Tackling the plastic problem
Using the tax system or charges to address single-use plastic waste – HM Treasury Consultation

This response has been produced by Greenpeace UK, Environmental Investigation Agency, The Marine Conservation Society, the Campaign to Protect Rural England and Surfers Against Sewage. This group commissioned research from Eunomia Research and Consulting, which feeds into these recommendations.

SUMMARY OF KEY RECOMMENDATIONS

- Plastic pollution is an environmental emergency and the Government need to treat it as such. Up to 12 million metric tonnes of plastic leak into the oceans each year, a figure that could double by 2025, with 40% of marine species known to ingest marine debris. Meaningfully addressing plastic pollution, particularly at source, would fully support several Sustainable Development Goals, with the benefits extending far beyond the marine environment.
- As a general set of principles any taxes, charges or bans should aim to reduce single-use items both at production and point of consumption, reduce the number of polymers on the market, encourage increased recycling rates and increased recycled content, prioritise actual recycling of items before down-cycling and focus on easy and cost-effective recycling in the UK. All these factors combined would have the effect of decreasing plastic pollution and incentivising and reviving domestic recycling infrastructure.
- Multiple polymers are used in an almost countless array of single-use items on the market. Policymakers should develop a hierarchy of SUPs to design and prioritise interventions. We propose five categories: pointless plastics, replaceable plastics, problem plastics, harder to replace plastics, and essential plastics.
- We define ‘pointless plastics’ as those with limited social utility for which no alternatives are required and which can be phased out without significant behavioural or infrastructural change. We define ‘replaceable plastics’ as those which perform a useful function, for which readily available alternatives exist that do not cause significant environmental or social harm. We define ‘problem plastics’ as those which are non-recyclable, non-recyclable at reasonable cost and/or hazardous in the environment. We

define ‘harder to replace plastics’ as those which perform a valuable function, and are not readily substitutable without behavioural change, waste infrastructural change, food system change or product innovation. We define ‘essential plastics’ as those which perform an essential function, where an alternative is unlikely to emerge in the medium term, and where increasing the cost of the item would result in social harm.

- ‘Single-use’ items are those which are not reusable by design, and single-use as regards their use as an item, regardless of the recyclability of any component materials. Legal definitions of plastic should be based on the properties of the material, in particular its behaviour and impact in the environment, rather than the feedstock or process of production.
- We recommend a combination of bans, taxes and charges to incentivise reduction and better design, and the introduction of a full extended producer responsibility system in the UK so that producers and retailers cover the full end of life management costs of items they put onto the market. These measures are not in each instance mutually exclusive, but can be combined across the lifecycle of a single-use plastic item.
- New taxes can take two years to come into force from the date they are announced in a budget (see e.g. Soft Drinks Industry Levy and Carbon Price Floor). However, there are instances where taxes have been introduced within a year of announcement in a budget (e.g. the Bank Payroll Tax). We recommend that the Government use the Autumn 2018 budget to announce a range of new taxes on single-use plastics, with a two-year timetable for implementation as a deadline, ideally moving faster. We urge the Government to implement new bans and charges by 2019.
- We have selected four single-use items as case studies for how bans, taxes, charges and EPR reform can work in practice to drive reduction, reuse and recycling. We propose policy interventions at the production, retail and consumption stage for each. These are not standalone case studies, but point to measures government should take to tackle similar single-use plastic items and polymers. We consider plastic sachets, single-use plastic cups, black and coloured plastics, and take-away containers.
- **Plastic sachets**
    - Example of a ‘pointless plastic’
    - Immediate ban on the production, distribution and sale of single-use plastic sachets, with derogations for essential uses
    - Other examples of pointless plastic include poly bags used in supermarkets to carry fruit and vegetables bundles, double/triple wrapping of confectionery, plastic cutlery, stirrers and straws and shrink wrapping of non-perishable goods - which should also be subject to bans
- **Single-use plastic cups (e.g. coffee cups)**
    - Example of a ‘replaceable plastic’
    - Producers and retailers pay item specific EPR fee for all single-use cups and lids placed on the market to cover the costs associated with end of life management
    - Producers pay tax on plastic coated paper (with broader implications for food and drink packaging beyond single-use cups)
    - Consumers pay 25p tax on single-use cups at point of sale to incentivise reusable cups. Tax level is reviewed annually to ensure set at level needed to drive 80-90% reduction over time
    - Fiscal measures are a precursor to a ban on single-use cups by the mid-2020s
- **Black and coloured plastics**
    - Example of a ‘problem plastic’
    - Immediate ban on the production and sale of plastic packaging using pigments that cannot, at reasonable cost, be detected by near-infrared (NIR) sorting technology. This includes carbon black pigment

    - Introduce full EPR on producers and retailers of remaining black and coloured plastics, leading to a phase-out of all black and coloured plastics, subject to derogations for essential uses
    - Other problem plastics include polystyrene, expanded polystyrene, PVC, and oxo-degradables, which should also be banned for single-use applications
- **Take-away packaging**
    - Immediate ban on the production and sale of expanded polystyrene packaging
    - Producers pay a unit tax on non-EPS plastic single-use containers
    - Retailers pay a unit tax of 50p on each plastic container purchased from producers to encourage reusable alternatives (particularly for home delivery sector) and low impact/no packaging choices (for 'on the go' sales)
    - Producers and retailers pay item specific EPR fee for containers to cover costs associated with end of life management. The fee is variable according to end of life costs of different materials
- For all new taxes and charges, the Government should establish a monitoring and evaluation process, with the effectiveness of the tax/charge being reviewed periodically, with a view to increasing the level of the tax and/or expediting phase-outs if further declines in consumption are required. Results of the monitoring should be made publicly available, alongside the Government's rationale for any decision to maintain or increase the level of the tax.
- All single-use plastics and packaging of all material types should be covered by a reformed EPR scheme that is transparent, provides full cost coverage of end of life costs, and is sufficiently 'granular' in attributing accurate end of life costs to specific types of materials. Fees should be sufficiently modulated in order to incentivise eco-design and to drive a continued reduction in the production and sale of single-use plastics.
- The Government should introduce taxes on all single-use plastics and packaging (subject to exemptions for essential uses) which are not subject to bans. This should be done on an item by item basis rather than by weight or value of plastic used, as the latter would encourage lightweighting. An item by item approach would allow policy makers to set the tax at a level sufficient to incentivise reduction/switching for each item, and allow policy makers to apply the tax at the most effective stage(s) in the lifecycle of each item. In prioritising items to target, the Government should be guided by prevalence of use, presence of items in the marine/terrestrial environment, and the environmental harm posed by items in the environment.
- The Government should introduce a tax on virgin plastics at the product formation stage to encourage greater recycled content in the remaining single-use plastic items brought to market. A tax on virgin plastics should work alongside mandatory targets for recycled content to reward producers that exceed targets. While an increase in recycled content is welcome and preferable to the current situation, this alone cannot solve the problems associated with plastic pollution.
- All resource use has an environmental footprint, and there is a need to mitigate the risk that wholesale switching from plastic to alternative materials could lead to a displacement of the harm caused by plastic to other areas of the environment. In mitigating this risk, policymakers need to think and legislate holistically, rather than being guided by narrow life-cycle analyses.
- In general, the government should not support 'alternative' plastics, including biodegradable and bio-based. Oxo-degradable plastics should be banned. Such 'alternative' plastics do not address the problem of marine pollution or prevent littering. No finished product has been proved to be marine biodegradable, and biodegradable plastics pose additional sustainability problems.

- While desirable to decouple production from fossil fuels, it would not be possible to sustainably meet current demand for plastics through bio-based sources, given the enormous land-use implications and there are additional risks of potential contamination of recycling systems.
- As with the other ‘alternatives’, compostable plastics that enter the marine environment will continue to pose risks to ocean ecosystems. Disposal challenges include that not all ‘compostable’ plastics necessarily compost at every industrial facility and that they may compromise recycling of conventional plastics.
- Some plastic items are ‘essential’ due to both their social utility and irreplaceability with non-plastic alternatives (e.g. for medical or research purposes). These should not be subject to bans, taxes or charges. We recommend that the Government establishes a Plastics Advisory Committee, to provide annual, impartial recommendations to ministers on essential uses of plastic, with these recommendations made public.
- In light of stalling recycling rates in England, and as highlighted by the fallout from the China ban on waste imports, there is a clear need for the UK to invest more in its collection and domestic recycling infrastructure. We are agnostic as to whether revenue raised through plastics taxation should be hypothecated for this purpose, though given that this taxation is designed to reduce single-use plastics coming to market, it may not be advisable to rely on this revenue stream, which would be expected to diminish over time if the tax were having the desired effect. In addition to increased investment, eliminating problem plastics that are expensive to process, and reducing single-use plastics overall, would reduce costs and increase recycling rates for the residual waste stream.

Question 1: How should the government define single-use plastics, and what items should be included and excluded, and why?

The term 'single-use plastic' has two components: 'single-use' and 'plastic'.

Defining single-use

A single-use item can be defined as an item which is designed to be used only once and then discarded.[1] Single use items are often used in packaging, consumer products, cosmetics and healthcare. Examples include: lightweight plastic bags, beverage containers, condiment sachets, take-away food containers, materials used to transport, wrap and pack perishable goods, plastic utensils, and wet wipes.

Single-use plastic represents a large proportion of plastic waste. Whereas 44% of plastic consumption in the UK is for packaging,[2] according to recent research by Eunomia, 67% of plastic waste in the UK is from packaging, and this is projected to grow by 22% by 2030.[3] Public concern regarding plastic and plastic pollution has focused on single-use items as their inherent disposability is related to their propensity to escape into the environment with consequent environmental, economic and social harm.[4]

Single-use items can be understood in opposition to reusable items, which are designed to be used multiple times for the same purpose. Examples include cotton bags, 'keep cups', or metal cutlery and straws. Reusable items are sturdy, washable, sometimes repairable, and have a life-cycle that is separate from each specific use.

Any item that is not reusable by design, is single-use.

For example, some households find an intermediate use for plastic carrier bags before disposal; some consumers may refill disposable plastic bottles. But both of these items are single-use *by design*.

The waste hierarchy, as established in UK law, prioritises prevention, followed by 'preparing for re-use', followed by 'recycling'.[5] Reuse is thus a separate part of the waste hierarchy from recycling, and the question of whether a product is single use or reusable should not be confused with its recyclability. As such, single-use should be understood to refer to the item rather than the material. For example, a disposable beverage container made from recycled material has a lower environmental impact than an otherwise identical container made from virgin plastic, but it is nonetheless single-use.

To summarise, single use items are:

- Any item that is not reusable by design
- Single-use as regards their use as an item, regardless of the recyclability of any component materials

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[1] Institute for European Environmental Policy, 2016. Single use plastics. *Available here:*
[2] http://www.bpf.co.uk/industry/default.aspx
[3] Eunomia, 2018. Plastics Consumption and Waste Management in the UK. *Available here*
[4] Seas at Risk, 2017. Single-use plastics and the marine environment: Leverage points for reducing single-use plastics. *Available here*
[5] The Waste (England and Wales) Regulations 2011. http://www.legislation.gov.uk/uksi/2011/988/pdfs/uksi_20110988_en.pdf

Defining plastic

Plastic is a loose term that is used to describe a range of polymeric substances. For example, 'plastic' describes:

- man-made synthetic polymers derived from petrochemicals;
- semi-synthetic polymers, derived from naturally occurring polymers which are chemically modified;
- combinations of synthetic and natural polymers, which have been documented as new types of plastics in existing patents[6]
- so-called 'biodegradable' plastics, which have not been proven to fully biodegrade outside of controlled environments, in real-world marine and terrestrial environmental conditions or to be harmless to marine life and wildlife; and/or
- combinations of polymers (natural, semi-synthetic or synthetic) chemically modified via processes including but not limited to polymerisation, substitution or co- and cross-polymerisation.

For the purposes of legislating on bans, taxes and charges, plastics made from any of the above should be considered to have the same negative environmental impacts as those plastics derived from petrochemicals. We do not support the inclusion of any exemptions for synthetic bio-based polymers since they would be expected to have the same environmental impacts on escaping into the environment.

Biodegradable plastics are currently only biodegradable under certain conditions, often only in high-temperature industrial composting facilities. There is currently no conclusive evidence demonstrating that so-called ‘biodegradable’ plastics can fully biodegrade in real-world marine or land environmental conditions or that the material and its by-products are harmless to marine life. There are also no globally accepted standards in existence against which marine biodegradability of plastics can be measured and/or proven. Any such ‘biodegradable’ plastics would therefore still function as plastic pollutants in the aquatic and terrestrial environments and could have the same negative environmental impacts as conventional plastics.

‘Plastics’ are not one single material or a small set of well-known materials. The industry itself states that “the plastics’ family is composed of a great variety of materials designed to meet the very different needs of thousands of end products. Accordingly, we encourage the Government not to introduce lists of example polymers that may be misinterpreted as exhaustive. Legislating against a set list of polymers will create the opportunity to replace ‘like with like’.

To encourage the innovation of new, less harmful materials, legal definitions of plastic should be based on the properties of the material, in particular its behaviour and impact in the environment, rather than the feedstock or process of production. At the same time, within the definition of ‘plastic’ the Government may wish to distinguish between more and less harmful feedstocks (e.g. virgin v. recycled materials).

Categorising single-use plastics

At the present time, multiple polymers are used in an almost countless array of single-use items on the market. These items and polymers differ in respect to their use value, the environmental

[6] https://patents.google.com/patent/US5346929

and social harm they pose, and their substitutability. Policy makers should be guided by these criteria as a hierarchy for designing and prioritising interventions.

