# Packaging markets redesigned

## The impacts of new models targeting lower plastic consumption in packaging

**July, 2021**

Wood Mackenzie
A Verisk Business

# ‘Packaging redesigned’

- As sustainability becomes increasingly important to the plastics industry, traditional business models will be re-imagined
- In this insight, we explore how plastic demand may be affected from a packaging industry re-designed from the bottom up
- As *reduce* and *reuse* models become more widely adopted, we present an alternative scenario highlighting the impact of these trends on plastic demand for different polymers and applications

# Packaging industry context

## The packaging industry is embarking on a range of pre- and post-consumption initiatives to increase the sustainability of the plastics value chain

- The plastic waste crisis has driven the plastics industry to consider new approaches to waste management. Recycling has emerged as a front-runner for effective end-of-life treatment, but a comprehensive approach to waste management requires a step-change in how brands and consumers think about the role of packaging in the first place.
- We estimate that plastic packaging demand will more than double by 2050 driven largely by an emerging middle class in developing Asian and African economies. While recycling successfully captures value from post-consumer products, it does little to avoid the problem of increasing plastic (and therefore, carbon) consumption.
- An increasingly stringent regulatory environment will only accelerate this transition. New legislation, such as the EU non-recyclable plastic packaging tax and extended producer responsibility laws, will increase the cost burden on the industry and force it to consider new approaches.
- The packaging sector is beginning to explore new solutions at the front of the value chain to reduce plastic consumption. In this insight, we leverage our cross-polymer demand model to simulate a scenario in which the industry seeks to redesign its approach towards packaging.
- This ‘packaging redesigned’ scenario reflects our view of an aggressive approach towards adopting new technologies and business models.

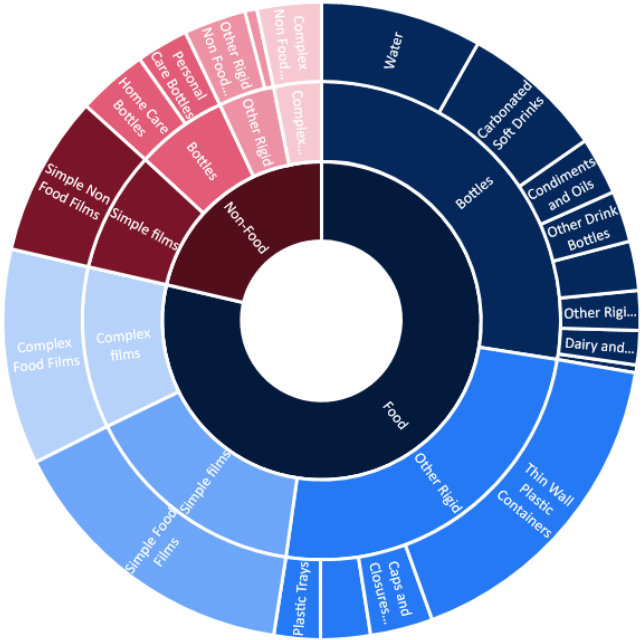
### The waste hierarchy

At the top of the waste hierarchy lie *Reduce* and *Reuse*. While recycling has attracted significant attention from the industry, recent efforts towards these models have gained traction

# Cross-polymer demand: the foundation of our analysis

Wood Mackenzie Chemicals recently released the first module of its cross-polymer demand model for packaging markets. The new framework models polymer demand at the application level and forecasts by end-use how markets are likely to evolve, accounting for material substitution and sustainability trends at its core. The cross-polymer demand model serves as the basis for our scenario modelling highlighted in this insight.

## Packaging application demand shares, 2020




**1. Utility demand forecast**

What is the latent demand for a particular application?

