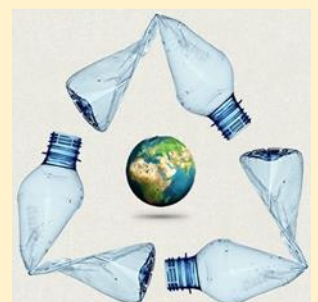


MONTANARO

ASSET MANAGEMENT

PLASTIC FANTASTIC: BIFFA POLYMERS SITE VISIT

24 June 2021



INTRODUCTION

Biffa operates two of the most technically advanced plastic reprocessing facilities in the world. In June 2021, we were fortunate enough to be invited to visit one of these: Biffa Polymers in Seaham. Located on Durham's Heritage Coast, Seaham is a seaside town 6 miles south of Sunderland and 13 miles east of Durham. Like many small towns in the Northeast, Seaham has a mining heritage, which sustained the local economy for much of the 20th century. Seaham's three pits had all closed by 1992 and the town sank into depression throughout much of the 1980s and 1990s, the deprivation of the area recalling the opening passage of Lord Byron's *Hebrew Melodies*, which he wrote while staying in the area:

"Upon this dreary coast we have nothing but county meetings and shipwrecks; and I have this day dined upon fish, which probably dined upon the crews of several colliers lost in the late gales. But I saw the sea once more in all the glories of surf and foam".

The final sentence of Byron's passage is fitting, because amid the gloom that followed the closure of the mines, the sea and coastline offered the glimmer of regeneration. The "Turning the Tide" project was a group of fourteen organisations that came together between 1997 and 2002 to regenerate the coast of Durham, leading to its designation as a heritage coast. Seaham beach was entirely restored and in 2002 the project shared a prize for "Outstanding Achievement in Regeneration" in the annual Royal Institution of Chartered Surveyors awards, alongside Cornwall's The Eden Project¹.



This theme of regeneration continues today. Half a mile inland from the coast, a world class recycling site has come to the area: Biffa Polymers PET, Seaham.

¹ <https://durhamheritagecoast.org/our-story/history/turning-the-tide/>

ABOUT BIFFA

Biffa has been at the forefront of the UK’s waste industry for over a hundred years, with operations that span the entire breadth of the waste management process including collection, recycling, treatment, disposal and energy generation.

A brief history: Biffa was founded in 1912 by Richard Henry Biffa in Wembley, London. By the 1920s, Biffa had started to build out a fleet of primitive motorised garbage collection trucks, replacing horse-drawn wagons. Motorised lorries were introduced in the 1930s and during the decade, Biffa won a prominent contract to remove the ashes and residue of burnt coal from Battersea’s Power Station.



As recycling programmes faded during the Second World War, the use of landfill rose and Biffa won a series of bulk collection contracts with several London boroughs, before moving into the industrial waste market in the 1960s. The 1970s saw Biffa responding to new regulation, as the Deposit of Poisonous Waste Act in 1972, and Control of Pollution Act in 1974, were introduced to regulate the use of landfill. The acquisition of Hargreaves Clearwaste established Biffa’s presence in the Northeast during the 1980s, before the company pioneered the concept of integrated waste management, manging multiple waste streams at a customer’s site. Biffa itself was then acquired by Severn Trent Water for £212 million in 1991.

In 1997, Biffa launched the “Biffa Award” to distribute grants to local community and environmental projects in the UK. Biffa then demerged from Severn Trent Plc in 2006 and joined the FTSE 250 before being taken private by Waste Acquisition Co Ltd in 2008. Innovation continued, with the Poplars AD Plant beginning to generate energy from food waste in 2011. The same year – just a few months before the company’s centenary – Biffa Polymers opened the UK’s first fully integrated sorting and recycling facility for mixed plastic packaging. Biffa listed on the London Stock Exchange in October 2016 under the ticker "BIFF". In March 2020, Biffa entered the FTSE 250. In FY21, the Group's total revenue was over £1,042 million and underlying EBITDA was £138 million, a margin of 13.3%.



What does Biffa do? Biffa is the leader in sustainable waste management in the UK.



The company has a **Collections business** which accounts for the majority of revenue:

Collections



I&C
Revenue:
£560.2m



Municipal
Revenue:
£164.6m



Specialist Services
Revenue:
£72.5m

The **Resources & Energy divisions** includes the polymers recycling business:

Resources & Energy



Recycling
Revenue:
£79.2m



Organics
Revenue:
£61.7m



Inerts
Net Revenue:
£47.1m



Landfill Gas
Revenue:
£45.5m

Future growth is being driven by three main opportunities that management are excited about. These cover the full “Reduce, Recycle, Recover, Collect” spectrum of waste management.

1. The Collections Opportunity:

- Clear market Leader in Collections;
- Organic Growth above market;
- >£100m invested in acquisitions;
- Unparalleled scale driving sector leading margins.

2. Leading in UK Plastic Recycling:

- Operational and development track record;
- Control of materials;
- Trusted off take partnerships.

3. Developing Energy from Waste Infrastructure:

- Proven market need;
- Control of waste and consented sites;
- Underpins I&C business.

This site visit allowed us to learn more about point 2: the opportunity in plastic recycling.

THE SITE VISIT

Mark Rogers, Head of Investments, and Ed Heaven, Head of Sustainable Investment, took an early train from London King's Cross and headed north to Durham to visit Biffa's plastic recycling facility at Seaham. This was Montanaro's first in-person company site visit since the implementation of the first UK lockdown and it was exciting to be back on the road again.

As we headed north, we saw glimpses of Biffa rubbish trucks out on their early morning rounds. This whetted the appetite for what lay ahead and posed an interesting question: how was a company whose history lay in collecting rubbish coping with the complicated business of processing and recycling plastic?

