Plastics Recycling – Enabling the circular economy

Phil Goodier
Managing Director, Biffa Polymers
Contents

1. An introduction to Biffa
2. UK plastics recycling
3. How plastic is recycled
4. Technical challenges & solutions
5. The future
Leading in UK Waste Management
A Century of Experience

- >230 Locations
- ~10,000 Employees
- c. 3,100 Collection Vehicles
- 7.5m Tonnes of WasteHandled
- £1.4bn Net Revenue

Now owned by US-based investment company ECP

* All financials are FY22 actuals

IET London November 21st 2023
Think Biffa – think waste!

But you probably think about waste collection?
Think Biffa – think waste management and treatment!

And of course, that’s our heritage and a very important part of our business.

But we also process waste – and Biffa Polymers is the UK’s largest recycler of rigid plastics.
Plastics Recycling in the UK

61% of all plastics recycled were exported – 890kt.

Displacing exports is a significant growth opportunity and regulatory need.

Source: British Plastics Federation: Packing Plastics
Plastics Recycling in the UK

- Plastic is collected from householders’ “dry mixed recycling” bins.
- It is then sorted (away from glass, card, cans) and segregated into different polymer types.
- In the UK we focus on:
  - HDPE (Milk bottles)
  - PET (carbonated soft drinks and mineral water)
  - Polypropylene (pots, tubs and trays)
The Circular Economy of Plastics

Mixed Recycling → Collection → Sorting → Bales

Producer → Blow Moulding → Pellets → Colour sort & decontamination → Washed flake → Hot Wash

IET London November 21st 2023
Factors holding back UK plastic packaging recycling

1. Collection rates (have stalled)
2. Lack of deposit return schemes (planned, delayed)
3. Exports (perverse incentives, fraud)
4. Design for recycling
5. Regulatory / financial framework
Biffa Polymers has 4 sites processing 190kt of mixed plastic inputs with key focus on PET and HDPE

- 4 sites
- 310 colleagues
- Turnover: £170M
- Input: 190,000te - c. 67% from Biffa
- Output Capacities
  - HDPE food grade: 30,000te
  - PET food grade: 50,000te pellet plus 3,000te flake
  - Extrusion (non-food): 14,600te
  - Two wash plants: 30,000te
What We Do

**Redcar** (HDPE – Food Grade pellet, HDPE/PP Non-Food flake and pellet)
- Capacity of 83,000tpa/1.8bn bottles
- Original site operating since 2008, 3rd HDPE food grade line opened in 2023

**Washington** (PP & HDPE flake)
- Capacity of 25,000tpa
- Opened in 2021, £7m investment

**Seaham** (Food Grade PET bottle to flake & pellet)
- Capacity of 57,000tpa/1.3bn bottles
- Opened in 2020, £27m investment

**Sherburn** (Food Grade PET flake to pellet)
- Capacity of 25,000tpa
- Acquired in 2023
Our Products

• High quality, comparable to virgin polymer

• Regulatory approval for use in food contact applications

• Their use is more sustainable than using 100% virgin polymer

• Inclusion of our material can reduce liability for the plastic packaging tax
Our Customers

The recycled polymers we produce serve a variety of industries:

• Packaging manufacturers (food contact and non-food)
• Cosmetics industry
• Pipe manufacturers
• Durable consumer and industrial products
How Plastic is Recycled
The Carbon Efficiency of Plastic Reprocessing

Mechanical Recycling
- High grades of mono-layer polymer
- Saves 2.3t CO$_2$e in a closed loop system$^1$

Chemical Recycling
- Grades that aren’t suitable for mechanical recycling should be chemically recycled

Energy Recovery
- Residual material should then be sent for energy recovery
- Saves 0.112t CO$_2$e vs landfill$^2$

Mechanical Recycling is the most carbon efficient solution and should be the first option for recycling

*Source: $^1$ Wrap Market Situation Report 2021, $^2$ Zero Waste Scotland Carbon Metric for landfill tCO$_2$e and Tolvik UK EfW Statistics 2021 for EfW tCO$_2$e
Critical Success Factors for Plastic Recycling

Fundamentals:

1. Keep it simple! Use PET, HDPE, PP for all consumer packaging.

2. Educate the householder! We don’t want PVC or Polycarbonate in the stream.

3. Avoid contamination in the packaging design.

4. Design for recycle (labels, caps, avoid colour for food grade)
How Plastic is Recycled

Technology Principles: Mechanical Recycling:

1. Polymer separation - density
2. Polymer separation – high speed optical sorting
3. Colour separation – high speed optical sorting
4. (For food grade) Removal of non-food provenance inputs – human pickers
5. (For food grade) Decontamination technology
Basic Process Flow

1. Receive bales (c. 70-85% “pure”)
2. Bottle sort – remove non-target polymers and coloured bottles
3. Granulated into flakes
4. Wash the flakes
5. Density Separate the flakes
6. Sort the flakes – further polymer / colour sort
7. Extrude the flakes into pellets
8. Decontaminate the pellets under vacuum
9. QC, Pack and ship

Our PET specification: Input bales c. 70% food grade PET. Output pellet : <50ppm benzene, acetaldehyde, <5ppm BPA
Technical Challenges and Solutions
## Technical Challenges & Solutions

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contamination of feedstock</td>
<td>Householder education, Deposit Return Schemes</td>
</tr>
<tr>
<td>Economics – recycled is more expensive than virgin</td>
<td>Improved yield, efficiencies. Economic incentives (taxes)</td>
</tr>
<tr>
<td>Coloured food grade packaging is “lost” to food grade</td>
<td>Packaging redesign</td>
</tr>
<tr>
<td>Food grade PP is not recycled</td>
<td>Packaging redesign, New technology including AI</td>
</tr>
<tr>
<td>Reliance on human pickers to remove non-food grade</td>
<td>AI / Robotics</td>
</tr>
<tr>
<td>Greying of polymer</td>
<td>Better sorting, packaging redesign</td>
</tr>
<tr>
<td>Films and flexibles</td>
<td>? Chemical recycling</td>
</tr>
</tbody>
</table>
Customer Partnerships: Partnering with Brands to Improve Circularity - PET

Suntory wanted a new design for their 500ml Ribena bottle to make it easier to recycle and more sustainable.

Solution

- Recycling-led approach taken by the brand
- Label size and colour was changed on the bottle to make it easier to remove
- New design was trialled by Biffa to ensure improved recyclability

Benefits

- 100% recyclable in new format
- Contains 100% PCR
- Does not incur plastic tax
Customer Partnerships: Helping Supply Chains Improve Circularity - HDPE

Drivers
• Make the supply chain more circular
• Easy to recycle
• Enable food grade rHDPE to be widely incorporated into new bottles

Results
• Same packaging across brands
• 78% collection rate
• 85% of milk bottles contain at least 30% of Biffa PCR material

Supply chain collaboration for a consistent design

HDPE caps – now natural too

PCR content >30%

Shrink-wrap labels

HDPE natural

IET London November 21st 2023
Thank you