**2. Sector Levers**

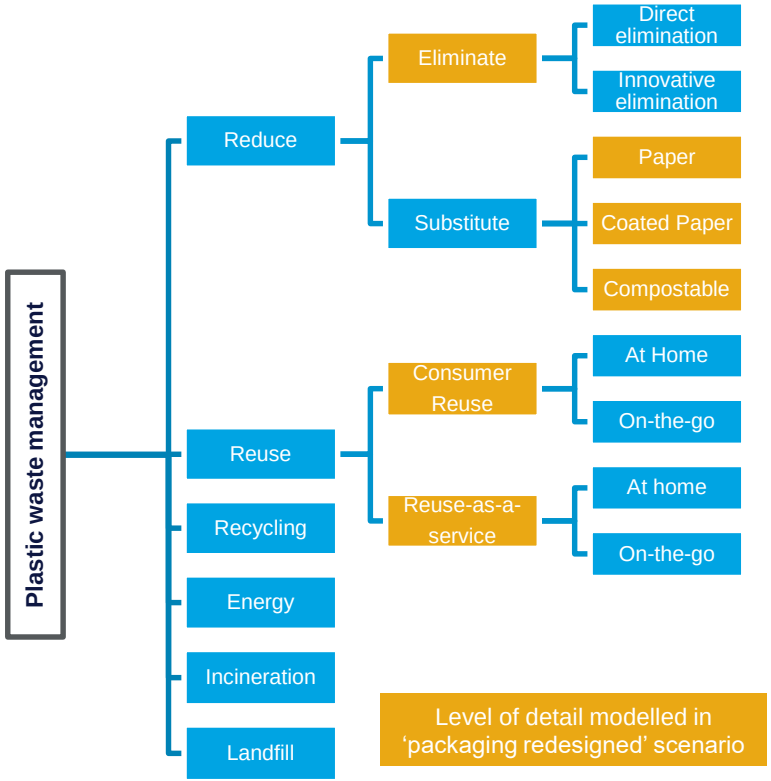
What trends are affecting the sector in question?

**3. Material competition**

Which materials are best placed to meet the residual demand?

# Laying out the reduce and reuse models adopted by the industry today

## Across *reduce* and *reuse* various models exist for displacing plastics from the waste stream, each with various implementation methods




- **Elimination** occurs directly, in which redundant or non-essential packaging is removed from the packaging design, or innovated out from the product altogether
- **Substitution** is assessed from three plastic alternatives: un-coated paper, coated paper and compostable materials. Other materials, such as aluminium and glass may be considered, but life-cycle assessments indicate very limited advantages from these substitutes.
- **Reuse** can be separated into consumer reuse models and reuse as a service models. In consumer reuse models, the consumer owns and refills multi-use containers. In reuse-as-a-service models, third parties collect returned containers and brands resupply bottles within their own ecosystems.

The Ellen Macarthur Foundation's *Upstream Innovation Tracker* has served to support scenario modelling assumptions, and examples of these displacement mechanisms found in the industry today can be found in the following pages

# Elimination in action

## Having a hard look at what components are truly necessary, vs. those which are ‘nice to have’ or can be removed through new technologies

- Elimination occurs through direct elimination and innovation elimination. With direct elimination, redundant components are removed from the package altogether or packaging is light-weighted to reduce plastic intensity. Innovation elimination has a similar result for packaging that *does* serve an essential function, but new technology must be implemented to allow components to be removed.
- An example of direct elimination is peppers at North America Walmarts. Recognizing single peppers do not need packaging when sold, Walmart removed them from a clear plastic film. Similarly, Tesco removed redundant lids from dairy pots. Direct elimination of packaging materials is typically low-risk, but in many cases the low-hanging fruit has already been cut from packaging designs.
- Innovation elimination can take several forms. Recent examples of this would include potatoes laser-printed with barcodes to remove packaging / label requirements from ICA in Sweden. Direct-to-consumer produce models from Infarm or Kecipir are also examples.
- Innovation elimination is likely to play a large role in future plastic reduction schemes, but these must be viewed from a comprehensive sustainability lens. Without renewable electrification of the transport sector, direct-to-consumer models could lead to higher carbon footprints from less streamlined delivery. Food spoilage is also of concern. Lower food product utilization leading to higher water consumption must be weighed against reduced plastic waste. As these models improve, we would expect players to optimize their solutions to reduce life-cycle impacts across resources.