The table below proposes five broad categories of plastic, examples for each category and summarises the appropriate policy response for each:

Type of plastic	**Definition**	**Examples**	**Policy response**
Pointless	Limited social utility for which no alternatives are required and that can be phased out without significant behavioural or infrastructural change	Sachets, excessive packaging (double/triple wrapping of confectionary), plastic utensils, vacuum packed pre-sliced fruit, bundles of fruit/veg on display trays or in nets, packaging where the exclusive purpose is branding, or to encourage over consumption by multiple items packaged together e.g. several items of veg packaged in one package	Immediate: Bans where items can be categorised in legislation. Taxation on retailers to rationalise use. Requirement on retailers to publish plastic use relative to turnover to leverage public pressure
Replaceable	Performs a useful function, for which readily available alternatives exist that do not cause significant environmental or social harm	Coffee cups, cotton buds, wet wipes, straws, carrier bags, fruit and veg bags, some fast food containers, some packaging of prepared food, plastic filters in cigarettes.	Immediate: Bans Producer/retailer/ consumer facing taxes/charges to reduce consumption and incentivise reuse/substitution, escalating to bans

Type of plastic	Definition	Examples	Policy response
Problem	Non-recyclable, non-recyclable at reasonable cost and/or hazardous in the environment	Polystyrene, expanded polystyrene, PVC, oxo-degradables, black plastics, complex polymer blends, microbeads.	Immediate: Bans where ban does not lead to greater environmental harm, subject to derogations for essential uses
Harder to replace	Performs a valuable function, and not readily substitutable without behavioural change, waste infrastructural change, food system change or product innovation	Packaging required to deliver perishable goods fresh to retailers over long supply chains e.g. crisp and sweet packets	Ongoing, completed by 2025: Universal phase out introduced on SUPs with periodically reviewed exemption lists, with onus on producers/ retailers to justify exemptions. R&D funds and tax incentives to bring innovative alternatives to market
Essential	Performs an essential function, where an alternative is unlikely to emerge in the medium term, and where increasing the cost of the item would result in social harm.	Pre-sterilized single use medical applications, syringes, single-use pre sterilized plastic pipette tips used in laboratories for research purposes	Ongoing: Automatic exemption from bans/taxes/charges, with periodic review of exemptions, though requirement to demonstrate effective disposal/recycling where appropriate

The above categories are to some extent overlapping, and some items belong in more than one. Plastic cotton buds for example are both ‘problem’, due to their propensity to leak into the natural environment, and ‘replaceable’.

A note on replaceable plastics

All resource use has an environmental footprint, and there is a need to mitigate the risk that wholesale switching from plastic to alternative materials could lead to a displacement of the harm caused by plastic to other areas of the environment. Life-cycle analysis (LCA) is the traditional tool used to compare the environmental impact of alternative materials for the same product within a given supply chain. However, LCA is of limited use for policymakers where a holistic approach as to how systems, rather than specific products, can be designed to deliver the best environmental outcomes is more appropriate.[7] Further, LCA rarely considers the implications if an item escapes its intended path and ends up as litter for example, and no packaging LCA currently exists that takes into account marine pollution impacts.

For example, LCA of milk containers shows that the greenhouse gas emissions from the material production and transport of glass is higher than for the plastic,[8] and thus that switching from plastic to glass would lead to higher emissions. However, the underlying assumption is that both production and transport rely on unabated fossil fuel technologies - whereas this is not necessarily the case, particularly on the transport side. Further, the relative impact of a glass bottle is reduced dramatically according to the number of times it is reused[9] - something which can be boosted through investment in collection infrastructure. Finally, emissions from road haulage in the UK are 8% of the UK's total transport emissions.[10] This is not to say that reducing haulage emissions is not important, but a) that transport emissions should be addressed through a broader policy framework that includes tackling household private transport and air transport services (which are far higher emissions sources) and b) emissions rises from specific policy initiatives to address environmental challenges like plastic pollution need to be looked at in the context of a shift to decarbonisation of transport and power across the board - and addressing these challenges should not be a bar to taking action on plastic.

There are also legitimate concerns that wholesale substitution of plastic single-use packaging with cardboard/paper alternatives should not exacerbate greenhouse gas (GHG) emissions, biodiversity loss and water pollution associated with the unsustainable sourcing and manufacture of pulp and paper. Yet again, it is important to put this risk in context. In the UK, 633 thousand tonnes of plastic packaging 'arises' each year for pots, tubs, trays and other rigid plastics excluding bottles.[11] Assuming that all of that is replaced by paper and cardboard (a conservative assumption, as a portion could be removed without the need for replacement) and assuming that paper/cardboard would be 20% heavier (a conservative assumption[12,13]) this would require approximately 760 thousand tonnes of additional paper/cardboard. This would add 8% to the UK's consumption, which in 2015 was 9.1 million tonnes,[14] 70% of which was from recycled sources.[15] As above, this is not to say that reducing the impact of pulp and paper is not important, but that this should be addressed through a regulatory framework creating higher sustainability and performance requirements across the sector. Again, this requires policymakers to think and act holistically in addressing the plastic pollution crisis.

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[7] Institute for European Environmental Policy, 2018. The shortcomings of life cycle assessments in food packaging policy. Available here.
[8] IASKS, 2012. Life cycle assessment of packaging materials for milk and dairy products. Int. J. of Thermal & Environmental Engineering Volume 4, No. 2 (2012) 117-128. Available here
[9] https://friendsoftheearth.uk/plastics/plastic-or-glass-milk-bottles-crate-expectations
[10] https://www.gov.uk/government/statistical-data-sets/env02-greenhouse-gas-emissions
[11] WRAP, 2016. Plastics - market situation report. Available here
[12] http://www.bpf.co.uk/plastipedia/polymers/Recycled_PET_Egg_Boxes.aspx
[13] https://www.treehugger.com/green-food/which-milk-container-has-the-lowest-carbon-emissions.html
[14] http://www.paper.org.uk/information/pages/statistics.html
[15] WWF/RSPB, 2017. Deforestation and social risks in the UK's commodity supply chains. Available here

Question 2. What are the most important problems associated with single-use plastics, and why?

Single-use plastics have multiple impacts on the environment, the foremost being that of plastic pollution of the marine, freshwater and terrestrial environment. Thus meaningfully addressing plastic pollution, particularly at source, fully supports multiple Sustainable Development Goals.

Marine plastic pollution (SDG 14)

Up to 12 million metric tonnes of plastic leak into the oceans each year, a figure that could double by 2025 if current trends continue.[16] Marine plastic pollution is harming more than 800 species globally, through entanglement and ingestion, including marine mammals, turtles, seabirds and fish species, as well as causing physical damage to habitats.[17] A total of 40% of taxa are known to ingest marine debris, with rises in the number of cetacean species, marine fish and seabirds known to be affected by ingestion or entanglement, including open ocean, deep-water and temperate pelagic and demersal species.[18] Ingestion may cause blockage of the digestive tract leading to starvation, whilst entanglement can result in drowning, suffocation or strangulation.[19] Sub-lethal effects may also occur; entanglement or ingestion of debris can compromise feeding capacity and digestion and thereby cause malnutrition, disease, and reduced reproductive output, growth rates and longevity.[20]

The impact of microplastics, both those generated from fragmentation of larger single-use plastics (known as secondary microplastics) and those from direct sources of primary microplastics (such as microbeads, plastic pellets etc) may be even more far reaching than that of macroplastics. Microplastics are present in all marine habitats, from the ocean surface to sea ice to the seabed, and can be ingested by species throughout the marine food chain. They can persist in organisms' digestive systems, release, adsorb and transfer contaminants and allow toxins to be transferred up the food chain.[21] There is scientific evidence of adverse effects in a range of marine and freshwater species, including impacts on growth and reproduction in species that perform vital ecosystem functions and are important in commercial fisheries.[22]

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[16] Jambeck *et al.* 2015. Plastic waste inputs from land into the ocean, *Science*, available here.

[17] CBD, 2016. Marine Debris: Understanding, Preventing and Mitigating the Significant Adverse Impacts on Marine and Coastal Biodiversity. Technical Series No.83. Secretariat of the Convention on Biological Diversity, Montreal, 78 pages. Available here

[18] CBD, 2016. Marine Debris: Understanding, Preventing and Mitigating the Significant Adverse Impacts on Marine and Coastal Biodiversity. Technical Series No.83. Secretariat of the Convention on Biological Diversity, Montreal, 78 pages. Available here

[19] Laist, D.W., 1997. Impacts of marine debris: entanglement of marine life in marine debris, including a comprehensive list of species with entanglement. In: Coe, J.M., Rogers, D.B. (Eds.), Marine Debris – Sources, Impacts and Solutions. Springer-Verlag, New York, pp. 99–139.

[20] Katsanevakis, S., 2008. Marine debris, a growing problem: sources, distribution, composition and impacts. In: Hofer, T.N. (Ed.), Science. Science Publishers Inc., pp. 53–100.;
McCauley, S.J., Bjorndal, K.A., 1999. Conservation implications of dietary dilution from debris ingestion: sublethal effects in post hatchling loggerhead sea turtles. Conserv. Biol. 13, 925–929.

[21] Galloway, T. & Lewis, C. 2016 (and references therein). Marine microplastics spell big problems for future generations. PNAS, 113, 2331-2333;
GESAMP, 2015. Sources, fate and effects of microplastics in the marine environment: a global assessment (Kershaw, P. J.,ed.). (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 90, 96 p.

[22] Galloway, T. & Lewis, C. 2016 (and references therein). Marine microplastics spell big problems for future generations. PNAS, 113, 2331-2333.

Filter-feeding marine megafauna such as fin whales and basking sharks are at risk from high levels of microplastic ingestion and recent studies have documented plastic additives and Persistent Organic Pollutants (POPs) in the tissues of fin whales, basking sharks and whale sharks.[23]

The impacts of microplastic ingestion on marine fauna include gut blockage, physical injury, oxidative stress, altered feeding behaviour and reduced energy allocation, with resulting impacts on growth and reproduction.[24] In addition to physical impacts there is the potential for transfer of toxins associated with plastics. Microplastics can concentrate persistent, bioaccumulative and toxic (PBT) chemicals such as PCBs (polychlorinated biphenyls) and DDEs (metabolites of DDT, dichloro-diphenyl-trichloroethane) from seawater and often also contain additives with endocrine disrupting properties.[25] Recent modelling studies indicate that transfer of such contaminants is likely to be of greater importance with regards to incorporated additives than sorbed PBT chemicals.[26]

Eliminating marine plastic pollution is central to achieving Goal 14.1 to "By 2025, prevent and significantly reduce marine pollution of all kinds". The economic cost of damage caused by plastic pollution to marine ecosystems globally has been estimated to be at least $13billion per annum.[27]

Terrestrial and freshwater environments (SDG 15, SDG 6): All plastic begins on land, where through littering or leakage from waste systems on land and at sea, it can become a blight on landscapes and a threat to terrestrial and marine life. Annual plastic releases to land are estimated to be 4-23 times more than releases to oceans[28], and more than half of microplastics remain on land.[29] There is growing evidence that microplastics interact with terrestrial organisms that provide essential ecosystem services, such as fungi, invertebrates and pollinators, though further studies are needed to understand the potential impacts.[30] Recent research documented major impacts on UK wildlife, with litter killing up to 3.2 million shrews, voles and mice every year, a vital part of the food chain.[31] Analysis of drinking water samples in five continents have detected significant contamination rates for plastic fibres and the World Health Organisation is

[23] Germanov, E., Marshall, A. *et al.* 2018. Microplastics: No small problem for filter-feeding megafauna. Trends in Ecology & Evolution, 33, 227-232. Available here

[24] GESAMP, 2015. Sources, fate and effects of microplastics in the marine environment: a global assessment. (Kershaw, P. J., ed.). (IMO/FAO/UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 90, 96 p.

[25] Ananthaswamy, A. 2000. Junk Food - a diet of plastic pellets plays havoc with animals' immunity. New Scientist, 20/01/01.

[26] http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=17683&FromSearch=Y&Publisher=1&SearchText=5416&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

[27] https://www.unenvironment.org/news-and-stories/press-release/plastic-waste-causes-financial-damage-us13-billion-marine-ecosystems

[28] Horton, A., Walton, A. et al. 2017. Microplastics in freshwater and terrestrial environments: Evaluating the current understanding to identify the knowledge gaps and future research priorities. Science of the Total Environment, 586, 127-141.

[29] http://www.ciwem.org/microplastics-blog-over-half-of-microplastics-released-remain-on-land/

[30] De Souza Machado, A., Kloas, W. et al. 2018. Microplastics as an emerging threat to terrestrial ecosystems. Global Change Biology, 24 (4): 1405-1416.

[31] https://ciwm-journal.co.uk/new-research-reveals-impact-of-litter-on-uk-wildlife/

now conducting a review of the potential health impacts.[32] Recent research carried out in Swiss floodplains has also identified plastic presence in remote unsettled high mountain areas indicating that plastics enter soil through diffuse aeolian transport.[33]

Sustainable Consumption and Production (SDG 12): The way in which plastics are currently produced and consumed is highly unsustainable and inefficient. In the 60 years since large-scale production of plastics began, approximately 6,300 million metric tonnes (Mt) of plastic waste has been generated globally, of which 79% has accumulated in landfills or the natural environment.[34] An estimated 95% of the value of plastic packaging (EUR 70-105 billion) is lost to the global economy after a single use cycle.[35] Currently 26% of plastic produced is used for packaging, and under current trends the volume is expected to quadruple by 2050. Industry efforts have thus far focused on recycling to mitigate the environmental impact of their plastic waste but unlike other materials, most plastic can only be recycled a few times, and at marginal profit, before ultimately ending up in landfills, incinerated or entering the environment. Thus recycling will only delay, rather than solve the plastic pollution crisis. It is essential to decouple material consumption from growth and drastically reduce production and consumption of single-use plastics to avoid an even greater plastic pollution problem.