After a short bus trip from Durham train station, passing through glorious English countryside



which gave way to the hubs of Sunderland and Newcastle in the distance, we arrived at the Seaham facility, the sea glistening out to the horizon. This was the furthest Ed had travelled since the pandemic began. The last time Mark and Ed travelled together had been to visit an investor in Finland days before the lockdown began.

After signing in and having our temperatures taken, we were led into a conference room with socially distanced seating. We had time for a cup of coffee and a brief chat with the CEO of Biffa, Michael Topham, and CFO, Richard Pike. It was good to see them in person after various Zoom meetings with Biffa's management team over the last few months, including a call focused on their sustainability initiatives with Richard earlier in 2021.

We were then introduced to other members of the management team, including Mike David, COO of Resources & Energy (the CEO described Mike as one of the most knowledgeable members of his team) and a more recent recruit, Phil Goodier, Managing Director of Biffa Polymers.

Value is now following carbon efficiency

Mike began a presentation to help us understand how Biffa's approach to sustainability is helping to deliver strong shareholder returns. Across their business, there is now a core focus on sustainability. The absolute driver of this is public opinion and like many of our businesses, Mike cited the airing of the Blue Planet documentary series as a big catalyst. Consumers and

Biffa's own customers all realise that they need to do more to eradicate waste and there is a great deal of focus on single-use plastic.

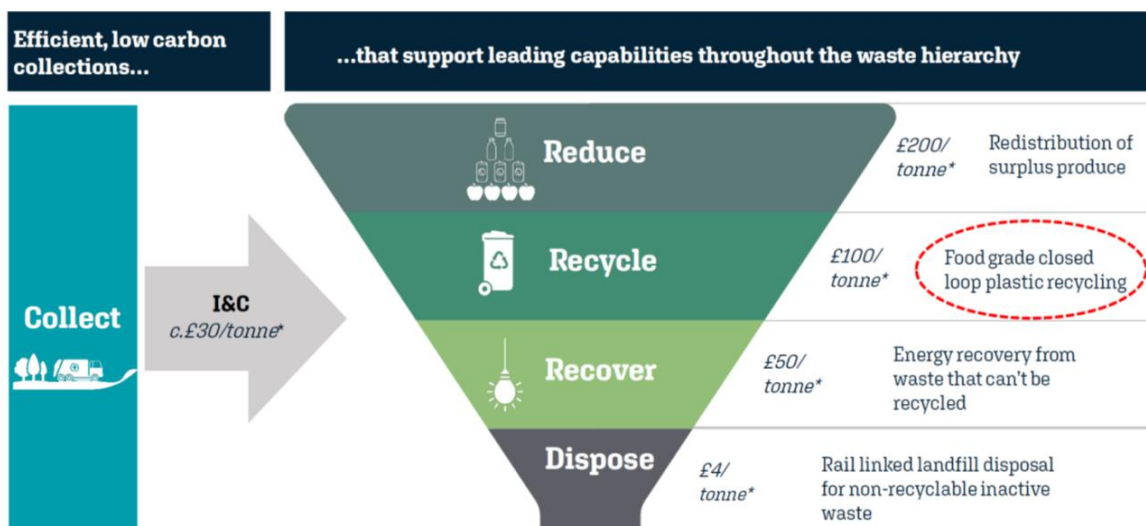
Governments have been quick to respond to the "Blue Planet Effect". In the UK, the government has announced a Plastic Packaging Tax to be introduced from April 2022. This will levy a £200 per tonne tax rate on plastic packaging produced in or imported into the UK that does not contain at least 30% recycled plastic. Meanwhile, parts of Asia have banned the import of plastic – and there is speculation that the UK will ban plastic waste exports altogether. All plastic created, imported and consumed in the UK may need to be dealt with at home.

Other measures elevating the focus on plastic recycling include proposed Deposit Return Schemes, while Biffa's own customers are all under pressure to hit performance related sustainability targets of their own.

As far as Biffa is concerned, all of this means that the Seaham facility is well positioned to help meet the growing demand for plastic to be recycled and re-used. This increased demand has shifted the economics of dealing with certain types of waste.

“Value is now following carbon efficiency”

As Mike succinctly put it, in the waste management business, *“value is now following carbon efficiency”*. Mike explained that Biffa is paid £4 per tonne to send non-recyclable inactive waste to landfill (in other words, not much). By contrast, they are paid £100 per tonne to recycle food grade plastic. The economics of sustainability stack up:



* Ex / tonne represents indicative adjusted EBIT per tonne handled (except Recover which is JV profit after tax per tonne)

The UK plastic market offers good opportunities for growth. Mike explained that 2.3 mega-tonnes of plastic is placed on the market each year (1.5Mt in consumer markets and 0.8Mt in non-consumer markets). Biffa can help process and recycle much of this, although Mike conceded that in some markets, such as plastic films, a recycling solution does not yet exist.

Material tonnage pa	Biffa capability, focus and opportunity
1.0Mt is used in plastic bottles – roughly 50% each PET / HDPE	A core Biffa capability and focus
440kt is used in pots / tubs / trays	A core Biffa capability and focus
670kt is used in films	Solution Needed
1.2Mt of the 2.3Mt is recycled – including exports (600kt) and downcycling	Export Bans growing – opportunity for further investment in UK recycling market
Average recycled content of primary products is only 13%	Plastics Tax <30%* increased demand

Biffa sees the greatest opportunity in the PET and HDPE markets. The company is the clear market leader in food-grade HDPE. In terms of recycled materials, both are under-supplied markets given food companies are rushing to avoid the penalties stipulated in the UK Plastic Packaging Tax (£200 per tonne levy from April 2022 if recycled content is <30%).