Representative examples from the Ellen Macarthur Foundation’s *Upstream Innovation* report

# Substitution: are plastics still the clear answer?

## What place do decomposable materials play in the future of packaging design and what does it mean for plastics?

- Substitution is well-known to the plastic packaging industry: for years plastics have added market share at the expense of other materials.
- More recently, paper materials have grabbed attention as a decomposable packaging material. Organic coatings, often starch-based, can be added to paper-based designs for rigidity and certain barrier properties while maintaining decomposable properties. Compostable products can include bio-based plastics such as PLA.
- Examples of substitution include Nestlé, who is testing a paper-based film replacement for its YES! snack bars. Several ventures, such as Papacks, are developing rigid coated containers. Unilever developed biodegradable tea bags using a paper/PLA based design, testing them with PG tips product.
- Substitution with bio-based products can have higher unit water consumption. These products offer a lower carbon footprint and improved end-of-life disposal, however. As with elimination, effective barrier properties to reduce food spoilage is essential to reducing the environmental footprint.
- More information on paper and plastic substitution for film applications can be found in our recent insight here.

### Examples of brands implementing substitution models to reduce plastic waste

| | | |
|---|---|---|
| Paper |  | Nestlé rolled out new paper packaging in Europe for its YES! brand snack bar |
| Coated Paper |  | Papacks ® developed a suite of rigid packaging containers, largely plant-based, suitable for food and non-food applications |
| Compostable |  | Unilever switched to a compostable starch-based material for tea-bags, the first major brand to do so |

Representative examples from the Ellen Macarthur Foundation's *Upstream Innovation* report

# Reuse models – more than just a Nalgene

## Reuse and new delivery models tested by established brand-owners and startups alike

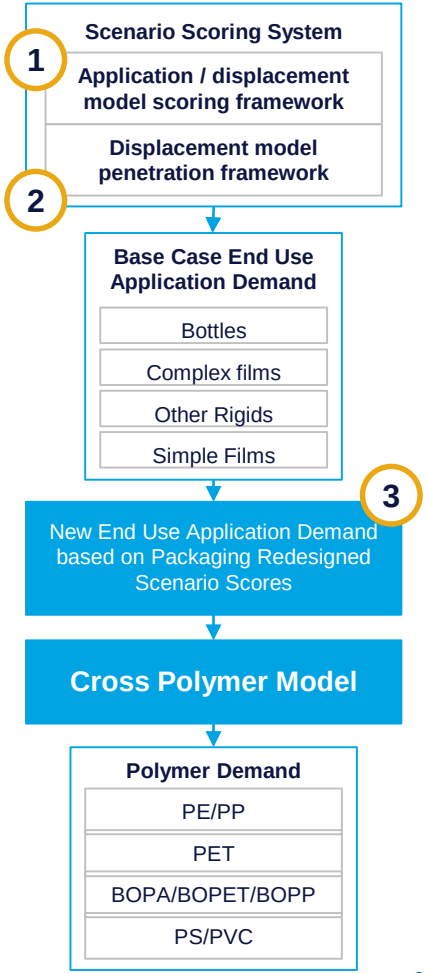
- While the reuse approach remains relatively immature in most consumer markets, there is a lot of energy going into exploring innovative reuse business models.
- Our scenario considers two primary reuse dimensions for plastic waste reduction, defined by who the owner of the reused container is. Consumer reuse schemes are defined as those in which the customer owns the reusable container, while reuse as a service methods are those in which the service provider owns the container.
- These efforts can be further segmented based on where these activities take place: the home environment or on business premises.
- Bottles are more exposed to reuse business models than flexible applications. These models often require up-gauging to improve packaging durability, but these affects are more than offset by the net-reduction in plastic consumed.
- Please see our recent *Chemical Solutions* insight for additional information on how reuse is being deployed in the industry today.

