Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) |
| PVC | Polyvinyl chloride polymer |
| PVDC | Polyvinylidene chloride polymer |
| SDG | Sustainable Development Goal |
| SPT | Soft Plastics Taskforce |
| VP | Vacuum Packaging |
| VSP | Vacuum Skin Packaging |
| VT | Vacuum Thermoform |

## Acknowledgements

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# 8.0 List of tables and figures

## List of tables



## List of figures