Biffa sense an opportunity. Due to the company’s vertically integrated model, they are well supplied with plastic to recycle. They have a number of Plastic Recycling Facilities (PRFs) and Materials Recovery Facilities (MRFs) that they can source material from (and these facilities

are in turn supplied by Biffa’s fleet of trucks). This means that the percentage of “feedstock” that they source internally for the Seaham site is currently c.70%. This will rise to c.90% following the acquisitions of Viridor and Green Circle. Ensuring the PRFs can collect and sort plastics adequately for sites such as Seaham has required investment²:

- **Wigan PRF:** £2m investment to convert a mothballed asset to process 58 kilotons per year (ktpa) of cans and plastics;
- **Aldridge PRF:** £6.5m invested to double capacity to 80ktpa of cans and plastics;
- **Grangemouth PRF:** £10m acquisition of Green Circle Polymers 50ktpa;
- **Viridor MRFs:** 4 MRFs producing sorted plastic, with offtake internalised from November 2022.

Consumer based waste elements recycled by our Biffa sites here in the UK Material collected via kerb side collections, council household waste sites and third party recycling collections							
Plastics			Metals		Glass	Fibre	
PET	HDPE	PP	Aluminium	Steel	Mixed Glass	Paper and Cardboard	
Drinks bottles such as water	Milk bottles and product containers	Food containers and products	Drinks cans	Food and drink cans	Drink bottles and jars	Mixed paper and cardboard	
Edmonton							
✓	✓	✓	✓	✓	✓	✓	
Teeside							
✓	✓	✓	✓	✓	✓	✓	
Aldridge							
✓	✓	✓	✓	✓	✓	✓	
Wigan							
✓	✓	✓	✓	✓	✗	✗	
The above facilities segregate mixed materials into individual elements. The plastics and aluminium then feed other Biffa sites listed below or are sold to UK based outlets for further processing. Any waste elements that should not have been included are sent as 'Waste to Energy'. Not all the elements have to be included for each site but they must not exceed capabilities of the site. No plastic containers over 2 litres.							
Derby							
✗	✗	✗	✓	✗	✗	✗	
This facility further refines aluminium cans from the above sites to feed directly to UK based smelters or EU smelters as a secondary outlet.							
Biffa Polymers - Seaham, Redcar & Washington							
✓	✓	✓	✗	✗	✗	✗	
Biffa Polymers reprocess already segregated polymers for the sites listed above and other third parties. Biffa Polymers then shred, wash and pelletise them ready to be made back into food containers where possible and other products where not.							
✓	Can be mixed with other material		✗	Can not be accepted at this site		✓	Accepted if single polymer stream

² As this article in *The Spectator* noted, debate exists about how effective rubbish collection and sorting is: <https://www.spectator.co.uk/article/the-fraudulent-business-of-recycling>

Biffa's 2,800 plus collection trucks and PRF / MRF network provides high quality sorted materials. Yet as we learned, collecting rubbish is one thing. Recycling PET plastic so that it can once again meet stringent food and drink safety stands is another altogether.

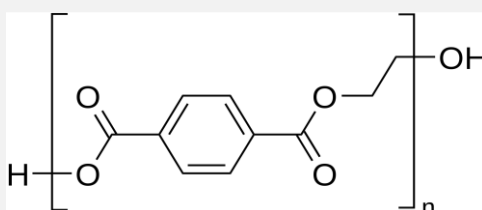
Biffa Polymers, Seaham

The Seaham site was opened in March 2020 (our site visit had originally been due to take place last summer). Biffa has three main plastic recycling sites:

- 1) **Redcar:** Foodgrade HDPE, plus numerous non- food products. Primary customers are the dairy industry (Biffa is the leader in recycled plastic milk bottles);
- 2) **Seaham:** PET – operational from March 2020;
- 3) **Washington:** HDPE/PET – operational from June 2021.

WHAT IS "PET"? Polyethylene terephthalate, commonly abbreviated to PET, is the most common thermoplastic polymer resin of the polyester family. It is used in fibres for clothing, containers for liquids and foods, thermoforming for manufacturing, and in combination with glass fibre for engineering resins.

The majority of the world's PET production is for synthetic fibres (in excess of 60%), with bottle production accounting for about 30% of global demand. In the context of textile applications, PET is referred to by its common name, polyester, whereas the acronym PET is generally used in relation to packaging.

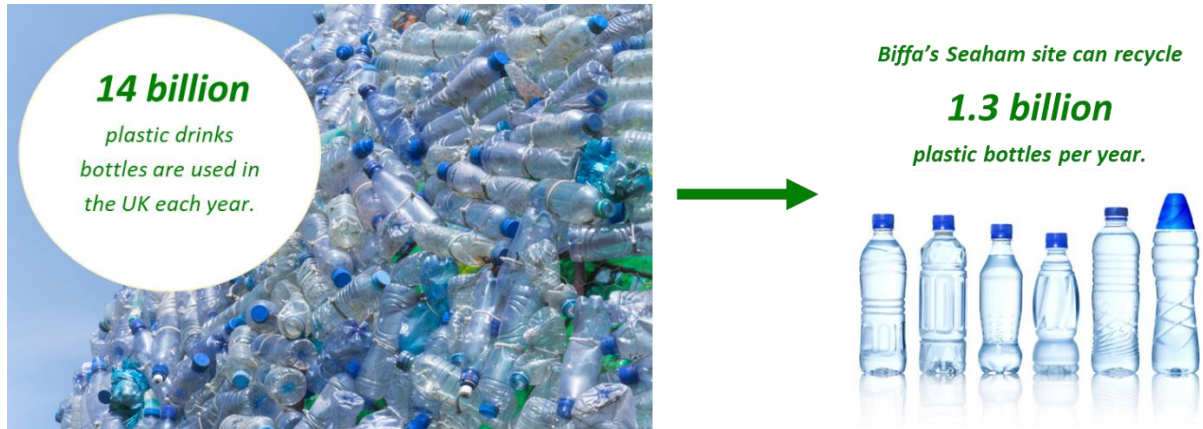


Management are bullish about the tonnage Biffa will be able to process across these three plants. In FY2020, they processed 63,000 tonnes and with the additional capacity of Seaham and Washington, this is forecast to increase to 155,000 tonnes by FY2024. A second PET line is being considered by the company, which would increase capacity by a further 57,000 tonnes if it goes ahead.