| | Consumer reuse | Reuse-as-a-service |
|---|---|---|
| At home | sodastream<br>e.g. SodaStream | Loop<br>e.g. Loop |
| On-the-go | Unilever<br>e.g. shampoo refill stations in store | cupclub<br>e.g. cupclub |

Representative examples from the Ellen Macarthur Foundation's *Upstream Innovation* report

# Scenario Methodology

1. To model the impact of each displacement mechanism on packaging end uses, each application was scored using an index measuring current implementation and our view of future development. Current activity was informed by the Ellen Macarthur Foundation's *Upstream Innovation* tracker.
   - » For example, packaging applications like water bottles are more susceptible to reuse schemes and new delivery mechanisms and are hence scored higher to have a greater percentage of demand impacted by technological advances.
   - » Advanced economies will be quicker to adopt new packaging designs, so a macro-economic dimension was added to capture more aggressive displacement in these countries.
   - » In our redesigned outlook it is likely that some applications will be found best suited for plastics – especially films as one of the most weight-efficient packaging means– resulting in demand reductions offset by new volumes. We account for this in our model by considering the net affect of demand changes.
2. Each redesign method was then evaluated on how we anticipated plastic consumption would evolve at ten-year increments. To develop this view we assessed how susceptible plastic consumption in packaging will be in the future to elimination, reuse or replacement with paper, coated paper or a compostable material.
3. The application / displacement model scoring matrix was then cross referenced with our forward penetration view to obtain how much market share of an end use application is exposed to a particular packaging re-design model.

