

# Plastics in the Bioeconomy report

## Executive Summary

Plastic is a material that has revolutionised our modern world. However, society is increasingly understanding the environmental impact of this ubiquitous material, particularly when it is not treated or managed carefully. According to the Ellen MacArthur Foundation, most plastic packaging is used only once (single use items) and 95% of the value of the material is lost to the economy annually, totalling US\$80-120 billion globally.

In response to the environmental harm caused by plastic pollution, the UK government is now taking a fundamental look at its regulations and policies relating to plastic packaging as part of a revised Waste and Resources Strategy. In addition, the UK Plastics Pact, a collaboration across the entire packaging supply chain, is an example of a new voluntary agreement designed specifically to tackle the issue of plastic waste. The UK Plastics Pact contains targets which are directly relevant to this study, specifically that 100% of packaging is to be recyclable, reusable or compostable, with a target of 70% to be effectively recycled or composted by 2025. Also contained within the UK Plastics Pact is a commitment to eliminate unnecessary or problematic single-use packaging.

To achieve these targets, significant changes will be required. We need to understand and assess our use of plastic, increase the rate of plastic recycling and treatment capability in the UK and, most importantly, look for alternatives for hard to recycle, single use plastics. This report examines how compostable packaging can play an important part in helping this transition over the next five years.

Compostable bio-based plastics can provide a sustainable alternative to petroleum-based persistent plastics in some applications. This report, commissioned by the Biomass Biorefinery Network, summarises research in the UK regarding:

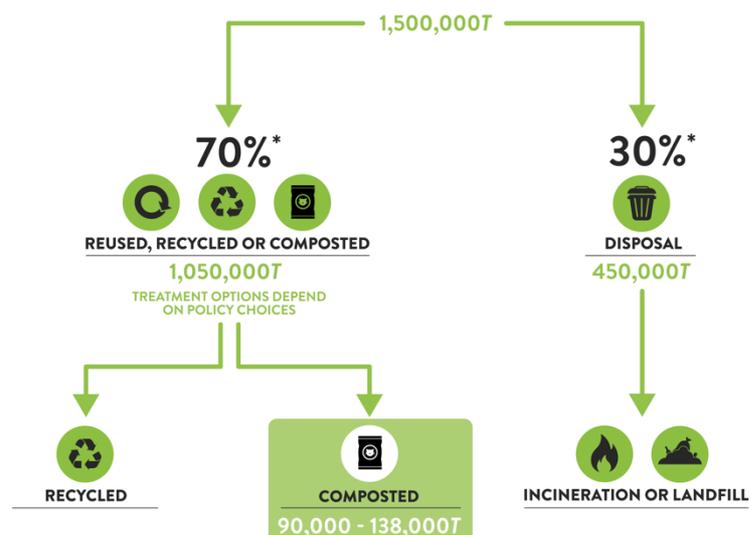
- The current scale and types of compostable plastics in the market;
- How the market for compostable plastics could grow in the medium term;
- Identification and quantification of suitable biomass resources that could be used as feedstocks; and
- the potential contribution of compostable plastics to the 2025 targets for plastic packaging as set out by the UK Plastics Pact and a strategy for how this could be achieved.

While the bioplastics market is growing, little information is available regarding the total compostable plastics market in the UK. This study aims to gather a first systematic analysis of the UK market, taking a look at the estimated market size for compostable bioplastics by material and exploring how this market is likely to grow based on its capability to substitute conventional plastic packaging in specific, often difficult to recycle, applications.

## Headline findings

The benefits of increasing the amount of compostable plastics used for packaging are significant. The study has found that there could be a tenfold increase in the compostable packaging market from 10,000 tonnes to over 100,000 tonnes (range from 90,000 – 138,000) depending on the degree of market uptake. There is a demonstrable need for compostable packaging, especially when the packaging can be used to capture food waste that would otherwise end up in the residual stream. Significant bioeconomy benefits would be achieved through valorising available, underutilised agricultural crop residues to produce the required biopolymers. Utilising bioresources will also contribute to the strong sustainable performance of compostable packaging when compared to conventional oil-derived plastic.