The Seaham facility processes and recycles PET plastic bottles and cost £27.5 million. It is among the most modern and technically advanced PET sites in the world. It is designed to convert PET from baled raw materials back into high-purity plastic pellets that are sold to drinks companies and other manufacturers for a range of applications, from food and beverage packaging to clothing.

The site forms part of Biffa's ongoing drive to invest in the UK's recycling infrastructure and encourage more waste recycling at home.

The plant can convert 57,000 tonnes of PET plastic per year, equivalent to 1.3 billion plastic bottles. PET is lightweight, durable, and highly recyclable, producing significantly lower carbon emissions than alternatives.



Phil Goodier, Managing Director of Biffa Polymers, talked to us about the site at Seaham, including its renovation from a standard warehouse. A video of the site being developed can be viewed [here](#).

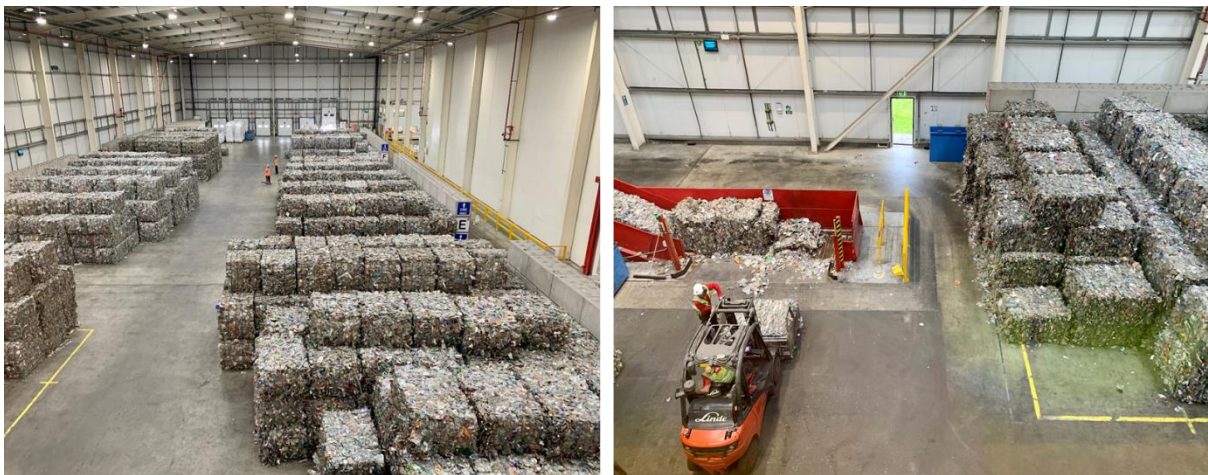


He then explained the industrial process that turns plastic bottles into recycled plastic pellets that can be sold to their many customers. The process is complicated and Phil talked us through it in detail, with the use of a video. He came across very well: he is passionate about the Polymers business and answered questions thoughtfully.

On the factory floor

There are ten steps to the process, which are outlined in the following pages alongside some photos taken during the site visit.

- 1) **Bales of plastic are released and fed into the industrial process.** As per the image below, plastic is delivered to the site as bales (if you have ever been in a hay storage barn, it looks almost identical to that, the difference being that these bales consist of plastic). Mike, who accompanied us on our tour, said that bales delivered from different PRFs (e.g. Wigan or Grangemouth) are mixed and fed into the machines together so that a great deal of variety is constantly churning through the process.



Bales are delivered and stored ready to be fed into the process



The bales are broken down and the items begin to move up a conveyor belt

2) **Optical and manual sorting** then takes place to ensure only PET passes through the process. Manual sorting is needed even though the optical sorting machine works at an extremely high efficiency rate.

3) **Label and sleeve removal:** the PET then passes through a machine that bounces and shakes them to remove labels and sleeves. When you peer into this machine, it is like someone has released thousands of bits of confetti into the air, with labels and sleeves flying all over the place (another image that came to mind was the [“Grab a Grand”](#) game from Noel Edmunds’ House Party Show).



Labels, sleeves and other unwanted waste are collected in the large red bins

- 4) **Shredding:** the plastic is then shredded into small flakes.
- 5) **Cleaning:** the flakes are then washed and dried.
- 6) **Over/under sized flakes** are removed, recovered and sold.
- 7) **Flake sorting:** The flakes pass through an optical flake sorting machine which is able to blow out, at the flake level, any coloured flakes. Coloured flakes cannot be turned into food grade PET. This was something of a surprise. Only clear flakes can be recycled and re-used as manufacturers do not want to receive coloured pellets (there is no way of extracting the colour during the recycling process). This is a problem for brands who have coloured bottles, particularly Lucozade and Ribena. Food and drink companies may well have to adjust their branding if they are to meet the government's plastic levy. (It is interesting to think about this: a Lucozade drink effectively has a much higher carbon footprint than a Coke because its bottle cannot be recycled to the food and drink market).
- 8) **Extrusion:** flakes are melted down in an extruder (the machine with the red stripe behind Mark) to create pellets.



- 9) **Molecular weight increase:** the pellets are heated in a controlled environment to rebuild strength to customer specification (this part of the site is like a mini-chemical laboratory).
- 10) **Discharge:** the pellets are stored, ready to be sent out to clients.

Phil mentioned that a successful recycle rate based on the tonnage of waste sent to the site would be around 60%: *“55% we would be disappointed with, 65% would be amazing”*. Any waste created during the process, such as non-PET plastic, gets re-bundled and sent away from the facility to energy to waste sites (about 40% of the tonnage sent to Seaham ends up as energy to waste). Phil stressed that this is a new facility and tweaks are constantly being made to enhance the process and improve the recycling rate.