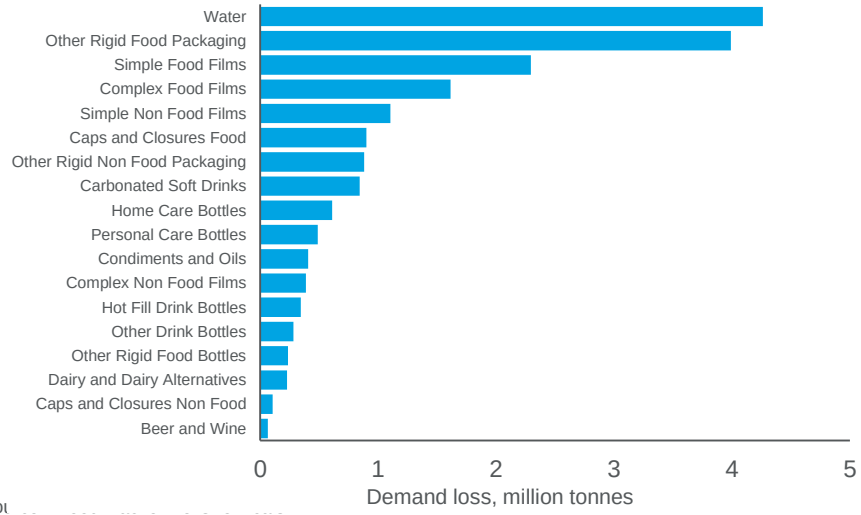


# Scenario Results

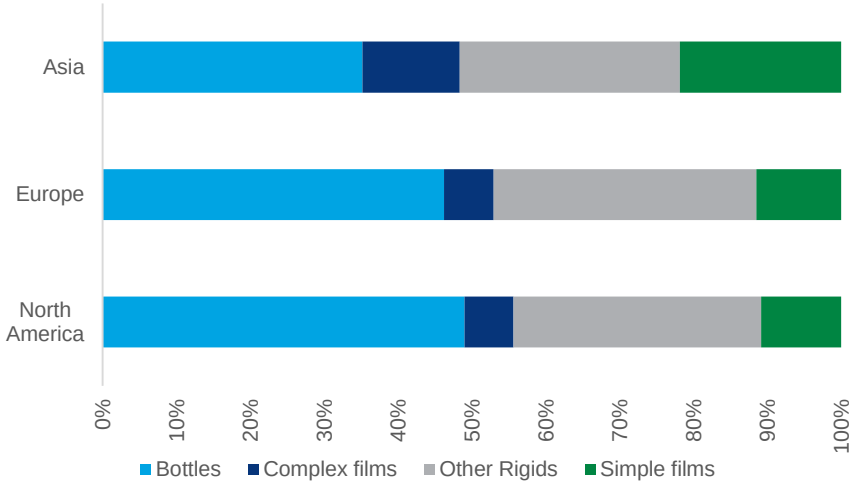
## Impact of Packaging Redesigned scenario on end-use demand

- The water bottles segment is shown to be most impacted due to changes in packaging redesign followed by other rigid food packaging. The scenario suggests water bottles may lose about 4 million tons of demand compared to the base case in 2040 - about 22% of its forecast market size. As modelled, displacement in the water bottle segment occurs from advancement of reuse models – both consumer and as-a-service – these driven by a shifting consumer and brand-owner sentiment and advancing legislative commitments seeking to reduce the plastic packaging footprint.
- The degree of impact of the packaging redesign scenario especially on bottles is higher in high income countries in North America and Europe, compared to middle income countries in Asia.