Climate change (SDG 14): The feedstocks used to produce virtually all plastics are derived from fossil fuels—namely oil, natural gas and coal. Carbon is emitted at various points during their life cycle, including during extraction, pipeline and refinery operations, production and conversion, and end-of-life treatment, such as incineration. Under business as usual, global plastic production will account for 20% of total oil consumption and 15% of the global annual 2°C carbon budget by 2050.[36] Overall natural capital costs of plastic use in the consumer goods sector are estimated at US$75 billion annually, over 30% of which are due to greenhouse gas emissions from raw material extraction and processing.[37]

Public Health (SDG 3, SDG 10): Plastics contain many chemical additives, including stabilizers and plasticizers, such as phthalates, as well as chlorinated, brominated and fluorinated compounds, which pose risks to human health and can leach into the environment.[38] Microplastics also attract and transport POPs and other toxins.[39] Under business as usual, 1.2 million tonnes of additives could enter our oceans per year by 2050, and combined with accumulations in soil and freshwater, cumulatively contaminate our food chain and water

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[32] See Chris Tyree and Dan Morrison (Orb), Invisibles: The Plastic Inside Us (2017), available at https://orbmedia.org/stories/Invisibles_plastics.

[33] Scheurer, M. and Bigalke, M., 2018. Microplastics in Swiss Floodplain Soils', Environmental Science & Technology *52* (6), 3591-3598, available at: https://pubs.acs.org/action/showCitFormats?doi=10.1021%2Facs.est.7b06003

[34] R. Geyer et al., "Production, use, and fate of all plastics ever made," *Science Advances* (2017), available here.

[35] Ellen MacArthur Foundation, The New Plastics Economy (2016), available here.

[36] World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company, The New Plastics Economy — Rethinking the future of plastics (2016, http://www.ellenmacarthurfoundation.org/publications).

[37] https://www.unenvironment.org/news-and-stories/press-release/plastic-waste-causes-financial-damage-us13-billion-marine-ecosystems

[38] Ellen MacArthur Foundation, The New Plastics Economy: Rethinking the Future of Plastics (2016), pp. 29-30.

[39] GESAMP, Sources, Fate and Effects of Microplastics in the Marine Environment: A Global Assessment (2015), p. 45

supplies.[40] Fossil-fuel extraction and refining also impact air and water quality of local residents and are often associated with human rights abuses in many indigenous and vulnerable communities. Additionally working and health and safety conditions in many countries accepting materials for recycling are often less than optimal.

Sources of plastic waste

Plastics originating from land-based sources make up most of the plastic pollution in the oceans, although there are some sea-based types of plastic debris (e.g. abandoned, lost or discarded fishing gear) that can have significant impacts on marine biota and habitats.[41] Although studies have identified Southeast Asia as a major source of plastic pollution[42], Europe, and the UK's contribution is not insignificant, with the River Tame near Manchester identified as having the highest levels of microplastic pollution documented anywhere globally to date.[43] Considered collectively, coastal European Union countries rank eighteenth in a recent assessment of global sources of plastic waste inputs from land,[44] discharging up to 218,000 tonnes of microplastics and up to 275,000 tonnes of macroplastics into the marine environment annually.[45] Recent analysis has shown that most marine plastic pollution arising in the UK ends up in the Arctic, as a result of ocean currents, where it is thought to cause "extreme harm to the fragile polar environment".[46]

Despite recent pledges by companies on plastics, UK plastic waste is still forecast to increase by over a million tonnes by 2030.[47] In 2018, plastic waste is estimated to reach 5.2 million tonnes, further increasing to around 6.3 million tonnes by 2030 – a 20% increase over the 12 year period. Packaging comprises 67% of the plastics waste stream in the UK, significantly higher than that in other European countries.[48] There is now an opportunity for the UK to demonstrate global leadership in tackling plastic waste through measures that reduce production and consumption of single-use plastics, addressing plastic pollution at source.

- **Which polymer types are particularly problematic?**

As set out in questions 8 and 12, we identify plastics with black carbon pigment, PVC, and expanded polystyrene as particularly problematic.

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[40] World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company, The New Plastics Economy — Rethinking the future of plastics (2016, http://www.ellenmacarthurfoundation.org/publications).

[41] CBD, 2016. Marine Debris: Understanding, Preventing and Mitigating the Significant Adverse Impacts on Marine and Coastal Biodiversity. Technical Series No.83. Secretariat of the Convention on Biological Diversity, Montreal, 78 pages. Available here

[42] Jambeck *et al.* 2015. Plastic waste inputs from land into the ocean, *Science*, available here. Lebreton, L.C., Van der Zwet, J., Damsteeg, J.W., Slat, B., Andrady, A. and Reisser, J., 2017. River plastic emissions to the world's oceans. *Nature communications*, *8*, p.15611.

[43] https://www.independent.co.uk/environment/greater-manchester-river-tame-microplastic-pollution-worst-ever-university-study-a8248576.html

[44] Jambeck *et al.* 2015. Plastic waste inputs from land into the ocean, *Science*, available here.

[45] Eunomia, 2016. Study to support the development of measures to combat a range of marine litter sources. Report for European Commission, 432 pp.

[46] https://www.theguardian.com/environment/2016/jul/05/plastic-waste-dumped-in-uk-seas-carried-to-arctic-within-two-years

[47] Eunomia, 2018. Plastics consumption and waste management in the UK. Report for WWF, available here

[48] Eunomia, 2018. Plastics consumption and waste management in the UK. Report for WWF, available here

- **Which items are particularly problematic?**

As set out in Question 1, we propose five broad categories for classifying plastic, in respect to their use value, the environmental and social harm they pose, and their substitutability. Within each category, a good guide for prioritisation is to target those items most prevalent within the natural environment.

Priority single-use plastic items that are particularly prevalent as plastic pollution include plastic cutlery, cups, food and drink containers, condiment sachets, straws, cotton buds and cigarette stubs. The top ten items found, by counts, during the Marine Conservation Society (MCS) 2017 Great British Beach Clean were:[49]

Rank	Material	Item
1	Plastic / Polystyrene	Pieces (0-50cm)
2	Plastic / Polystyrene	Wrappers (crisp, sweet, lolly, sandwich)
3	Glass	Other
4	Paper / Cardboard	Cigarette stubs
5	Plastic / Polystyrene	Caps/lids
6	Plastic / Polystyrene	String
7	Plastic / Polystyrene	Wet wipes
8	Plastic / Polystyrene	Cotton bud sticks
9	Plastic / Polystyrene	Fishing line
10	Plastic / Polystyrene	Cutlery / trays / straws

Packaging, in particular that of food and drink consumed ‘on the go’ is a major contributor to plastic pollution. On average 138 pieces of 'on the go ' litter were found per 100m of beaches surveyed, making up 20% of all plastic pollution found on the UK’s beaches. These items include plastic drinks cups, plastic cutlery, foil wrappers, straws, sandwich packets, lolly sticks, plastic bottles, drinks cans, glass bottles, plastic cups, lids and stirrers.

The latest information on street litter is provided by Keep Britain Tidy’s Great British Spring Clean in 2017[50] which shows that the majority is packaging and drinks related.

[49] MCS, 2017. Great British Beach Clean Report. Available here

[50] https://www.gov.uk/government/publications/litter-and-littering-in-england-2016-to-2017/litter-and-littering-in-england-2016-to-2017

Litter type	Percentage of litter recorded (3,226 items in total)
Food and food packaging	23%
Alcoholic drinks	22%
Non-alcoholic drinks	20%
Other, including tissues	13%
Smokers' litter	12%
Chewing gum and wrappers	5%
Dog faeces	5%

Question 3. Are there more environmentally friendly alternatives, currently available or possible in the future, to these types of single-use plastic items or their manufacturing processes, and can they still offer similar benefits?

As set out above, policymakers need to assess the viability of available alternatives holistically and on a case by case basis. Policy should be designed according to waste hierarchy principles so that, in the following order:

a. Producers and retailers remove unnecessary plastics, without substitution, and supply chains are (re)designed to reduce, so far as is possible, the need for single use plastics in the first place
b. Where (a) is not viable, single-use items are replaced with reusable alternatives, and supply chains are (re)designed to increase the viability of the most sustainable, reusable alternatives
c. Where (b) is not viable, single-use plastics are substituted with alternative materials which are themselves subject to tightened sustainability regulations

- **Should the government encourage biodegradability in plastics, and if so, how?**

No. In general, the government should not support biodegradable plastics. Foremost, biodegradable plastics do not address the problem of marine pollution or prevent littering. The industrial conditions required for biodegradation, as defined by European Standards EN13432 and EN14995, are often not met in the natural environment and those needed for rapid biodegradation rarely occur. For example, some need prolonged temperatures above 50°C.[51]

[51] Biodegradability of Plastics https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2769161/

Even under the most optimistic time frames, such biodegradable plastics could still cause death and injury to marine species through entanglement and ingestion. A study found that once ingested by sea turtles, the polymer mass of biodegradable plastics reduced by just 4.5 – 8.5% over 49 days.[52]

Currently, there is no standard providing clear pass/fail criteria for the degradation of plastics in sea water.[53] US standard ASTM D7081 (which has been withdrawn without replacement) defined marine degradable plastics as materials that, besides full biodegradation in a composting test, reach 20% biodegradation in a marine test within 6 months, and at least 70% disintegration within 3 months.[54] No finished product has been proved to be marine biodegradable.[55]

Biodegradable plastics pose additional sustainability problems. Under anaerobic conditions (i.e. without oxygen) often found in landfills, anaerobic microbes decompose biodegradable polymers into methane and carbon dioxide, dangerous greenhouse gases.[56] The widespread introduction of biodegradable plastics may also present recycling complications. They generally need to be recycled in separate waste streams to other polymers, which requires investment in separating technologies. Contamination of recycled plastics designed for a long service life with those designed to break down in the environment poses significant concern. There is also some evidence to suggest that labelling a product 'biodegradable' will result in a greater inclination to litter.[57]

Other 'alternatives' that are sometimes offered as sustainable replacements to conventional plastics – including bio-based plastics and compostable plastics – also need to be considered with caution and should not be encouraged, whilst oxo-degradable plastics should be banned, for reasons expressed below.

Bio-based plastics

Bio-based plastics are derived (at least in part) from renewable materials such as starch, cellulose, oils, wood and proteins.[58] While desirable to decouple production from fossil fuels, it would not be possible to sustainably meet current demand for plastics through bio-based sources, given the enormous land-use implications. For example, in 2013, bioplastic production required 600,000 hectares of land to produce 1.6 million metric tons of plastics – a fraction of the total demand, which reached 322 million tonnes in 2015.[59] Land use conversions associated with converting rainforests, peatlands and grasslands to produce bio-products could release 9 to 170 times more CO_2 than the annual greenhouse gas savings that bioplastics would provide by displacing conventional plastics.[60] Production puts significant pressure on other natural

[52] Experimental degradation of polymer shopping bags (standard and degradable plastic, and biodegradable) in the gastrointestinal fluids of sea turtles http://resodema.org/publications/publication17.pdf
[53] http://docs.european-bioplastics.org/2016/publications/fs/EUBP_fs_standards.pdf
[54] https://www.astm.org/DATABASE.CART/WITHDRAWN/D7081.htm
[55] https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_TheNewPlasticsEconomy_19012016.pdf
[56] Cho, H.S., Moon, H.S., Kim, M. et al. (2011) Biodegradability and biodegradation rate of poly(caprolactone)-starch blend and poly(butylene succinate) biodegradable polymer under aerobic and anaerobic environment. Waste Management. 31: 475–480.
[57] http://unesdoc.unesco.org/images/0024/002475/247517e.pdf
[58] http://www.bpf.co.uk/plastipedia/polymers/biobased_plastics_feedstocks_production_and_the_uk_market.aspx
[59] www.corbion.com/base/DownloadHelper/DownloadFile/7462
[60] *Land-use change emissions: How green are the bioplastics?*. Available from: https://www.researchgate.net/publication/230523937_Land-use_change_emissions_How_green_are_the_bioplastics

resources including fresh water, raising concerns of competition with agriculture and food security,[61] as well as potentially threatening biodiversity.

Similar to critiques of biodegradables, bio-based plastics do not solve the problem of plastic leakage into the ocean, and thus still pose threats of entanglement and ingestion. Furthermore, the widespread introduction of bioplastics could disrupt recycling systems. For example, sink and float systems for separating bottles made of PET (which sink) from those made of HDPE (which float) are contaminated by the bioplastic PLA.[62]

Compostable plastics

Compostable plastics could potentially be recovered through home or industrial composting systems, depending on their design for composting under different conditions. While they present some advantages over conventional plastics – for instance, they could return organic nutrients to the soil in applications prone to be mixed with organic contents, such as tea-bags or food waste collection bags – the government should not support their widespread adoption.