Seaham PET food grade plant: the process



Flakes & pellets

Although the main purpose of the process is designed to turn plastic bottles into food grade plastic pellets, Biffa Polymers produces a variety of recycled plastic. Plastic bottles need to be broken down into flakes and then sorted by colour, so that only clear flakes are processed into pellets.

What do these flakes look like? And what happens to the coloured flakes? We saw three types of flakes created by the process:



Jazz Flakes



HDPE Flakes



PET Flakes

Jazz Flakes: these “regrinds” are blended and washed and available in two different grades: HDPE Jazz Extrusion Grade and Polypropylene PP Jazz Injection Regrind. These may end up as composite materials (similar to the types of materials that would be used in Trex’s composite decking).

HDPE Food Grade Flake: This material is used as recycled content in manufacturing new plastic milk bottles, plastic food trays, and cosmetics containers.

PET Flakes: these are high-quality hot washed natural flakes that can be used in the manufacture of new plastic bottles. It is these that are turned into pellets at the Seaham site. Ed is holding a jar of these pellets in the image on the right.



After seeing the process in action, we were taken into a laboratory where two scientists explained to us how they test samples for quality. Although the clear flakes and pellets look essentially white in colour, under testing the scientists can tell how far away from pure white they actually are. Some batches are more yellow in spectrum than others, for example. This is the result of lots of different factors, not only the input material, but every setting on every machine across the site. Since Seaham has been operational, the team have experimented with different settings to see how it effects the quality of the end product.

Interesting, some clients are fussier than others, particularly those manufacturers who have only recently transitioned away from using virgin pellets (which are pure white). Biffa needs to spend time educating clients to make them realise that the shading of their pellets should not impact the end product (the newly created recycled bottle). What is key is the strength and integrity of the recycled pellet. Plastic bottles filled with drinks are essentially small, pressurised containers (especially fizzy drinks). They may wait on a shelf for many months before being opened. You only need one bottle to explode to ruin a large amount of inventory waiting in a warehouse or supermarket aisle. Strength and integrity are more important than the purity of the colour, at least for most manufacturers. Having said that, Biffa is able to tweak batches to client specifications. Clearly, the more clients who ask for the same product, the more efficient the pellet production process.



OPPORTUNITIES & CHALLENGES

Seaham is an impressive plant and seeing it leads to some obvious questions:

1. How big is the recycling opportunity in the UK?

Plastic is a huge market. In the UK alone, it is estimated that five million tonnes of plastic is used every year, nearly half of which is packaging, according to government figures. In terms of plastic bottles, UK consumers go through an estimated 14 billion plastic drinks bottles a year (in addition to 9 billion drinks cans and 5 billion glass bottles)³. Only 7.5 billion of these plastic bottles are recycled. The remaining 5.5 billion are landfilled, littered, or incinerated⁴.

³ <https://consult.defra.gov.uk/environment/consultation-on-introducing-a-drs/>

⁴House of Commons Report, 'Turning the Tide on Plastic', 2017 / <https://www.theguardian.com/environment/2021/mar/24/no-bottle-deposit-return-scheme-for-most-of-uk-until-2024-at-earliest>

The need – and opportunity – to increase recycle capability exists, but it requires scale in both supply chains and processing capacity, which in turn requires investment. Deciding to go for this is not as straightforward as you might at first think (see question 5).

Other forms of plastic can be recycled, but creating a food grade product out of them is difficult. For example, the UK produces hundreds of thousands of pots, tubs and plastic trays each year. Returning some of these to a food grade product is complex, as these products are difficult to track. You can only make recycled food grade product out of plastic that was originally certified for the food or drink industries. Biffa is exploring whether AI technology could help it to identify which plastics have been previously used for food or drink, by picking up on certain materials, labelling or brands.

The UK also uses well over a million tonnes of plastic film each year. Currently there is no viable solution to recycle films. Thin plastic films can seriously harm the equipment used in recycling facilities as the composition of films and their high tensile strength means that they would become wrapped or tangled around moving or revolving machinery – imagine putting a roll of clingfilm through a machine. It is not going to work out well.

2. What is going to drive domestic growth?

The UK government’s plastic tax is a game-changer. Food and drink manufacturers are rushing to ensure that plastic packaging has at least 30% of content made from recycled plastic by April 2022.

Some companies, such as Coca-Cola, have gone further than this, announcing in June 2021 that all of their “on-the-go” bottles will be made from 100% recycled plastic, no mean feat if you consider that the company owns brands from Coke to Dr Pepper to Fanta and Sprite. Such initiatives offer marketing opportunities to companies.

Another driver of domestic growth for plastic bottle recycling could be the rollout of Deposit Return Schemes (DRS). This idea has long been mooted in the UK and was first announced in 2018 by the then environmental secretary Michael Gove.

The scheme, which would cover PET plastic bottles, glass bottles and steel and aluminium cans, rewards recycling by offering a financial incentive for consumers who deposit their used drinks containers at recycling points. This is financed by adding a small extra deposit on the price of drinks sold in plastic and glass bottles and cans, which the consumer gets back once they have returned the container for recycling. This deposit can be redeemed for cash.

Tomra, a Norwegian company that manufactures advanced collection and sorting solutions to aid the circular economy, makes reverse vending machines that allow consumers to



process used bottles for cash. Their machines have collected 35 billion drinks containers in over 40 countries.

A Despot Recycling Scheme:



The introduction of such a scheme has been delayed in most of the UK, however, due to the impact of Covid-19, although a DRS will start next year in Scotland. If such a scheme were introduced in the UK, it could help to improve recycling rates significantly. Tomra have calculated that in some countries where DRS schemes have been rolled out nationally, recycling rates have hit 90%. The recycling rate of household waste in England was 46% in 2019.