### Packaging Redesigned: 2040 impacts



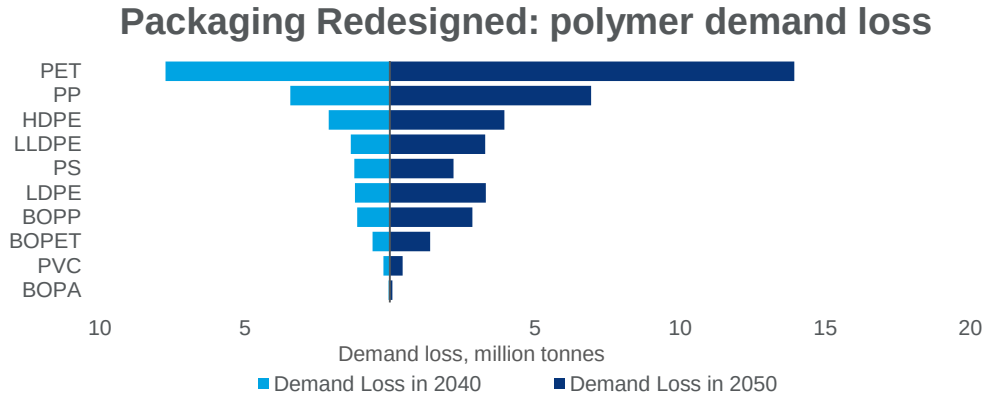

### Packaging Redesigned: 2040 share demand loss

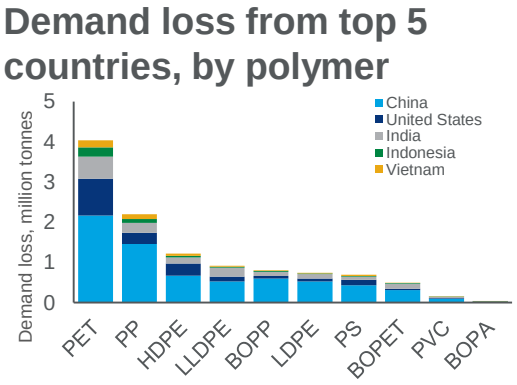


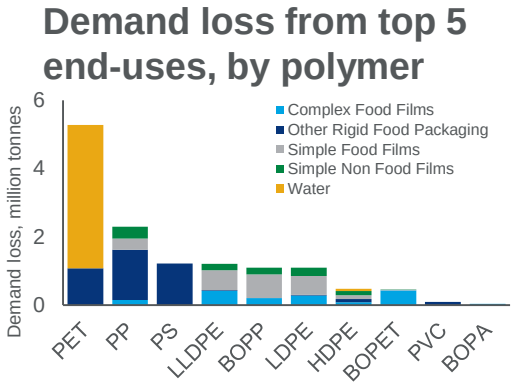
# Exposed polymers value chains

## Impact of Packaging Redesign score in Polymer Demand

- The biggest impact in terms of demand loss globally is on PET, mainly due to water bottles being most exposed to demand loss and the former being primarily composed of PET. Losses within the water bottle sector are primarily a function of adoption of reuse models to displace plastic demand.
- From a regional perspective, the largest influence of redesign is predicted to be on China, followed by United States and then India. The top 5 impacted contribute about 60% of the total demand destruction due to packaging redesign in 2040.
- Other polymers demand significantly affected by the packaging redesign, are polypropylene, HDPE and LLDPE. These polymers are affected due to the impact of the redesign on other rigid food packaging and films. These polymers along with PET make up for 76% of demand loss in 2040.




Source: Wood Mackenzie Chemicals

# Conclusions: What it means for the packaging industry and polymer value chains

1. A redesigned packaging industry could displace up to 20% of polymer demand into packaging.

2. Various end-uses would be more and less exposed to new business models such as ***eliminate***, ***reuse*** and ***substitute*** disrupting the industry:
   - » Water bottles are expected to be most at risk from lower demand as reuse models grow in adoption.
   - » Film applications are less likely to be impacted given their efficiency in packaging products.

3. As a result, polymers are also exposed to varying degrees:
   - » PET is most exposed from its dominance within the water bottle subsector, while PP and HDPE would also be expected to see significant demand reduction in other rigid applications
   - » Film polymers such as BOPET and BOPA are relatively less exposed

4. As the industry seeks to reorient and redefine the role of packaging for consumers, it should consider the life-cycle impacts of the design options available. These include the plastic waste footprint of the packaging design, but also carbon and water intensities.

# Appendix

# Appendix

## Packaging Redesign Scoring Framework

**Packaging Re-design Scoring Framework**

| Type | Form | Description | High income countires | | | | | | UMI/LMI/LI | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Eliminate | Reuse | | Substitution | | | Eliminate | Reuse | | Substitution | | |
| | | | Eliminate | Consumer | RAAS | Paper | Coated paper | Compostable | Eliminate | Reuse | NDM | Paper | Coated paper | Compostable |
| Food Packaging | Rigid | Carbonated soft drinks | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Water | 1 | 4 | 4 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 1 |
| | | Beer and wine | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Hot fill drink bottles | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Dairy and dairy alternatives | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Other drink bottles | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Condiments and oils | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Other food bottles | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Food Caps & Closures | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | Thin wall plastic containers | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 |
| | | Plastic Trays | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 |
| | | Other Rigid Food Packaging | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 |
| | Flexible | Reyclable plastic film food packaging | 1 | 1 | 1.5 | 1.5 | 1 | 1.5 | 1 | 1 | 1.5 | 1.5 | 1 | 1.5 |
| | | Non-recyclable film plastic food packaging | 1 | 1 | 1.5 | 1.5 | 1 | 1.5 | 1 | 1 | 1.5 | 1.5 | 1 | 1.5 |
| Non-food packaging | Rigid | Personal care bottles | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Home care bottles | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| | | Nonfood Caps & Closures | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | Other rigid non-food packaging | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 2 |
| | Flexible | Recyclable plastic non-food packaging | 1 | 1 | 1.5 | 1 | 1 | 1.5 | 1 | 1 | 1.5 | 1 | 1 | 1.5 |
| | | non-recyclable plastic non food packaging | 1 | 1 | 1.5 | 1 | 1 | 1.5 | 1 | 1 | 1.5 | 1 | 1 | 1.5 |