### POTENTIAL FOR CONSUMER PLASTIC PACKAGING DISPOSAL IN 2025



T=Tonnes

Amounts based on 2018 figures

\* Targets set by UK Plastics Pact (2018), to be achieved by 2025

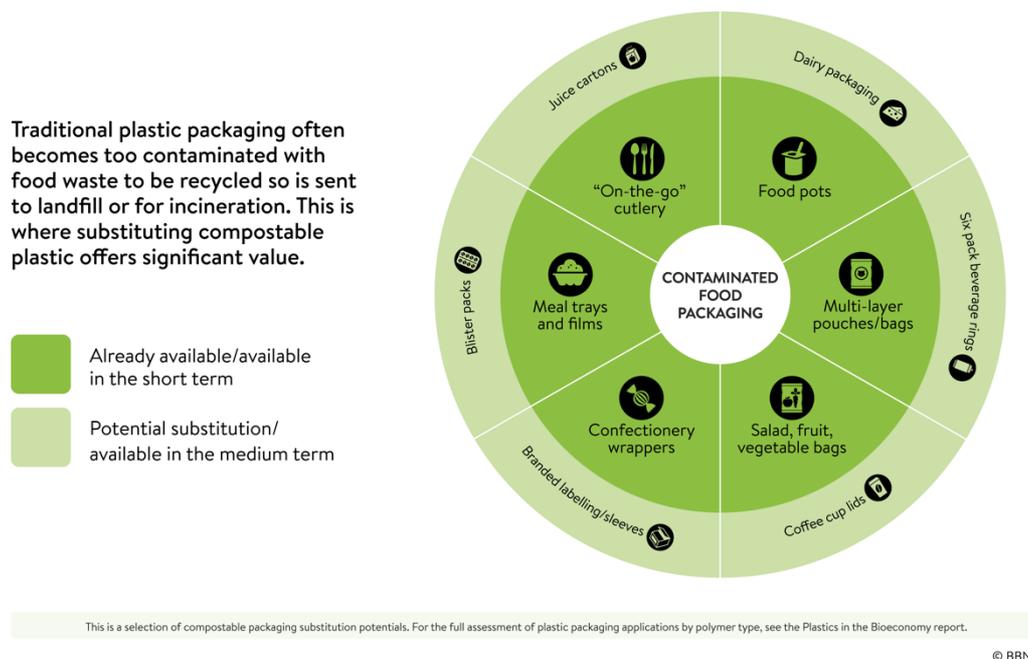
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## Increased uptake of compostable packaging

The focus of this study is on consumer packaging. This includes all consumer-facing grocery and non-grocery packaging placed on the market. Of the 2.361 million tonnes (Mt) of total plastic packaging placed on the UK market in 2017, nearly 65% (1.5Mt) is classed as consumer/retail packaging.

To understand the UK market opportunity for compostable packaging we needed to understand the packaging it could most readily replace – its substitution potential. Our assessment concluded that the materials most readily substituted at present can largely be categorised as food product packaging, short lived single- use items and flexible packaging.

## COMPOSTABLE PLASTIC PACKAGING TO REMOVE FOOD WASTE FROM HOUSEHOLD WASTE AND RECYCLING STREAMS



Our analysis of the market estimates the UK could significantly increase the uptake of compostable packaging to between 90,000 and 138,000 tonnes per annum:

- Potential Flexibles market 53,000 - 77,000 tonnes per annum
- Potential Rigid market 9,000 – 11,000 tonnes per annum
- Carrier Bag potential 28,100 – 50,000 tonnes per annum

## Complementing conventional plastics

It is important to highlight that the adoption of compostable packaging is not a solution in itself. The plastic packaging system also needs a higher recycling rate. The effective plastics system of the future will have different polymers playing different roles, while the adoption of compostable or conventional plastic needs to take a whole-system approach which considers both the role of the packaging and its end of life.

### **Significant economic benefits**

Our analysis found that the transition to a greater adoption of compostable packaging could, by 2025, provide an economic benefit to the UK's bioeconomy in excess of **£267m** per annum, simply through sales of the biopolymers required for compostable packaging. A wider economic benefit could also be achieved through cost reductions in collections and processing costs for those hard to recycle plastics, such as those heavily contaminated with food waste or multilayer plastics. At end of life, our analysis estimates a 12% lower net cost associated with recovery systems for biopolymer materials (£100/tonne) compared to virgin material recovery (£112/tonne).