Other opportunities for Biffa include a breakthrough in the recycling of plastic films and being able to turn plastic food containers back into food grade products. All of this requires further technological innovation.

3. Could Biffa expand internationally given the war on plastic is global?

We asked management if there was an international opportunity with their Polymers business given many other countries are focusing on the plastic issue. The CEO was relatively coy about this, but noted that certain things need to be in place for a market to be ready for a Seaham type facility.

For starters, consumer habits are important. In the UK, despite the absence of a DRS, councils have been relatively good at encouraging waste sorting at source (i.e. at the home – dividing your rubbish between recycling and waste). In addition to this, you need the collection and sorting infrastructure (PRFs and MRFs) before plastic waste can be sent to be made into flakes and pellets. Places such as Dubai, have almost no recycling infrastructure whatsoever. Daily waste collections are made and rubbish is either sent to landfill or incinerated. There is no consumer buy-in towards recycling, as household waste is often dealt with by house staff. An effective recycling process essentially requires national buy-in, led by the government.

4. How difficult would it be for a competitor to replicate the Biffa site?

Management noted that the plastic recycling business is a fragmented market. The food grade market is less so, however. Barriers to entry are higher given the complexities involved in meeting stringent regulatory standards. At a new site, it takes 9 months for a pellet to acquire the necessary food approvals (this is based on the time a plastic bottle may be sitting

on a shelf before its product is consumed). It is tough to get right and people in the industry still remember the Perrier bottle scandal in the 1990s (see below). Margins are better, however, so it is an attractive part of the market.



1990s Perrier bottle scandal

An independent French company over a hundred years old, Perrier was the leading brand in a growing sector with a 15% share of the US market.

Then, on 6 February 1992, American regulators in North Carolina discovered that its bottles had been contaminated with benzene (a chemical compound that has been linked to chromosome aberrations in bone marrow that could produce leukemic clones). While no one suffered as a result of drinking the benzene-contaminated water, Perrier still had to recall 160 million bottles from 120 countries at a cost of over \$250m.

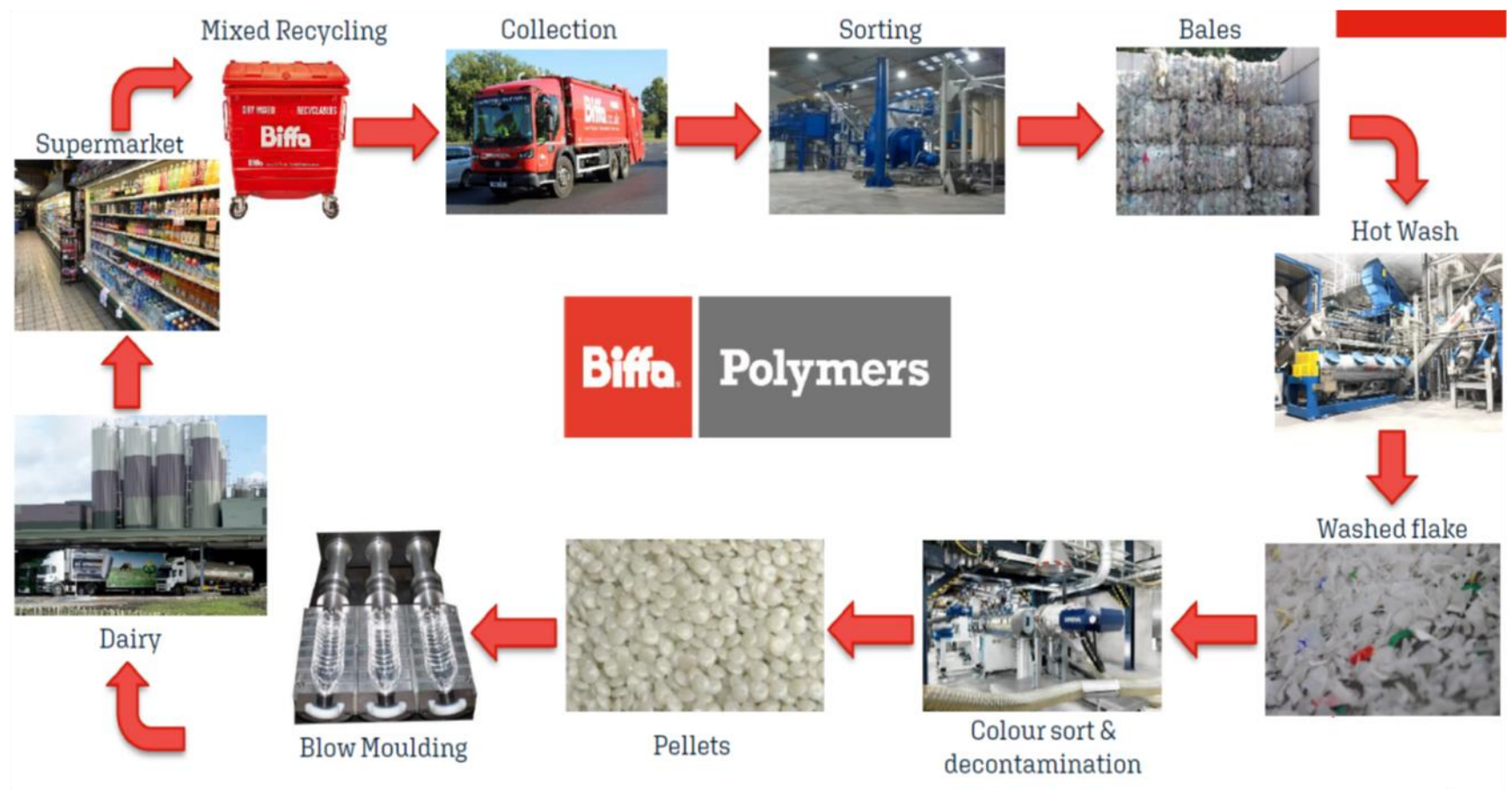
Within 18 months, its market share had declined to 9% in the US and dropped from 49% to less than 30% in the UK. The share price fell by 37% and the company was taken over by Nestlé. Some 750 people in the mineral water division were made redundant. By 1995, Perrier sales had fallen to one-half their 1989 peak.