As with the other 'alternatives', compostable plastics that enter the marine environment will continue to pose risks to ocean ecosystems. Disposal challenges include that not all 'compostable' plastics necessarily compost at every industrial facility, as not all facilities operate at an appropriate level. For example, many compostable plastics take around 60 to 90 days to compost in an industrial facility, but many facilities operate on much shorter cycles (i.e. 30 days).[63] There is a lack of data available regarding the timeframes that UK facilitates operate on or the availability of kerbside compost collection across the UK. Many households do not have composting facilities, and even when they do, it is possible that home-based composting will often fail to achieve the heat or moisture levels needed to trigger biodegradation.[64] Use of compostable plastics in packaging formats that already have established recycling systems (e.g. bottles) are likely to result in contamination, particularly if consumers cannot readily tell the difference between compostable and conventional plastics.[65] As with 'biodegradable' plastics, it is also possible that labelling a product 'compostable' will result in a greater inclination to litter.

Oxo-degradable plastics

Oxo-degradable plastics should be banned. These are conventional polymers with chemicals that are added to accelerate the oxidation and fragmentation under UV light and/or heat, and oxygen.[66] They do not fulfil the requirements required for a plastic to be deemed 'compostable', such as ISO 18606, EN 13432 and ASTM D6400, as their biodegradation takes too long and plastic fragments can remain in the compost.[67]

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[61] https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2017/10/24/biobased-plastics-in-a-circular-economy/biobased-plastics-in-a-circular-economy.pdf
[62] http://www.green-alliance.org.uk/resources/Novel_Materials.pdf
[63] https://serc.berkeley.edu/compostable-plastics-are-they-playing-you/
[64] http://www.helenlewisresearch.com.au/wp-content/uploads/2014/03/Compostable-DSMG-082013.pdf
[65] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3791860/
[66] European Standards Organisation (CEN), CEN/TR 15351:2006 Plastics - Guide for vocabulary in the field of degradable and biodegradable polymers and plastic items: Oxo-degradation (or oxidative degradation) is defined as degradation identified as resulting from oxidative cleavage of macromolecules.
[67] European Bioplastics website, Harmonised standards for bioplastics webpage; European Bioplastics, Fact sheet - Bioplastics, industry standards and labels (2016); Plastics Europe, ibid.; California State University, Chico Research Foundation, Performance Evaluation of Environmentally Degradable Plastic Packaging and Disposable

As with other 'alternatives', oxo-degradables will be harmful to marine life if they enter the ocean, both in macroplastic and microplastic form, often taking much longer to degrade than claimed, with tests finding that approximately 98% of the oxo-degradable plastic remained after 40 weeks in sea water.[68] While producers assert that oxo-degradables are recyclable, others in the plastic industry report that they negatively affect the quality and economic value of plastic recyclates.[69] Oxo-degradables are more prone to degradation, which is damaging for medium- and long-life applications such as those used in construction. While stabilisers can be added to offset this, problems then arise related to the quantity of stabiliser required and how it affects the recycling process.[70]

Further information on the relevant definitions, standards, challenges to collection and recycling and environmental impacts of 'alternative plastics', including impact on marine species, carbon footprint and natural resource impacts is provided in Table A, Appendix 1.

Question 4. Are there single-use plastic items that are deemed essential by their nature or application, which cannot be substituted or avoided?

Bans, taxes and charges on single-use plastics must not inadvertently disrupt or increase the cost of vital services and processes like healthcare and scientific research. Government should develop 'essential use' categories within which specific products are exempt from taxes, charges and bans.

However, a single-use plastic item should only be classified as essential where both the application (or social utility) of the item is essential, *and* plastic is an essential component of the item.

For example, single use items used for medical purposes such as pre-sterilised gloves and syringes, and pre-sterilised plastics used in research laboratories, fulfil essential functions and cannot easily be substituted with alternative materials.

On the other hand, branded plastic confectionary wrappers within multi-brand packs may be difficult to substitute with non-plastic wrappers, but the function performed (branding) could not reasonably be described as essential. The same could be said for sachets containing liquid goods, where plastic is an essential, non-substitutable part of the product, but the use itself (provision of condiments in the limited number of scenarios where larger containers are not available) could not reasonably be described as essential.

Given 1) the many potential essential uses of single-use plastics, 2) the specialist knowledge required to classify an item as essential or otherwise, and 3) the fact that classifications may change as new technologies emerge - it would not be practicable for legislators to attempt to produce, in isolation, an exhaustive list of essential uses exempt from taxes, charges and bans. This should also not be left to a self-regulating industry body, as the commercial interest of plastic producers to classify plastic items as essential would create a conflict of interest.

Food Service Ware – Final Report (2007): study proving the oxo-degradable carrier bags on the market remained intact and did not show any sign of biodegradation.

[68] T. O'Brine, R. C. Thompson, Degradation of plastic carrier bags in the marine environment, Marine Pollution Bulletin (2010)

[69] Such as the British Plastics Federation, Website/BPF Recycling group, in DEFRA response to OPA (2012)

[70] https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/13941/4/warm165-133.pdf

As such, we recommend that the Government establishes a Plastics Advisory Committee, to provide annual recommendations to ministers on essential uses of plastic. To ensure impartiality, the Committee's membership should be drawn from leading materials science academics, and draw evidence from stakeholders including representatives of sectors that consume essential single-use plastics (e.g. health, research, security), producers of essential single-use plastics, independent experts and environmental NGOs. The recommendations of the Committee should be made public.

POLICY OPTIONS

The rationale for taxes, charges, bans and Extended Producer Responsibility

Taxes

Environmental taxes are traditionally explained as a way to 'price-in' the costs to society of pollution which the market, left to itself, does not take into account, and thereby reduce the polluting activity to a 'socially optimal' level.[71] According to this approach, the environmental and social harm of a product or service are 'external' costs, not taken into account by buyers or sellers of those goods or services. The role of taxation is to 'internalise' these costs, increasing the price of the good or service to reduce its prevalence to the point that the private benefit derived from the good or service is balanced against the social cost.

More recent approaches have sought to reframe the objectives of economic policy as a) providing a 'social foundation' that meets fundamental needs around food, health, income and so on, and b) avoiding crossing 'planetary boundaries' like climate change, air pollution and chemical pollution.[72] According to this approach, environmental taxes should be set at a level that deters goods and services to the extent that planetary boundaries are not crossed, but not to the extent that social needs cannot be met.

Taxes are sometimes seen as preferable to bans because setting an incentive without legislating for a specific outcome leaves some flexibility for the market to determine the optimal outcome.

Taxation of an item may also be useful as a precursor to a ban, shifting behaviour over time in a way that reduces the economic and political barriers to bans.

From the above, it follows that taxation on plastic is appropriate where:

- Production and consumption of plastic items shifts in response to changes in price; and
- Production and consumption can be shifted to an 'optimal level', or one within planetary boundaries; and
- Policy makers want to leave some flexibility in the market to determine the optimal level

It also follows that taxation on plastic is not appropriate where:

- Changes in price do not shift production and consumption at the required scale or pace; and/or
- There is no 'optimal level' of production for the plastic item, due to the environmental and social harm it poses and/or its limited role in meeting a social need

Charges

The economic rationale for a charge is the same as for a tax with the difference that with a charge, proceeds are not passed to Government. Proceeds might go to good causes, which is the case for the larger retailers under carrier bag charges, or be retained by the business. From the Treasury's perspective this would likely be preferable to a tax where:

[71] https://www.ifs.org.uk/comms/r68.pdf
[72] https://www.kateraworth.com/doughnut/

- The proceeds are likely to be relatively trivial; and
- The number of actors from whom the proceeds need to be collected is large.

Essentially, the administrative burden of collecting taxes should not be too high relative to the overall tax take. As such, HM Treasury has a preference for taxes that achieve the greatest level of taxation, from taxing as few actors as possible.

Bans

Bans are appropriate where fiscal incentives do not shift production and consumption of goods or services at the required scale or pace, and/or goods or services are particularly harmful and have a limited social use.

It is also worth noting that bans have an advantage over taxes and charges in that they are simpler for businesses to comply with and are simpler for public authorities to administer. For example, for plastic items for which non-plastic alternatives with lower environmental impacts are readily available (e.g. disposable cutlery or stirrers), the administrative simplicity of a ban, and lack of need for flexibility, would make a ban preferable over a tax or charge.

Extended Producer Responsibility

Extended producer responsibility (EPR) is defined by the OECD as "an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle."[73] The practical implications of this approach are that responsibility for collecting or taking back used goods, and for sorting and treating for their eventual recycling lie with producers. Such responsibility may be simply financial or, additionally, organisational.

EPR is consistent with the polluter pays principle, in that it is intended to shift the end-of-life costs away from citizens/taxpayers, towards producers/consumers. It can also be designed in such a way as to provide financial incentives to design products and packaging for reuse or to facilitate recycling at the end of life and increase recycled content.

The extent to which EPR can actually bring about improvements in environmental outcomes depends, broadly, on 1) the overall magnitude of the fees faced by producers, which relates to the extent to which all end of life costs are covered, and 2) the 'granularity' of the scheme in attributing accurate end of life costs to specific types of materials and applications.

For example, under the UK's current approach to producer responsibility for packaging – which is very different to most other packaging EPR schemes in Europe – it is estimated that only 10% of the costs of dealing with the materials at end of life are covered by producers. The rest are covered by taxpayers. This leads to very little incentive to improve practices.

EPR is not necessarily an alternative to a tax or charge, but can be used to complement taxes and charges. For example, a tax on single-use cups is designed to reduce consumption of single-use cups, and incentivise switching to reusable alternatives. EPR on the other hand is designed to ensure that for the remaining single-use cups brought to market, producers are responsible for the costs associated with their disposal.

[73] http://www.oecd.org/env/extended-producer-responsibility-9789264256385-en.htm

The shortcomings of the UK's existing approach to EPR - a market-based offsetting scheme known as the Packaging Recovery Note (PRN) system - are well documented.[74,75] These include lack of transparency, over-complexity, price volatility, perverse incentives on data recording, difficulty regulating, an incentive to export waste, and the fact that producers cover only a fraction of the full cost of recycling. As such, it is important to note that the proposals in this submission for EPR measures do not refer to measures within the existing PRN system, but within a fully reformed, genuine EPR programme.

In addition to the item-specific measures (bans, taxes and charges) at various stages of the life cycle recommended within this submission, all single-use plastics and packaging of all material types should be subject to a reformed EPR scheme. The following principles should be considered:

- Transparency in data of different types of plastics and packaging materials placed on the market and recycling rates per annum.
- Full cost coverage of end of life costs including for separate collection for recycling, costs for collection in the residual waste stream and of litter collection, costs of recycling, treatment and disposal.
- Application of item-specific fees where a particular product is disruptive to the recycling process or is highly littered
- Granularity in attributing accurate end of life costs to specific types of materials.
- Modulation of fees in order to incentivise eco-design and to drive a continued reduction in the production and sale of single-use products and packaging. Fees should be modulated based on material type, plastic type, the application of the material within the item (single vs multipolymer formats), reusability, recyclability and actual rates of recycling achieved, recycled content and requirements for sortability.
- Ongoing review of efficacy of EPR fees in driving eco-design.

While EPR can be used to achieve cost coverage and provide incentives on eco-design, EPR on its own is not well-suited to driving waste prevention. To bring about significant waste prevention, in terms of a reduction in the number of items produced and consumed, other measures such as bans, taxes or charges are more appropriate.

The plastics lifecycle

There are different ways to conceptualise the lifecycle of a plastic product depending on the purpose of the exercise (e.g. comparative life-cycle analysis, supply chain analysis etc[76,77,78]. In identifying intervention points for bans, taxation and charges, the six stages below offer a helpful framework. The rationale and effect of interventions vary at each stage, as summarised below.

Stage 1 - Extraction of raw materials: Oil and natural gas are the key 'feedstocks' for most plastics, though this process will also include the sourcing of biomass (e.g. corn and wheat) which can be converted into plastic. Given that only 4% of oil is used for plastic production

[74] Eunomia, 2018. Plastic packaging: Shedding light on the UK data. Available here
[75] https://greenallianceblog.org.uk/2018/02/12/ten-things-i-hate-about-how-uk-recycling-is-not-funded/
[76] http://www.mdpi.com/2076-3298/4/2/39/htm
[77] http://www.polymerjournals.com/pdfdownload/880407.pdf
[78] http://www.diva-portal.org/smash/get/diva2:546648/FULLTEXT01.pdf2

globally[79] - plastics focused interventions at this stage (e.g. an extraction tax) would have implications far beyond plastics. Although extraction level interventions are appropriate to tackle other environmental problems like global warming, it is probably too broad a tool to target plastics.

Stage 2 - Material formation (Refining/polymerisation): Where specific materials are problematic irrespective of the use (e.g. black carbon pigments, PVC, EPS) interventions at the material formation stage should be considered to the extent that 'essential' uses are not affected. Where policymakers wish to influence post-consumption (e.g. ease of recycling for particular materials) interventions should also be considered.

Stage 3 - Product formation from the polymer(s): Where the specific item is problematic (e.g. a single-use plastic cup) but policymakers do not wish to restrict the use of the material across the board due to useful applications (e.g. PET used in medical applications) interventions at this stage are appropriate. Where policymakers wish to influence the choice of feedstock (e.g. virgin plastic v. recycled plastic) or post-consumption (e.g. ease of recycling of particular product designs), or where policymakers are concerned that producers will export products the sale of which is restricted in the UK, interventions should also be considered.

For the purposes of this submission, stages 2 and 3 are referred to as 'production' stages.

Stage 4 - Wholesale and retail: Where retailers and wholesalers have the option to switch to no packaging, reusable packaging/items or lower impact packaging/items, and a fiscal incentive is likely to encourage that switch, interventions at this stage should be considered. Taxing retailers on the items they purchase from producers can be more targeted than taxing producers, as retailers determine the specific use to which an item is put, whereas the end use of an item may not be clear at the production stage and taxation/bans may affect essential uses. Where policymakers are concerned that wholesalers/retailers will import products the production of which is restricted in the UK, interventions should also be considered.

