

A worker in a dark environment is pushing a wooden cart. On the cart is a large, glowing orange object that resembles a plastic bottle or container. The scene is dimly lit, with the primary light source being the glowing object. The worker is wearing a dark shirt and is seen from the side, pushing the cart forward.

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Vision for the  
Future of Plastics

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# Vision for the Future of Plastics

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We rely on plastics for our everyday lives. Plastics perform critical functions especially in sectors like healthcare and packaging. Decarbonizing the plastic sector is possible but can only be achieved if we stop throwing them away or incinerating them. Currently, most plastics are produced without a plan for their end-of-life: how they will be collected, reused, recycled, or composted, and this has created the environmental disaster involving plastic waste. Net zero plastics are possible only if we switch to a circular economy of plastics.

In this paper, we outline a Vision for the Future of Plastics, based on our research at the Plastic Waste Innovation Hub at UCL. We are a multidisciplinary research hub and specialize in systems thinking around plastics – how they are produced, regulated, sold, used, discarded, and recycled. No solution to the plastics problem comes from one single discipline or sector. Reducing the climate impact of plastics needs collaboration in the adoption of circular economy policies for plastics.

There are faults through the whole plastics material system. We outline a Vision for a more sustainable system at each stage: material production, object manufacturing, labelling, use, collection, recycling, end of life.

## Producer – Think ‘end-of-life’ during design phase

**We know:** There are many biodegradable and compostable plastic alternatives now on the market.

**Our research:** Most biodegradables and compostables are untested in real-world systems and “compostables” don’t always compost in either home composters or industrial composting systems, which leads to contamination of the compost stream. Consumption of plastics is ever increasing, and the share of recycled plastics is still very small, resulting in GHG emissions and plastic pollution.

**We can:** Design compostable plastics that are compatible with existing systems of food waste collection; use alternative bio-based feedstocks, to produce bio-plastics; design labels so people understand where to put them; use life cycle assessment (LCA) to assess the environmental impact of compostable packaging.

## Manufacturer and retailer – Reduce and Simplify packaging

**We know:** Manufacturers choose material packaging and supply chains that minimize their costs. Some are also committed to reducing their environmental impact but have little understanding of the impact of their packaging. Retailers want to build brand loyalty through novel and innovative packaging, but this is not always informed by sustainability considerations. This has led to the use of complex brightly coloured multi-material packaging, which is expensive to sort, disassemble, and recycle.

**Our research:** Plastic packaging is put into landfill or burnt, or ends up in the environment. Each of these fates will lead to CO2 emissions and other contaminants entering the environment.

**We can:** Design packaging using plastics for which established recycling systems exist and are cheap to recycle such as PE, PP and PET.

## Society – Change the System to Promote Behaviour Change

**We know:** Rates of recycling and composting are increasing but still low.

**Our research:** Our Big Compost Experiment shows that collection and recycling systems are not always well designed to maximize resource recovery. People are confused by the plastic recycling labelling. People have low confidence in the system and so are unmotivated. People don't know how to correctly dispose of compostable and biodegradable packaging.

**We can:** Make it simple so people find it easy to do the right thing. We can reduce the choices and complexity of packaging and provide straightforward collection and recycling systems. For instance:

- Make all plastic packaging recyclable.
- Unify systems of waste sorting, collection, and recycling across the UK.
- Ban exports of plastic waste so people know that the UK is dealing with all its own waste and develop treatment infrastructures that maximize recovery of plastics.
- Design compostable packaging to be compatible with food waste recycling.

## Finance – Sustainable Digital Transition Investment

**We know:** 350 million tonnes of plastic are being used every year. However, less than half of it is properly collected and recycled. This involves the waste of resources.

**Our research:** Shows finance has a pivotal role to play, gaining from the pace and breadth of digital innovation, to support a sustainable finance (ESG). A plastic credit market, where secondary plastic quality has additional added value, can be supported by distributed ledger technology (DLT) or blockchain technology to provide new solutions and foster greater sustainability.

**We can:** Promote research and development of DLT systems to embed accountability in purchasing and use choices that involve plastics.

## Recyclers – Invest in Enzyme Technology

**We know:** That much of household unrecyclable mixed plastic waste gets burnt either in the UK or abroad.

**Our research:** Biological enzymes capable of decomposing plastic into simpler chemicals are the building blocks for new plastics. This technology is the basis for Enzyme Recycling that has the potential to deal with mixed plastic and organic waste.

**We can:** Continue to develop the fundamental science underpinning this recycling technology of the future and work in collaboration with industry partners to make the UK world leaders in this new technology.

## Citizens – Get Involved

**We know:** People are worried about the environmental pollution caused by plastic waste.

**Our research:** By setting up a citizen science experiment called the Big Compost Experiment we have allowed thousands of people to take an active role in carrying out experiments and collecting data on the effectiveness of biodegradable and compostable plastics.

**We can:** Continue to actively involve the public in our research so that we better understand the real world problems regarding plastic waste and assess the effectiveness of the solutions we are proposing.

## Policy Makers – Encourage environmentally friendly plastics

**We know:** The market alone cannot solve the plastic waste problem. The policy system needs to provide clear signals to stakeholders encouraging the right behaviours. Laws are required to control pollution of the commons and their implementation needs constant active dialogue among stakeholders.

**Our research:** Inviting policy makers at an early stage of our research helps us to understand what data they require to make evidence-based decisions.

**We can:** Impact policy making in the areas of plastic waste taxes, labelling and certifications. We can design instruments such as packaging taxes that provide the right set of signals to industry to encourage recycled content; reuse solutions and take-back schemes which reduce product carbon footprints and other pollution.

Please, check all our latest research at the [UCL Plastic Waste Innovate Hub website](#).