Should a competitor wish to replicate the Seaham site, it would not be a case of just purchasing the necessary kit and pressing the start button. Mike informed us that the configuration of the equipment is bespoke to Biffa and was designed by their own team of engineers (many competitors outsource engineering). This is something Biffa is proud of and they have a legacy of innovation – and a Queen’s Award to prove it. In 2008, Biffa Polymers was developed as the world's first food-grade rHDPE milk bottle facility, a move recognised with the Queen's Award for Enterprise Innovation.

Biffa’s integrated set-up is also of huge benefit. It allows the company to have a great amount of control over the supply of “feedstock” (the plastic bales that arrive at the site). This network means that it could be possible for a plastic bottle to be picked up by one of Biffa’s trucks, processed into pellets within 24 hours and back on a shelf three days later. Such speed, while not always necessary, has a significant environmental benefit: the faster plastic can be recycled and put to use, the less virgin plastic needs to be made.

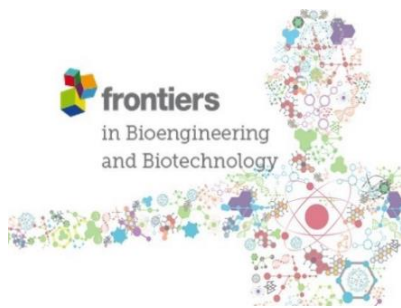
Biffa control their plastics feedstock via their collection business



5. Is sustainability both a tailwind and a threat?

An issue for Biffa to consider is if the projected growth for plastic recycling will materialise. Could plastic waste be reduced to such an extent that having multiple Seaham sites dotted across the country makes no sense? These facilities could end up being obsolete in a few years' time given the huge amount of innovation taking place to identify plastic alternatives.

We have seen this ourselves with Santen, a Japanese ophthalmic specialist in which we invested, who after our engagement replaced the plastic bottles used to store an eye-drop solution with a biomass-based alternative. Innovation is also taking place closer to home. A Scottish company called Vegware manufactures plant-based compostable foodservice packaging and provides waste facilities to compost and recycle their materials. Vegware, which is privately owned, is the fastest growing export company selling sustainable, recyclable, compostable products for food and drinks.



Unexpected alternatives could also emerge. An article published in July 2021 in the journal *Frontiers in Bioengineering and Biotechnology*⁵ noted that “microorganisms, like bacteria and fungi, are becoming an emerging resource for the development of eco-sustainable plastic degradation and recycling processes”. Austrian scientists have discovered that bacteria present in the digestive system of cows can break down plastic. This sounds

like science fiction, but such solutions have the potential to become tools in the battle against plastic pollution.⁶

⁵ Quartinello F, Kremser K, Schoen H, Tessei D, Ploszczanski L, Nagler M, Podmirseg SM, Insam H, Piñar G, Sterflingler K, Ribitsch D and Guebitz GM (2021) *Together Is Better: The Rumen Microbial Community as Biological Toolbox for Degradation of Synthetic Polyesters*, *Frontiers in Bioengineering and Biotechnology*.

⁶ A cow's diet already contains natural plant polyesters, so the team was confident that there is some mechanism within their stomach that is able to conduct polyester hydrolysis, a chemical reaction that breaks down such materials. The line of thought was: if they can tear these biological polyesters apart, can they do the same for artificial ones? Once the team identified these bacteria in the rumen (one of the four compartments of a cow's stomach) they tested their ability to break down polyethylene terephthalate, or PET, the most common thermoplastic in the polyester family. They also tested two other types of plastic. One was polybutylene adipate terephthalate or PBAT, commonly used in compostable plastic bags. The other was Polyethylene furanoate, PEF, which is made from sugars derived from plants. Samples of these three plastics were placed in an incubated rumen liquid. The plastic was either turned into a powder or into a plastic film. The results are certainly exciting – all three plastics were broken down with no problem. Powders were broken down faster than films, which is hardly surprising given that chemical reactions tend to happen faster as the surface area of the reactant increases. The team noticed that the reactions with the rumen liquid were more effective compared to research that looked at a single microorganism to break plastics apart. The team believes that the environment of the rumen liquid might be more conducive to the task. The degradation of the plastic might be down to the work of multiple enzymes working at peak conditions thanks to the rumen liquid properties. www.iflscience.com

Even with these advances, however, plastic recycling facilities will still be needed, at least in the mid-term. Recycling and reusing what we make sits at the very heart of the circular economy. This is central to major environmental initiatives, from climate change to protecting biodiversity and eliminating plastic waste from our oceans. There is a sustainability angle to recycling: once recycled and reused, a plastic product can have a lower carbon footprint than a virgin alternative made from glass or cardboard. Biffa cited analysis conducted by Alpha Consulting which found that the environmental footprint of a recycled plastic milk bottle was better than its glass or cardboard equivalent.

Given there are still 5.5 billion plastic bottles sent to landfill, incinerated, or littered in the UK each year, it is likely that much greater plastic recycling is going to be needed, at least in the medium-term (and probably the long-term unless something truly innovative and unexpected is invented). After all, the Seaham site *only* recycles 1.3 billion plastic bottles a year. There is a lot to go for.

Deciding whether to invest in recycling facilities or machines for other forms of plastic packaging is more difficult, however. There is no viable solution to plastic films currently, but Biffa noted that the benefits of using plastic film are questionable. It is not obvious that they help to prolong or protect the shelf life of foods and alternatives already exist (why use rolls of clingfilm when you can just buy a tupperware box?). Do they design a plant for films or will the industry – and consumers – phase them out?