Stage 5 - Consumption: Where consumers have the option to switch to no packaging, reusable packaging/items or lower impact packaging/items, and a fiscal incentive is likely to encourage that switch, interventions at this stage should be considered. However, policymakers should be mindful that a) consumer behaviour can be 'sticky' and not respond to fiscal incentives (see e.g. the energy retail market where only a minority of consumers switch to cheaper tariffs[80]); b) consumer facing charges, as more publicly visible, can carry greater political risk than upstream measures; and c) administering a tax or charge upstream on producers and retailers, where there are fewer regulated entities, has lower transaction costs.

Stage 6 - Post-consumption: Upstream measures to reduce the number of single-use plastics brought to market, and ensure those that are brought to market are recyclable at reasonable cost will be more effective than dealing with single-use plastic once it becomes waste. At the same time, post-consumption measures should be designed to disincentivise the amount of waste going to landfill (through a higher landfill tax) and incineration, and incentivise the amount sent for recycling. Adequate funding of collection and disposal through a reformed EPR scheme upstream is essential at this stage.

[79] http://www.bpf.co.uk/press/oil_consumption.aspx
[80] Competition & Markets Authority, 2016. Energy market investigation. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/531157/Energy-final-report-summary.pdf

Expected timeframe for implementation

The Soft Drinks Industry Levy (known as the 'Sugar Tax') was announced in the 2016 March Budget, and entered into force two years later in April 2018.[81] Similarly, the Carbon Price Floor was announced in the 2011 March Budget, and entered into force two years later in April 2013.[82] Accordingly, we would expect new plastics taxes announced in the autumn Budget of 2018 to be implemented by 2020 at the latest. There is precedent for new taxes to be introduced in less than a year (see for example, the Bank Payroll Tax, announced at 2009 Pre-Budget Report and applying from December 2009[83]) so ideally, we would like to see new plastic taxes enter into force in less than two years.

Bans and charges can be implemented to a faster schedule. Accordingly, we urge the Government to implement bans on problem plastics by 2019 and bring into force new charges by 2019.

[81] http://www.legislation.gov.uk/uksi/2018/41/regulation/1/made
[82] http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN05927#fullreport
[83] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/247878/0451.pdf

INTRODUCING CASE STUDIES

For the purposes of this consultation response, we have selected four single-use items as case studies for how bans, taxes, charges and EPR reform could work in practice to drive reduction, reuse and recycling. We propose policy interventions at the production, retail and consumption stage for each. These are not standalone case studies, but point to measures government should take to tackle similar single-use plastic items and polymers.

We consider:

1. Sachets - These are an example of what we classify as 'pointless plastic'. Other examples of pointless plastic include poly bags used in supermarkets to carry fruit and vegetable bundles, disposable cutlery, double/triple wrapping of confectionery, multilayer pouches containing liquid household products, and shrink wrapping of non-perishable goods.
2. Single-use cups - These are an example of what we classify as 'replaceable plastic', as readily available alternatives (e.g. reusable cups) are available. Other examples of replaceable plastic include straws, carrier bags and cotton buds.
3. Black and coloured plastics - These are both an example of what we classify as 'problem plastic' (where they are non-recyclable at reasonable cost), and 'replaceable plastic' (where they are recyclable, but easily substitutable). Other examples of problem plastics include expanded polystyrene and PVC
4. Take-away containers - These are an example of 'problem plastic' (where made from polystyrene), 'replaceable plastic' (where they a substitutable with reusable alternatives/low impact alternatives) and in some instances, 'difficult to replace' plastic

Sachets: Single-serve sachets are typically used for condiments such as ketchup, mayonnaise, vinegar, salt and sugar. Sachets are also used for cosmetics like shampoo and perfume in sample sizes. Such packaging is usually made of either multi-layer flexible materials or laminates, such as polyethylene coated paper, and plastic coated foils. Sachets are frequently consumed out of cafes and restaurants, and will usually enter the residual waste stream, or become littered – sometimes being blown away from terraces or other locations where customers are outdoors.

Non-plastic alternatives are already available in paper for dry goods like sugar, salt. However, paper sachets would not be appropriate for liquid goods. Multi-use alternatives to single serve sachets exist in the form of larger, re-usable dispensers for condiments. Dispensers or bottles for condiments such as ketchup, mustard, brown sauce and vinegar used to be very common and still are in some establishments.

There is no publicly available data on UK consumption of single portion sachets, however, it is likely to be in the tens of billions given what is known about the levels of consumption of other single-use plastic items in the UK.[84]

Single-use cups and lids: Single-use cups can be made from expanded polystyrene (EPS), polyethylene (PE) coated card in the case of paper cups used for coffee and sodas, and thermoformed PET/PP such as those used for milkshakes, smoothies and juices. It is widely

[84] http://www.eunomia.co.uk/reports-tools/a-plastic-future-plastics-consumption-and-waste-management-in-the-uk/

reported that annual consumption of single-use coffee cups in the UK is circa 2.5 billion. However, this figure, from 2014, is now considered by an industry expert to be an underestimate, with the overall size of the problem likely to be over 10 billion cups per annum, and set to grow further.[85]

Just 1 in 400 (0.25%) of coffee cups are currently recycled, and an estimated 500,000 cups are littered every day.[86] Although both the paper and plastic components of disposable cups are recyclable in theory, they are not recyclable in practice at most local authority recycling centres due to the difficulty separating the paper fibre and the polyethylene lining.[87] Hence, even if a disposable coffee cup is placed in a paper recycling bin, it is unlikely to be recycled. Furthermore, notwithstanding the difficulties in recycling, cups are often used 'on-the-go' and thus are unlikely to be disposed of into recycling collection points, only 37% of councils offer bring and recycle on-the-go schemes and cups are likely to need to be collected separately from other recyclable waste in order to channel them to appropriate facilities.[88] In the last five years, the Marine Conservation Society's Beachwatch beach clean and survey programme has seen an increase of 93% in plastic cups found on UK beaches.[89]

While some may be marketed as such, a truly biodegradable (under any circumstance) single use cup has yet to be developed. A waterproof layer is needed to preserve the mechanical strength of the cup when filled with liquid, and there are currently no fully compostable options. Some paper cups, which are often classified as biodegradable, have a plant-based polylactic acid (PLA) waterproof layer. However, this PLA layer impedes the ability of the cup to degrade in non-controlled environments – such as the marine environment – as it only breaks down under specific industrial composting conditions.

Regarding cup lids, there are currently no plastic- or PLA-free alternatives.

Given the lack of options for switching away from plastics in single-use cups, the focus should therefore be on reducing single-use cups in circulation, and preventing waste through incentivising the use of reusable cups.

Black and coloured plastics: An estimated 1.3 billion black plastic trays (black crystallised polyethylene Terephthalate or CPET) are used in ready meal packaging in the UK every year.[90] The problems associated with recycling black plastics, particularly CPET coated with the carbon black pigment, are well studied. While the material is technically recyclable, the main issue lies in the current inability of near-infrared technology to effectively identify the carbon black pigment and sort this material from others. This means that most get sent to landfill.[91] There is no official source of waste data for black plastic in packaging applications, though a report written by Nextek for WRAP estimates that there are 30,000 – 60,000 tonnes of black packaging per year in the household waste stream.[92] The non-sortability of black plastics also has repercussions on

[85] https://www.edie.net/blog/To-keep-the-momentum-of-circular-economy-brimming-we-need-to-battle-for-the-cup/6098093
[86] https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/657/657.pdf
[87] https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/657/657.pdf
[88] Recoup, 2016. UK Household Plastics Collection Survey. 58pp.
[89] https://www.mcsuk.org/news/Coffee-cup-charge-response
[90] http://www.wrap.org.uk/sites/files/wrap/In_market_trial_to_prove_recycling_process_for_black_CPET_trays_case_study.pdf
[91] http://www.wrap.org.uk/content/recyclability-black-plastic-packaging-0
[92] http://www.wrap.org.uk/sites/files/wrap/Recyclability%20of%20black%20plastic%20packaging.pdf

the quality of recyclate being processed at materials recycling facilities; without separating black PET from black PP for example, the material becomes low value and hard to use. There is also the problem that plastic packaging in other colours, such as grey, brown and blue may also contain carbon black pigment, meaning that tackling black plastic packaging alone is not the solution.[93]

There are very few absolutely compelling practical reasons to use black plastic, the main one being to completely protect products from UV deterioration due to exposure to light. For the most part, the reasons why it is used are aesthetic; for example often as a signifier of high quality ranges. Retailers are already moving away from black plastic. Waitrose, for example, has pledged not to sell any of its own-label food in black plastic beyond 2019.[94]

Take-away containers: Takeaway food packaging filled at the point of sale, including clamshells made of Expanded Polystyrene (EPS), lined/waxed paper, and other rigid plastics are common due to their low cost, light weight, durability and insulating properties.
Even if disposed of correctly, high amounts of food contamination, particularly for such food packaging types as pizza boxes and chip wrapping, make such items technically difficult to recycle. Although increased awareness amongst brands of the negative public perception of EPS has prompted a switch to PE-coated card and paper composites, usually packaged together with plastic films, adoption of these materials does not address the issues of litter and recyclability associated with takeaway packaging.

Data is very sparse as to the number of individual types of takeaway packaging items used in the UK. However, it is possible to derive an approximate estimate based on figures suggesting that adults in the UK are eating 22 million fast food and takeaway meals every week.[95] That equates to 1.15 billion fast food and takeaway meals a year. The average number of containers per meal is likely to be more than one, given that some takeaway meals will involve multiple containers. Therefore it may well be that usage is closer to 2 billion fast food containers per annum (figures from Eunomia).

Alternatives exist to single-use takeaway in the form of reusable takeaway container schemes such as the sustainable tiffin scheme currently operated by the Thali chain of restaurants. Notably, the Asian Catering Federation (ACF) has announced plans for introduction of a nationwide Tiffin Club which will allow ACF's members to purchase reusable tiffin sets which they then provide to customers in return for a refundable deposit, a membership fee and a donation to a partner charity targeting marine plastic.

[93] https://www.plastikmedia.co.uk/black-plastic-food-trays-are-just-the-tip-of-the-iceberg-warns-colour-tone
[94] https://www.mcsuk.org/news/waitrose_black
[95] https://www.huffingtonpost.co.uk/entry/100-million-ready-meals-and-takeaways-being-consumed-by-uk-adults-each-week_uk_58b931c2e4b0d2821b4d1a72

PRODUCTION

Question 5. What factors influence the choice of polymer, or combination of polymers, in the production of single-use items?

- **Can you provide data on the production and use of single-use plastic items you produce?**

The UK is among the largest consumers of single use plastics in Europe. The table below compiled by Eunomia for WWF highlights the projected item use for 2018.[96]

Product	Consumption (2018), billion items	Ranking within EU28 based on consumption per capita
Cotton buds	13.2	1
Sanitary towels	4.1	1
Crisp packets	8.3	2
Wet wipes	10.8	2
Cutlery	16.5	2
Straws	42.0	2
Stirrers	44.1	2
Drinks cups and lids	4.1	2
Food containers	5.2	2
Sweet wrappers	6.0	8
Drinks bottles	10.1	8
Cigarette filters	45.8	25
Total	210.2	5

[96] https://www.wwf.org.uk/sites/default/files/2018-03/WWF_Plastics_Consumption_Report_Final.pdf

- **What proportion of the polymers you use or sell do you import and export, respectively?**

Not applicable

- **What proportion of the single-use plastics you produce do you export?**

Not applicable

Question 6. What proportion of the plastic that you produce is made of recycled plastic, and what are the barriers to increasing this?

Currently, due to limited corporate transparency, it is hard to ascertain the overall proportion of plastics entering the UK market made of recycled content.

A number of companies have endorsed targets to increase the proportion of recycled content contained in packaging including through the recent WRAP UK Plastics Pact. Signatories commit to target a 30% average recycled content across all packaging by 2025.[97] This has been endorsed by companies including Pret, Sainsburys, Lidl and Danone, among others.[98] However, it is worth noting that there are no enforcement mechanisms to ensure that companies follow through with this pledge.

A number of supermarkets have set individual targets to increase the proportion of recycled content, with examples listed below (note that not all are specific to plastic):

- By 2025 Aldi aims for 50% of its packaging to be made from recycled material;[99]
- Lidl aims to increase the amount of recycled materials used in its own-brand packaging by 50% by 2025;[100]
- By 2022, M&S will assess the feasibility of making all their plastic packaging from one polymer group, which will help maximise the use of recycled content.[101]
- Sainsburys aims to increase recycled materials in packaging. 38% of material in primary packaging is post-consumer recycled;[102]
- Tesco's plastic bags are made of 80% recycled content, and will offer fresh food packaging made of 95% recycled content from LINPAC for some meat and poultry.[103]

Various barriers have been identified to a wholescale transition to recycled plastics, including underdeveloped markets (which in turn inhibits investment in technology and facilitates); contamination in recycling streams; a lack of standardisation of recycled grades; and aesthetic

[97] http://www.wrap.org.uk/content/the-uk-plastics-pact
[98] http://www.wrap.org.uk/content/plastics-pact-members
[99] https://www.aldipresscentre.co.uk/press-releases/view/482
[100] https://www.lidl.co.uk/en/Packaging-and-plastic-12985.htm?ar=1
[101] https://corporate.marksandspencer.com/documents/plan-a/plan-a-2025-commitments.pdf
[102] https://www.about.sainsburys.co.uk/~/media/Files/S/Sainsburys/documents/making-a-difference/sainsburys-sourcing-with-integrity-kpis.pdf
[103] https://www.tescoplc.com/little-helps-plan/our-targets-actions/#section7

limitations which affect marketing and branding.[104] Some of these issues can be addressed through legislation, such as the setting of mandatory recycled content targets or through economic incentives, such as a tax on virgin polymers, tax relief where recycled content is above a certain level or other economic incentives under EPR schemes for manufacturers that use recycled plastic content, to ensure that this is the cheaper option than using virgin polymers. Such measures would help make recycled content a more cost effective choice at the production stage as opposed to virgin polymers, in turn boosting the domestic recycling sector. Measures to drive up the standard of recycled content can also be introduced, as well as to standardise grades of recycled plastic.