### **Materials capture**

Plastic waste is often too contaminated with food waste to be suitable for recycling and is ultimately sent for incineration or to landfill.

This presents an opportunity for the compostable packaging market. If the focus for compostable packaging is packaging that often becomes contaminated a double benefit could be achieved. Not only would landfill and incineration be avoided, but the compost produced would return organic matter to the soil.

### **Abundant feedstocks**

Supporting this transition is the availability of bioresource feedstocks. To understand the feedstocks that could be available for bioplastics production, we examined agricultural production in the UK and mapped this against several key biopolymers. The research confirmed that the UK has an abundance of renewable bioresources to supply the biochemicals needed to produce the biopolymers for the potential compostable packaging market

Our findings identified over eight million tonnes of suitable bioresources from key agricultural residues alone, with a further five million tonnes available from other, non-target bioresources. When compared to the proposed growth of compostable packaging of between 90kt to 138kt there are approximately 100 times more bioresources available.

### **A sustainable alternative**

A life-cycle assessment (LCA) was conducted to understand the sustainability implications of producing and using low-density polyethylene (LDPE), a petroleum based-material, compared with the exemplar compostable bioplastic polylactic acid (PLA), a bio-based

material<sup>1</sup>. Our LCA analysis showed that PLA has the potential to have a lower environmental impact (in terms of global warming potential) than LDPE.

Analysis into end of life considerations found that whilst LDPE has the potential to avoid significant amounts of CO<sub>2</sub> emissions through recycling, little filmic LDPE is actually recycled in the UK. Recycling LDPE is dependent on high quality post-consumer packaging reaching recycling facilities, which this does not happen at present. Even in a scenario where 90% of LDPE is placed into a recycling bin, if more than 10% of this is contaminated with food waste then PLA will be preferable to LDPE.

### **Facilitating the transition**

The huge environmental impacts of food waste have created a consensus across the UK that household food waste collections are required. If collections were rolled out across England, as intended within the Waste and Resources Strategy, then the UK could have a collection and processing infrastructure capable of supporting compostable packaging. This removes one of the biggest barriers to the widespread adoption of compostable packaging. The amount of food waste generated in the UK is estimated at 10 million tonnes per annum<sup>2</sup>, so an estimated market of approximately 100k of compostable plastics is just 1% of volume. However, segregation, collection and the composting vs anaerobic digestion discussion all need careful planning to ensure maximum capture of compostable packaging and allow successful growth of the bioplastics market. To ensure non-compostable packaging does not contaminate the system, clear labelling will be required to help consumers dispose of the packaging appropriately.

The question is – what proportion of the plastic packaging placed on the market could be reused, recycled or composted by 2025? The answer will be shaped by government policy and needs to be informed through evidence and engagement with stakeholders.

## **Next steps**

The UK Plastics Pact sets out strong, ambitious targets to create a circular economy for plastics and support the drive for compostable bioplastics. This report helps to set out the challenges of achieving a 70% recycled or composted target and explores how compostables can address the challenges that cannot be resolved through recycling.

A transition towards compostable packaging provides significant economic and environmental opportunities, yet requires whole system support. To facilitate this transition, investment will be required from industry to take forward research and development innovation around bioplastics, retailers and consumers will need to 'buy compostable', the waste and resource recovery industry and local authorities will need to expand existing collection and treatment models to accommodate compostable materials

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<sup>1</sup> PLA was selected as a suitable option to represent biodegradable bio-plastics

<sup>2</sup> [http://www.wrap.org.uk/sites/files/wrap/Estimates\\_%20in\\_the\\_UK\\_Jan17.pdf](http://www.wrap.org.uk/sites/files/wrap/Estimates_%20in_the_UK_Jan17.pdf)

and, most importantly, the UK government will need to provide policy and regulatory support to drive change. Ultimately it will involve investment in infrastructure and collections, public education and behavioural change.