While alternatives to plastic may materialise, some may be derivatives of plastic rather than outright replacements, for example hybrid or composite materials that blend traditional plastic with a biomass ingredient, making them easier to recycle or decompose. The strength of Biffa's business model is that no matter what consumers are using, waste will still need to be collected and processed – and in a circular economy, much will have to be recycled. It would be no surprise if in the future, the Seaham site is not just able to recycle PET plastic, but other materials that can also help deliver a greener economy.

Conclusion and thoughts on the plastic problem

The Seaham site is impressive and inspiring: it is a world class facility, the only one of its kind in the UK capable of recycling plastic bottles back into food grade pellets that can once again be used by food and drink manufacturers. It can recycle up to 1.3 billion plastic bottles a year, a huge number, but a drop in the ocean when set against the global plastic problem.

Plastic waste really is a global problem, threatening ecosystems, biodiversity and human health. Some of the statistics are worth documenting:

- **Half of all plastics ever manufactured have been made in the last 15 years;**
- Production increased exponentially, from 2.3 million tonnes in 1950 to 448 million tons by 2015. **Production is expected to double by 2050;**
- Every year, about **8 million tonnes of plastic waste escapes into the oceans** making up 80% of all marine debris from surface waters to deep-sea sediments.
- Plastics often contain additives making them stronger, more flexible, and durable. These additives can extend the life of products if they become litter, with some estimates ranging to at least **400 years to decompose.**⁷

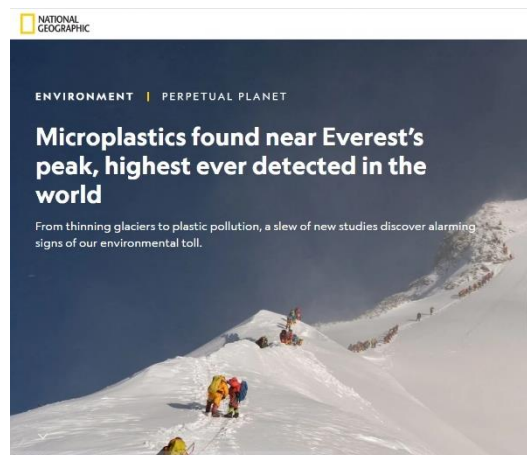
Plastic in the oceans is a particular issue, as global currents transport waste across the world. According to an investigation by *National Geographic*, on Henderson Island, an uninhabited atoll in the Pitcairn Group isolated halfway between Chile and New Zealand, scientists found plastic items from Russia, the US, Europe, South America, Japan, and China. They were carried there by the South Pacific gyre, a circular ocean current.



⁷ Statistics taken from National Geographic

One at sea, plastics are broken down into microplastics by the elements. These often measure less than one-fifth of an inch across and spread throughout the water column, which is why they have been found in every corner of the globe, from the heights of Mount Everest to the depths of the Mariana Trench.

Plastic waste has had a severe impact on wildlife, at sea and on land. Over 700 species are known to have been negatively impacted by plastic. Almost every type of seabird has been documented as eating plastic waste. Microplastics have been found in more than 100 aquatic species, including fish, shrimp, and mussels – which mean that microplastics now form part of the human food chain. Plastics have been consumed by animals including elephants, hyenas, zebras, tigers, camels, cattle and other large mammals, in some cases causing death, mainly by entanglement or starvation. Tests on some animals, meanwhile, have confirmed organ and cell damage and even disruptions to reproductive systems.



When you take all of this into account, you can only be heartened by the work taking place at Biffa's Seaham site, although it needs recognising that more scale and capacity is needed to change the tide in the battle against plastic.

More therefore needs to be done and Biffa proposed several steps that are needed to tackle plastic in a 2019 report: "*Plastics Surgery: Managing Waste Plastics*"⁸. In the report, Biffa makes the following recommendations:

1. Stop exporting waste plastics:

The UK should aim to recycle all plastics domestically, optimising the material as a resource, generating UK investment and jobs and avoiding unintended environmental problems in other countries due to the inherent difficulties faced by UK-based regulators monitoring activities overseas.

2. Phase out problem plastics:

Plastics need tackling proactively, at source, at the production and design stage. The type of plastic, its application and even its colour need consideration, so that the resulting item is genuinely recyclable in mainstream, widely available systems and the resulting re-processed plastic is attractive to the widest possible end markets. There needs to be a reduction in the use of problematic single-use plastic, such as the proposed bans on plastic straws, stirrers and cotton buds and the plastic carrier bag charge. Similar bans or charges may also be useful for other unnecessary plastic items in future.

3. Make recycling easy:

Recycling needs to be made easier by packaging being made simpler, labelling made clearer and recycling collections being made more consistent.

⁸ Reality Check Series: 4 - *Plastic Surgery: Managing Waste Plastics*, Biffa, September 2019

Plastic as a business opportunity is not exactly new, however. Who can forget the scene in the seminal 1967 film, *The Graduate*, when the protagonist Benjamin Braddock (played by Dustin Hoffman) [is solicited by Mr Maguire](#) with a business opportunity: *“I just want to say one word to you...just one word: plastics. There is a great future in plastics”*.



Today, the plastic opportunity comes from recycling and making sure the material can form part of a truly circular economy. Biffa’s investment and ongoing commitment towards tackling the plastic problem is to be welcomed. By proving that the Seaham site can be a commercial success – that “*value is now following carbon*” – the company can demonstrate that a focus on sustainability makes both economic and environmental sense.

In turn, by investing in Biffa and supporting management as they develop the polymer business, shareholders can play a part in helping to tackle the pandemic of plastic.

Ed Heaven, Head of Sustainable Investment, July 2021.