Taxing virgin plastic resins (production) would entail taxing companies either selling or purchasing resins. For companies selling, the tax base would be the weight/value of the resins and the taxpayers would be the plastic manufacturers. For companies purchasing (i.e. converters), the tax base would be the weight/value of the resins, and the taxpayers would be the converters. Such a tax should be accompanied by tariffs on the imports and exemptions on the exports of plastic products and products containing plastics. Whether on sales or purchases, such a tax would contribute to making recycled plastics more competitive and should increase over time.

While an increase in recycled content is welcome and preferable to the current situation; this alone cannot solve the problems associated with plastic pollution. Regardless of the recycled content, if they enter the natural environment, plastics will continue to cause injury and death of species through entanglement and ingestion and even when captured for recycling, are after a few short cycles, ultimately destined for landfill or incineration, with associated environmental impacts. Plastic production has increased twentyfold in the past half-century and is expected to double again in the next 20 years.[105] The only long-term, comprehensive way to address plastic pollution is to significantly reduce consumption.

Question 7. What proportion of the plastic that you produce is commercially recyclable and what are the barriers to increasing this and improving the grade it can be recycled to?

A lack of corporate transparency makes it hard to assess the amount of plastic being placed on the market which is widely recyclable. In 2016, Co-op reported that 45% of our own-brand packaging is widely recyclable.[106] Tesco states that over 78% of its packaging is recyclable, though this depends on the type of material accepted by local authorities.[107]

A number of retailers have made commitments to increase the recyclability of plastics:

- By 2022 Aldi aims for 100% of all own label packaging (expanding to all products by 2025) to be recyclable, reusable or compostable (where it does not have a detrimental effect on product quality or safety, or increase food waste).[108]
- Asda has committed to make all own brand packaging 100% recyclable by 2025.[109]

[104] https://www.ellenmacarthurfoundation.org/assets/downloads/ce100/Scaling-Recycled-Plastics-across-Industries.pdf
[105] http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf
[106] https://assets.ctfassets.net/ha6uma2zsxub/351z57di4o0mA0EUaCEK8I/be2cdee88303f08903d76556ee8f2939/convenience_report.pdf
[107] https://www.tescoplc.com/little-helps-plan/products-packaging/
[108] https://www.aldipresscentre.co.uk/press-releases/view/482
[109] https://corporate.asda.com/media-library/document/plastic-unwrapped/_proxyDocument?id=00000161-6552-dcfd-a37b-fff368bf0000

- Co-op has a target that 80% will be easy to recycle by 2020, working towards 100%. Currently, 46% packaging material is easy to recycle by product line.[110]
- Lidl has committed that 100% of own-brand packaging will be widely recyclable, reusable, refillable or renewable by 2025.[111]
- By 2022, all M&S product packaging in the UK will be not only 'recyclable', but 'widely recycled'.[112]
- Tesco packaging will be fully recyclable or compostable by 2025.[113]
- Waitrose will make all of its own-label packaging, across all food categories, widely recyclable, reusable or home compostable by 2025.[114]

In addition, a number of companies have endorsed a recycling target through the recent WRAP UK Plastics Pact. Signatories commit to 70% of plastic packaging being effectively recycled or composted by 2025.[115] Of course, recycling targets do not reflect recycling rates, which are much lower and these targets are non binding. Data compiled by Co-op found that two thirds of Britain's recyclable plastic packaging is not being recycled.[116] The overall plastic recycling rate is much lower still. Government statistics say that in 2015, UK households and businesses generated 2.26m tonnes of plastic packaging waste, reflecting the amount placed on the market, achieving a recycling rate of 39%.[117] Eunomia estimates the figure for plastic packaging waste generated to be closer to a range of 3.1 to 3.9 million tonnes, and the real recycling rate in 2015 to be between 23% and 29%.[118]

As with the introduction of targets to increase recycled content, advances in recyclability are welcome and preferable to the current situation. However, the focus must remain on reducing current consumption trends if the problems associated with marine plastic pollution are to be comprehensively addressed.

Question 8. In your opinion, how can the tax system or charges play a role in delivering better environmental outcomes at this stage?

- **What interventions should be implemented, and why?**

Black and coloured plastics: production stage

The Government should ban the use of pigments in packaging that cannot, at reasonable cost, be detected by near-infrared (NIR) sorting technology. This includes carbon black pigment.

[110] https://resource.co/article/co-op-commits-100-cent-recyclable-plastic-packaging-11865
[111] https://www.lidl.co.uk/en/Packaging-and-plastic-12985.htm?ar=1
[112] https://corporate.marksandspencer.com/documents/plan-a/plan-a-2025-commitments.pdf
[113] https://www.tescoplc.com/little-helps-plan/our-targets-actions/#section7
[114] http://www.waitrose.com/home/inspiration/about_waitrose/the_waitrose_way/packaging.html
[115] http://www.wrap.org.uk/content/the-uk-plastics-pact
[116] https://assets.ctfassets.net/ha6uma2zsxub/351z57di4o0mA0EUaCEK8I/be2cdee88303f08903d76556ee8f2939/convenience_report.pdf
[117] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/683051/UK_Statisticson_Waste_statistical_notice_Feb_2018_FINAL.pdf
[118] Eunomia 2018, Plastic Packaging Shedding Light on the UK Data

There are already alternative black pigments that are NIR detectable.[119] As such, there is no 'optimal use' of carbon black pigment in packaging, and it can be classified as a 'problem plastic' in which a ban is more appropriate than a tax or charge on production.

A ban on production of packaging with hard to detect pigments is needed alongside a ban on sale to ensure that UK producers do not export these items overseas, where they are also likely to enter waste streams.

Even where the polymer type can be detected, black and coloured plastics still present a waste problem due to a lack of end markets (research by Eunomia). Given that the vast majority of black and coloured plastic is chosen for aesthetic purposes, and alternative packaging solutions exist that achieve a similar effect[120] it can be classified as a 'replaceable plastic'.

As such, the Government should introduce a tax to incentivise producers to move away from NIR detectable black and coloured plastics. At the same time, the Government should introduce an EPR scheme, which in principle should involve producers covering full end of life costs, with fees modulated based on reusability, recyclability (and perhaps more importantly actual rates of recycling achieved), recycled content and requirements for sortability. This already occurs in France, where the French Producer Responsibility Organisation (PRO) Citeo (formerly Eco-Emballages) charges a 'penalty' fee to producers who put 'disruptive' packaging on the market.[121]

In the medium term, the production of black and coloured plastic packaging should be phased out in full, with derogations for essential uses. Where EPR is not effective at reducing production, the phase-out should be expedited.

A ban on the production of plastic packaging using problem pigments would help to eliminate such items from the UK supply chain, and contribute to a reduction of such items placed on the global market.

Public data is not available on the profit margins associated with black and coloured plastic packaging production, and so the effect of EPR on remaining black and coloured plastic packaging is difficult to model. It is also possible that producers would be able to pass additional costs on to retailers, given that for premium goods, the costs of the packaging represents a fraction of the retailer's costs.

For these reasons, the Government should monitor the effects of EPR on production and consumption, and where this is below the desired effect, expedite a phase-out.

Another example of a 'problem plastic' is polyvinyl chloride (PVC). The production of PVC involves the creation of toxic waste, notably ethylene dichloride (EDC) tar and dioxins, which end up in some of the process wastes and, in some instances, in the PVC itself.[122] PVC is one

[119] http://www.wrap.org.uk/sites/files/wrap/Recyclability%20of%20black%20plastic%20packaging.pdf

[120] http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=PLASTIC_ZERO_sort_plast_brochure_final_en.pdf

[121] https://ieep.eu/uploads/articles/attachments/47856bb4-4af9-47a6-a710-7af0fe8b3518/Policy%20options%20brief%20EPR%20price%20modulation%20IEEP%20Nov%202017%20final.pdf?v=63677462325

[122] https://www.greenpeace.org/archive-international/en/campaigns/detox/polyvinyl-chloride/the-poison-plastic/

of the world's largest dioxin sources, and this group of chemicals comprises some of the most toxic chemicals ever released into the environment. Further, PVC recycling is neither technically nor financially feasible. While a number of retailers have voluntarily phased-out the use of PVC in packaging and elsewhere[123] it is still used in the UK in trays and pots[124] and an estimated half a million tonnes are used in packaging applications across Europe.[125] Accordingly, the UK Government should lead by introducing a ban on the production of PVC for packaging.

Take-away containers: production stage

The Government should ban the production of clamshells, trays and other items designed to hold take-away food, made from expanded polystyrene (EPS). Although EPS is technically recyclable, in practice, very little of the material is recycled—as with most on-the-go single use packaging. Its low density that makes it cheap to produce also makes it less financially viable to collect and recycle as it takes up a great deal of room on a recycling vehicle relative to its weight. Furthermore, it is actually a fairly brittle material that can easily fragment at any point in the disposal process. Both the lack of recycling and the nature of the material mean that it frequently ends up in the environment where it fragments into microplastics. Indeed, the most commonly found item in the Marine Conservation Society's Great British Beach Clean 2017 was plastic/polystyrene pieces (0-50cm).[126] In addition to environmental impacts, there is emerging evidence that styrene, a key component in polystyrene, is 'probably carcinogenic', according to the World Health Organisation's International Agency for Research on Cancer.[127] Accordingly, EPS is a 'problem' plastic and production should be banned in all single-use applications including take-away containers, other packaging (e.g. food packaging and domestic appliance packaging) and phased out for fish boxes.

The Government should introduce a tax that covers the production of non-EPS plastic take-away containers. This would likely cover a wider range of uses than take-away food (e.g. fruit punnets), all of which could be characterised as 'replaceable' (e.g. switching to reusable containers and card-based alternatives). Where such a tax is weight based, which is arguably a simple basis for implementation, the effect might be to encourage a shift towards lightweighting, which can be problematic from an environmental perspective if it means increased used of plastic films and laminates. As an alternative, Government should explore a unit tax set at a level sufficient to disincentive producers. This could be set relative to the per-unit margin on each item produced.

In addition to a tax to disincentivise production, the Government should introduce a per-unit EPR charge on every plastic container placed on the market to properly cover end of life costs.

Single-use cups and lids: production stage

In a circular economy, there is no place for a single-use cup. Single-use cups can be classified as 'replaceable plastic' given that reusable alternatives are available, and ultimately, the aim should be for a complete phase out of single-use cups in the form of a ban on production. Given

[123] http://www.ethicalconsumer.org/portals/0/downloads/clothes%20shops.pdf
[124] http://www.wrap.org.uk/content/types-plastic-packaging
[125] http://www.bpf.co.uk/article/bpf-responds-to-waitrose-ban-on-pvc-use-in-packaging-267.aspx
[126] http://www.isonomia.co.uk/?p=4196
[127] https://chemicalwatch.com/register?o=66688&productID=1&layout=main

the global nature of the plastic pollution problem, banning the production of single-use cups in the UK would avoid the appearance of hypocrisy in continuing to allow items produced in the UK to be exported elsewhere (and potentially be littered and end up in UK waters). Allowing UK-based production to continue might also undermine the UK's diplomatic efforts (through for example, the Commonwealth Clean Oceans Alliance) to persuade other governments to follow suit and ban consumption if UK companies are selling into their markets.

As a precursor to a ban, there is a need to reduce consumption of single-use cups, and properly cover the end of life costs of single-use cups placed on the market. An item-specific EPR fee for all single-use cups and lids placed on the market (including those sold in bulk to members of the public through retailers) could thus be used to cover the costs associated with end of life management of these items – which should in principle include the costs for those that are recycled, the cups that remain in the residual stream, and those that are littered and subsequently collected.

As noted above, plastic coated paper is recyclable in theory, but rarely recycled in practice due to the expense of doing so and the difficulties in separating it from co-mingled waste collections.[128] When composted, the plastic in plastic coated paper does not biodegrade, making its way into compost treated soils and contributing to the problem of microplastic pollution.[129] Plastic coated paper is widely used in the food and drink packaging industry, and beyond single use cups, is used for paper plates, cartons, frozen food containers and paper bags. Accordingly, the Government should introduce a tax on the production of plastic coated paper, escalating to an eventual phase out, to incentivise the innovation of plastic free alternatives.

Sachets: production stage

The vast majority of single-use plastic sachets produced are used to deliver sample size portions of condiments and cosmetics. Accordingly, they could be characterised as 'pointless plastic' in that they have limited social utility for which no alternatives are required.

One argument that is sometimes put forward is that sachets ensure good 'portion control', and thus prevent food waste, and that therefore their use should not be restricted. However, this has not been demonstrated to be true. Indeed, from work Eunomia has done in the quick service restaurant sector, there is considerable variation in the number of 'consumables' such as ketchup sachets, sugar sachets, milk tubs, stirrers, napkins etc. given away across branches of the same chains. Those that better control access to consumables - by keeping them behind the counter and only providing them on request – give away far fewer than those that may just hand them out automatically. It seems reasonable to assume that of those that are given to customers without having been requested, a higher proportion will be wasted. Ensuring that sachets are not given away for free would be expected to lead to customers only asking for as many as they will actually use.

As noted in section 12, a tax or charge on sachets at the retailer or producer level would not be expected to change production or consumption levels. This would suggest a ban on plastic sachet production as the appropriate measure. However, any ban would require derogations to allow production of potentially essential uses for sachets (e.g. anti-bacterial lubricating gels, sterilised wipes for medical purposes).

[128] https://recycling.co.uk/paper-recycling-information/
[129] https://ecocycle.org/files/pdfs/microplastics_in_compost_presentation.pdf

A ban on the production of single-use plastic sachets (subject to derogations) would help to eliminate such items from the UK supply chain, and contribute to a reduction of such items placed on the global market. Although UK export data on plastic sachets is not readily available, any reduction in global supply would be welcome given the impact of sachets produced by European companies on waterways and beaches in Southeast Asia.[130]

Similarly, a ban on production should be applied to other comparable 'pointless plastics', including straws, stirrers and plastic utensils. An exemption could be considered (based on the availability of alternatives) for the use of plastic straws by people with disabilities and in the medical sector.

[130] https://zerowasteeurope.eu/2016/07/the-curse-of-sachets-in-asia-why-western-companies-should-be-held-accountable/

RETAIL

Question 10. Can you provide data on the volumes and costs of different types of single-use plastic used?

There is a lack of transparency regarding the quantity and type of single use plastics placed on the UK market by different corporate actors. According to recent research, the UK is among the largest consumers of single use plastics in Europe. The table below compiled by Eunomia for WWF highlights the projected item use for specific items in 2018.[131]

Product	Consumption (2018), billion items	Ranking within EU28 based on consumption per capita
Cotton buds	13.2	1
Sanitary towels	4.1	1
Crisp packets	8.3	2
Wet wipes	10.8	2
Cutlery	16.5	2
Straws	42.0	2
Stirrers	44.1	2
Drinks cups and lids	4.1	2
Food containers	5.2	2
Sweet wrappers	6.0	8
Drinks bottles	10.1	8
Cigarette filters	45.8	25
Total	**210.2**	**5**

[131] https://www.wwf.org.uk/sites/default/files/2018-03/WWF_Plastics_Consumption_Report_Final.pdf

Question 12. In your opinion, how can the tax system or charges play a role in delivering better environmental outcomes at this stage?

- **What interventions should be implemented, and why?**

Black and coloured plastics: retail stage

For the reasons outlined in section 8, the Government should ban the sale of plastic packaging using pigments that cannot, at reasonable cost, be detected by near-infrared (NIR) sorting technology. This includes carbon black pigment.

A ban on the sale of packaging using non-detectable pigments is needed alongside a ban on production to ensure UK retailers do not import these items from overseas, leading to an unfair competitive loss for UK-based producers of more sustainable packaging. A ban on the sale of plastic packaging using problem pigments would eliminate such items from the UK supply chain.

Even where the polymer type can be detected, black and coloured plastics still present a waste problem due to a lack of end markets (research conducted by Eunomia). Given that it is retailers who will specify black packaging – typically for food packaging, where it is chosen for aesthetic reasons as a signifier of higher quality - it is appropriate that retailers should be subject to a tax on each item they purchase from producers. In determining the appropriate level for a tax, it is important to consider that black plastic is not selected because it is cheaper than alternatives. Looking at a sample of rigid plastic trays, black trays are marginally more expensive (7.7p per tray) than equivalent clear trays (7.6p per tray).[132]

As a 'replaceable plastic', in the medium term, the sale of black and coloured plastic packaging should be phased out in full, with derogations for essential uses. Where a tax is not effective at reducing sales, the phase-out should be expedited.

The effectiveness of a tax on remaining black and coloured plastic packaging – if applied across all such packaging at a standard rate per tonne - would be difficult to discern given that different retailers might place a higher or lower value on the use of black plastics in specific applications. For example, for a premium beef steak, where presentation were important in encouraging customers to pay the premium, the retailer would likely be happier to continue to pay more to use black plastic, compared to an application where the black plastic is not actually visible at the point of sale (where the plastic tray is fully contained within a cardboard outer, for example).

For these reasons the Government should monitor the effects of taxation on production and consumption, and where this is below the desired effect, expedite a phase-out.

Take-away containers: retail stage

For the reasons set out in section 8, the Government should ban the sale or distribution of take-away containers made from expanded polystyrene.

[132] https://www.plastikmedia.co.uk/black-plastic-food-trays-are-just-the-tip-of-the-iceberg-warns-colour-tone/;%20https:/www.propacpackaging.co.uk/d2-45-clear-padded-197-x-155-x-45.html

Increasingly, take-away meals are provided through home delivery.[133] For this sector, the Government should explore measures to incentivise the provision of reusable containers by retailers - dropped off by and returned to couriers or by customers. As noted above, a number of outlets are already implementing reusable containers, but overall use across the sector remains low. To increase uptake, Government should introduce a tax on all single-use containers purchased by restaurants and fast food outlets. At present, packaging costs are a small percentage of the meal cost (the Asian Catering Federation reports that the packaging for a typical family meal for four costs around 25p (research from Eunomia) whereas the average order for one home delivery service is reportedly £24.20[134]). Therefore an additional 10 or 20 percent on the cost of the containers will not be an adequate incentive for outlets to shift behaviour. Accordingly, we suggest a per unit tax of 50p on each single-use plastic container purchased by food outlets - subject to periodic review. Importantly, the Government should encourage standardisation of reusable containers to prevent the risk of households stockpiling containers.

For take-away food purchased on the go, it is probably unrealistic to expect consumers to carry reusable containers. Government efforts here should seek to incentivise outlets to find no-packaging and low-impact packaging solutions. These solutions will vary according to the food type (soup, sandwiches and salads/prepared meals all present different challenges) but again, a per unit tax of 50p on each single-use plastic container purchased by outlets should provide the incentive needed to drive innovation.

In addition to a tax to reduce use, the Government should introduce a per-unit EPR charge on every plastic container placed on the market to properly cover end of life costs.

Single-use cups and lids: retail stage

As noted in section 8, in a circular economy, there is no place for a single-use cup, and ultimately the Government's aim should be for a complete phase out of single-use cups in the form of a ban on the sale of single-use cups in the UK. One retailer, Boston Tea Party, has taken a lead on this, becoming the first chain in the UK to ban all disposable cups, with customers having to use their own, or borrow a reusable cup.[135]

As noted in section 8, there are currently no alternatives to single-use plastic cups that do not contain plastic, due to the requirement for waterproofing and rigidity. Therefore, a tax on retailers purchasing cups from retailers would not lead to a shift in more sustainable purchasing by retailers, and would be less effective than a consumer facing tax on sale. However, retailers, like producers, should be subject to an item-specific EPR fee for all single-use cups and lids placed on the market to cover the costs associated with end of life management. In addition, the Government should introduce a tax on single-use cups at the point of sale for the reasons laid out under Section 16.

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[133] https://www.theguardian.com/lifeandstyle/2017/mar/03/restaurant-takeaway-delivery-boom-uk-deliveroo-ubereats-food

[134] https://london.eater.com/2018/3/29/17175482/deliveroo-future-plans-robots-profits-investors

[135] https://www.edie.net/news/5/Boston-Tea-Party-becomes-first-coffee-chain-to-ban-all-disposable-coffee-cups/?utm_source=Greenhouse+Morning+News&utm_medium=email&utm_campaign=1afc6bca3c-Greenhouse_Morning_News_April_25th_2018#.WuA3f14guwU.twitter

Sachets: retail stage

The Government should ban the sale or distribution by retailers of sachets, and comparable pointless plastics such as straws, stirrers and utensils, as applying an additional tax (or an item-specific fee under EPR) on retailers would not be expected to curb consumption.

While they are often given away for free at the point of sale, sachets are relatively expensive for retailers. One of the cheapest examples of a Heinz 10ml (11g) tomato ketchup sachet found online costs 7 pence per unit, equivalent to 64 pence per 100g of product[136]. Elsewhere, the purchase of 200 of the same Heinz sachets, can be at a cost of about 9.5p per sachet, which is 86 pence per 100g of product.[137] This is two to three times the cost of condiments purchased in bottle form (from research conducted by Eunomia)

Retailers are clearly not buying sachets because they are cheaper. One practical reason for retailers purchasing sachets might be for food that is to be eaten off-premises, and for which the customers wish to apply condiments at the point of eating and not before. Another might simply be that they feel that customers expect to have condiments available in sachets – and freely available. There is evidence to suggest that for many, the expectation is that condiments will not be separately charged for. Of course, there is no reason why condiments in refillable containers which stayed on the premises could not also be free.

[136] https://www.sachetsandmore.com/product/heinz-tomato-ketchup-sachets/
[137] http://m.restaurantsupplystore.co.uk/heinz-sachets-tomato-ketchup-200-pcs

CONSUMPTION

Question 13. What factors influence consumers' choices related to single-use plastic items?

Numerous factors influence consumer behaviour, including price, convenience, availability, marketing and knowledge. At the moment most consumers do not have a choice. Single use plastics given out by businesses such as food and drink outlets are chosen for their convenience and low price and very rarely are customers offered an alternative.

While 'soft' policy interventions to increase consumer choice can have a positive impact, it is worth noting the limitations of simply providing consumers with a choice. For example, should consumers be expected to choose between clear and coloured plastics, on the basis that colouring can make plastic unrecyclable? First, the public are presented with a number of competing issues as regards, for example, the health, climate and labour rights implications of their buying choices, and it is unrealistic to expect consumers to take all of these issues into account, including recyclability, with each purchase. Second, colouring of plastics is often done for branding purposes to make products more attractive to consumers, so it would be contradictory to expect consumers to respond negatively to colouring. Third, there is a natural expectation on the part of the consumer that products (and particularly packaging) available for sale by trusted brands are not harmful to the environment. Hence, even where consumers do have a choice and knowledge of an issue, this may not be enough to drive behaviour change without harder policy interventions like bans and taxation upstream.

Question 16. In your opinion, how can the tax system or charges play a role in delivering better environmental outcomes at this stage?

- **What interventions should be implemented, and why?**

Black and coloured plastics: consumption stage

A tax or charge on the consumption of black and coloured plastics is not advisable, as customers have no option to avoid this packaging at the point of sale.

Take-away containers: consumption stage

A tax or charge on the consumption of take-away containers is not advisable as, unlike reusable cups, it is probably unrealistic to expect the public to carry reusable containers, and consumers do not typically have a choice about the type of container provided by outlets. Given the above, a consumer-facing tax or charge may also be viewed as punitive.

Single-use cups and lids: consumption stage

The Government should introduce a tax on single-use cups at the point of sale.

The tax should be applied to retailers of all sizes. This would maximise the intended shift in preference for reusables through creation of a social norm, i.e. people will expect to pay the tax

or charge everywhere they go if they use a disposable cup. This will mean a quicker payback for those who choose to 'invest' in a reusable cup.

A number of larger retailers have already implemented financial incentives to encourage the use of reusable cups. Most commonly, coffee shops offer a discount for customers using reusable cups. The main coffee shops offer the following discounts:

- Costa Coffee and Pret a Manger: 50p;
- Starbucks: 25p; and
- Caffe Nero: double loyalty stamps (free hot drink after 9 stamps).

A number of smaller retailers have started offering discounts as well, such as Patisserie Valerie (50p), Paul (25p) and Greggs Bakery (20p).

Starbucks is the only chain in the UK that is trialling charging customers for the use of paper cups. The trial began in February for a period of three months and is only applied in a limited number of stores (35 London branches). The charge has been set at 5p. Starbucks have reported reusable cup usage has more than doubled in the first six weeks of the trial.

The Foreign and Commonwealth Office introduced their own levy on coffee cups in their UK operations in February 2018 and has since increased the fee per single-use cup from 10p to 50p.

UK Parliament have announced a 25p charge will be added to hot drinks served in compostable cups from September 2018 across the Parliamentary Estate. Reusable coffee cups will be available to buy, and incentives will be offered to customers who refill them. This measure is part of a comprehensive range of steps to drastically reduce Parliament's consumption of single-use plastics by 2019.

A tax is preferable to a discount for a number of reasons. A recent study by academics at Cardiff University[138] involving a trial at a small number of coffee shops noted (in respect of a charge, but the same points relate to a tax) that, "a charge may be more effective than a discount. These results are in line with prospect theory, which suggests that people are more sensitive to losses than to gains when making decisions. A charge on disposable cups (a loss) is therefore more likely to produce behaviour change than a discount on a reusable cup (a gain)."

Furthermore, it is worth noting that while there is a precedent for placing a fee on specific items (such as the charge on single-use carrier bags) it is unclear whether Government could mandate that all retailers must offer a discount of a certain value. Finally, there are concerns among smaller retailers that they could not sustain discounts without raising prices. While this would undoubtedly be the case for larger retailers as well, smaller retailers consulted by Eunomia felt that their margins are likely to be lower, and therefore they wouldn't be able to sustain similar discounts to those offered by the likes of Starbucks and Costa if too many people started bringing in their own reusable cups. The concern is therefore that they would have to start raising their prices sooner than the large retailers, which would place them at a disadvantage, potentially losing customers to the big retailers.

A tax is also preferable to a charge. While the waste prevention effects of a tax or a charge would be the same, a tax would avoid the risks – that could occur with a charge – that funds

[138] http://orca.cf.ac.uk/99366/1/Coffee%20cup%20summary%20report%20-%20Poortinga%20%28FINAL%29.pdf

disbursed by retailers displace CSR spending, and lead to undue influence over recipients, who themselves might become overly dependent upon the proceeds of the charge, potentially limiting their support for high ambition in respect of waste and litter prevention.

This is not an insignificant consideration. If a tax were implemented at 25p, and brought about a reduction in consumption of 40%, the gross amount raised would be £1.5 billion (figures from Eunomia calculation). To put this in context, fuel duty, which represents 3.6 per cent of tax receipts, is expected to raise £28.2 billion in 2018-19. If a tax on disposable cups raised £1.5 billion, it would account for 0.19% of tax receipts (before deduction of 'reasonable costs').

It is worth noting that HM Treasury has a preference, unsurprisingly, for taxes that achieve the greatest level of taxation, from taxing as few actors as possible. Accordingly, there might be merit in considering a tax on takeaway cups for larger retailers, but a charge, set at exactly the same level, for smaller retailers. However, this should be a 'fallback' position, with a tax on all retailers being preferable.

It is difficult to estimate the extent to which a reduction in use of disposable cups might be achieved for a certain level of tax. This is because there is, as yet, no observable example of such a tax on disposable cups, from which one might be able to transfer estimates of:

- Initial declines once the tax is implemented; and
- Any further reductions in consumption over time if and when the level of the tax is increased.

The initial declines observed in the Cardiff trial are certainly lower than those that would be expected if a nationwide tax were implemented. Under a tax, consumers would have a guarantee that the financial incentive for using a reusable will endure. This is in stark contrast to both the Cardiff trial, and the current mixture of industry-offered discounts, which may prove to be time limited. Confidence that the incentive will endure will encourage customers to 'invest' in a reusable cups.

Interestingly, recent research from Starbucks suggests that 48% of customers would carry their own reusable cup to avoid a charge. In a 2017 submission to the Environmental Audit Committee, Eunomia suggested that for a tax of 25p per cup reductions in the order of 30% - perhaps not immediately, but over time - do not feel wildly wide of the mark. Since then, interest in the idea of a tax on cups has grown, as has the number of retailers offering discounts, alongside Starbucks' trial of a charge. Accordingly, it may be that a decline in the first year of 30 to 40 percent, or perhaps more could reasonably be expected for a tax of 25 pence.

Over time, however, the level of the tax could be increased, and combined with the likelihood that more people will own reusable cups, and the possibility that other chains may join Boston Tea Party in banning disposable cups, the social norm could be expected to shift considerably. Therefore, declines of perhaps 80 - 90%, as seen for carrier bags, could be achieved through a tax. Of course such discussion is somewhat speculative in nature. Accordingly, the Government should establish a monitoring and evaluation process, with the effectiveness of the tax being reviewed periodically, with a view to increasing the level of the tax if further declines in consumption are required. Results of the monitoring should be made publicly available, alongside the Government's rationale for any decision to maintain or increase the level of the tax.

Sachets: consumption stage

A consumer facing tax/charge on sachets at the point of sale may lead to a large reduction in use as consumers would go from a situation where something that was previously, free ‘at the margin’ (i.e. taking one would cost them no more than taking none) is now ‘infinitely’ more expensive at 5p or 10p (analysis commissioned from Eunomia). However, given the limited justification for the presence of sachets in the first place (as set out above), the administrative burden of introducing, collecting and enforcing a charge relative to the amount that would be raised, and the inconvenience of a tax or charge for consumers, we recommend a ban on production, sale and distribution as simpler and more effective than a consumer facing tax/charge.

For the same reasons outlined above, we recommend a ban on production, sale and distribution of single-use plastic straws, stirrers and utensils as simpler and more effective than a consumer facing tax/charge. However, in order to encourage waste prevention and reduce consumption non-plastic single-use alternatives should be subject to a tax or charge.

DISCARDING AND WASTE TREATMENT

Question 17. What are the barriers to the collection of single-use plastics and more environmentally friendly methods of waste treatment, including barriers to any existing technologies?

As plastic consumption increases, recycling has not kept pace. Worryingly, progress on recycling in England has stalled since 2012 and recycling rates fell for the first time in 2015 (from 44.8% in 2014 to 43.9% in 2015).[139]

The effect of the financial crisis and associated austerity measures have had a noticeable impact on local authority services. Between 2015 and 2020 the Revenue Support Grant to English local authorities will have been cut by 75%, with almost half of local authorities scheduled to no longer receive any core central government funding by 2019/20.[140]

The starting point to improving outcomes at the discarding and waste treatment stages is to ensure that collection and treatment infrastructure is properly funded. As noted above, producers and retailers putting products onto the market currently contribute only a fraction of disposal costs. Whereas the current PRN system is worth around £60 million a year, local authorities spend around £600 million collecting packaging.[141] Relying on the taxpayer to cover end of life costs is contrary to the polluter pays principle, and a fully reformed approach to EPR should ensure producers and retailers are financially responsible for these costs.

The Chinese ban on waste imports has highlighted the lack of domestic recycling capacity in the UK, with trade representatives warning that lower grade plastics are already piling up in the yards of waste processing facilities in the UK[142] and around the world.[143] Investigations by Greenpeace's investigative journalism arm *Unearthed* have revealed that the UK exports around two-thirds of the one million tonnes of plastic collected for recycling each year.[144] The UK does not have enough domestic capacity to handle its own waste, with a number of reprocessors having gone out of business in recent years. As a result, there will inevitably be increased incineration and landfill of plastic waste in the UK following the China ban – with the accompanying environmental hazards. Runoff from landfill and spillage on collection are key pathways through which 'correctly' disposed of plastics enter the ocean.[145]

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[139] https://www.gov.uk/government/statistics/local-authority-collected-waste-management-annual-results

[140] https://larac.org.uk/sites/default/files/LARAC%20POLICY%20PAPER%20The%20future%20of%20LA%20Waste%20Funding%200418.pdf

[141] https://larac.org.uk/sites/default/files/LARAC%20POLICY%20PAPER%20The%20future%20of%20LA%20Waste%20Funding%200418.pdf

[142] https://www.theguardian.com/environment/2018/jan/02/rubbish-already-building-up-at-uk-recycling-plants-due-to-china-import-ban

[143] https://www.nytimes.com/2018/01/11/world/china-recyclables-ban.html

[144] https://unearthed.greenpeace.org/2017/03/13/data-uk-exporting-two-thirds-plastic-waste-amidst-concerns-illegal-practice/

[145] https://www.sciencedaily.com/releases/2017/04/170425092245.htm

UK Trade Info statistics reveal that China (including Hong Kong), Indonesia and Vietnam were also among the top five recipients of UK plastic waste exports in 2016.[146] This means that the UK exports plastic waste to countries already overwhelmed with managing their own waste, where resources would arguably be better used collecting and recycling domestically generated waste. Furthermore, waste exported for recycling is included within recycling statistics, though there is little transparency in the proportion of waste actually recycled upon receipt, particularly given problems with exports of low quality and contaminated waste.

European law requires national authorities to prohibit the export of waste to countries where there are grounds to believe waste will not be managed in accordance with human health and environmental protection standards that are broadly equivalent to standards established in EU legislation (Regulation (EC) No 1013/2006 Of The European Parliament And Of The Council, Art. 49). However, the Environment Agency does not conduct remote monitoring and enforcement of standards, and there is evidence that standards in China, and likely in other export destinations, can fall dramatically below EU equivalent standards. As such, the UK has little control in practice over how waste is handled once exported.

There is thus an evident need for the UK to invest more in its collection and recycling infrastructure. This submission is agnostic about whether funds raised through taxation should be hypothecated for investment in collection and recycling, though given that the taxation measures proposed are geared towards reduction, the associated revenue streams would ideally diminish over time, and may be an unreliable base for funding new infrastructure.

Eliminating problem plastics that are expensive to process, and reducing single-use plastics overall, would also reduce costs and increase recycling rates for the residual waste stream. The bans on black and coloured plastics, polystyrene, sachets etc proposed in this submission would have a positive effect in this regard. For example, stirrers and food containers have recycling rates of less than 10%, while all other product types other than bottles are rarely recycled, with recycling rates of less than 1%.[147] The reduction of commonly littered single-use items like take-away food containers will also help to reduce local authority clean-up costs, which in England alone cost the taxpayer between £717 and £850 million a year for litter clean up.

In addition to removing problem plastics from the waste stream, there is a need to standardise recycling practice across the UK (and particularly between neighbouring local authorities) to reduce high levels of public confusion over what is and isn't recyclable, as consumer confusion results in lower collection rates and/or more contamination.[148]

[146] https://www.uktradeinfo.com/Statistics/OverseasTradeStatistics/Pages/OTS.aspx
[147] https://www.wwf.org.uk/sites/default/files/2018-03/WWF_Plastics_Consumption_Report_Final.pdf
[148] https://www.ciwm-journal.co.uk/downloads/Viridor-UK-Recycling-Index-2017.pdf

Appendix 1 - Environmental impacts of biodegradable, bio-based, compostable and oxo-degradable plastics

Table A - Definitions, standards and environment impacts of “biodegradable”, bio-based, compostable and oxo-degradable plastics

	“Bio-degradable” plastics	Bio-based plastics	Compostable plastics	Oxo-degradable plastics
Definition and relevant standard	Biodegradation is the partial or complete breakdown of a polymer as a result of microbial activity, into carbon, hydrogen and oxygen, as a result of hydrolysis, photodegradation and microbial action (enzyme secretion and within-cell processes).[149] Complete biodegradation occurs when none of the original polymer remains. European standards EN13432 and EN14995 define the characteristics of biodegradability and compostability.[150]	Bio-based plastics are derived (at least in part) from renewable plant materials such as starch, cellulose, oils (e.g. rapeseed oil), lignin (wood) and proteins (maize zein).[151] Most bio-based plastic materials (~80%) in Europe are starch-based, with major sources including maize, potatoes and cassava. [152] Bio-plastics can indicate their ‘bio-based carbon content’ or ‘bio-based mass content’.[153] Bio-based carbon content is measured by the 14C-method (EU standard: CEN/TS 16137, US standard: ASTM 6866). A material can	A compostable plastic undergoes degradation by biological processes to yield CO_2, water, inorganic compounds and biomass.[154] Compostable plastics are manufactured from either fossil-based on bio-based materials. Depending on the polymer used, compostable packaging could be recovered through home or industrial composting systems. A packaging item compliant with the industrial criteria set in BS EN 13432 is considered 'compostable'.[155] Similarly, a plastic item compliant with the industrial 'compostability' criteria set in BS EN	Oxo-degradable plastics are conventional polymers (e.g. LDPE) to which chemicals are added to accelerate the oxidation and fragmentation of the material under the action of UV light and/or heat, and oxygen.[156] Oxo-degradable plastics do not fulfil the requirements of relevant standards for plastic packaging and plastics recovery through composting, such as ISO 18606, EN 13432, ASTM D6400, AS 4736 or GreenPla, as their biodegradation takes too long, and plastic fragments can remain in the compost.[157] The

[149] https://wedocs.unep.org/bitstream/handle/20.500.11822/7468/-Biodegradable_Plastics_and_Marine_Litter_Misconceptions,_concerns_and_impacts_on_marine_environments-2015BiodegradablePlasticsAndMarineLitter.pdf.pdf?sequence=3

[150] http://docs.european-bioplastics.org/2016/publications/fs/EUBP_fs_standards.pdf

[151] http://www.bpf.co.uk/plastipedia/polymers/biobased_plastics_feedstocks_production_and_the_uk_market.aspx

[152] http://www.bpf.co.uk/plastipedia/polymers/biobased_plastics_feedstocks_production_and_the_uk_market.aspx

[153] https://www.european-bioplastics.org/bioplastics/materials/biobased/

[154] ASTM Standard D833, 2008, "Standard Terminology Relating to Plastics," ASTM International, West Conshohocken, PA, 2008, DOI: 10.1520/D0883-08, www.astm.org

[155] https://www.ellenmacarthurfoundation.org/assets/downloads/EllenMacArthurFoundation_TheNewPlasticsEconomy_15-3-16.pdf

[156] European Standards Organisation (CEN), CEN/TR 15351:2006 Plastics - Guide for vocabulary in the field of degradable and biodegradable polymers and plastic items: Oxo-degradation (or oxidative degradation) is defined as degradation identified as resulting from oxidative cleavage of macromolecules.

[157] European Bioplastics website, Harmonised standards for bioplastics webpage; European Bioplastics, Fact sheet - Bioplastics, industry standards and labels (2016); Plastics Europe, ibid.; California State University, Chico Research Foundation, Performance Evaluation of Environmentally Degradable Plastic Packaging and

	"Bio-degradable" plastics	Bio-based plastics	Compostable plastics	Oxo-degradable plastics
		also indicate its bio-based mass content. The European Committee for Standardization is currently developing a standard for this.	14995 is considered 'compostable' (see below for more details). At present there are no specific standards for home compostable packaging and plastics.	EU are proposing to ban oxo-degradable plastics and a range of groups signed an Ellen Macarthur Foundation statement opposing them.[158]
Example polymers	PBS, PCL, PBAT, PVOH, bio-PVOH, bio-PBS, PHA	Bio-PET, bio-PE, PEF, bio-PP, bio-PA, bio-PVOH, PHA	PLA, ecovio®, starch-based polymers, cellulose-based polymers	Oxo-biodegradables are made from polymers such as PE, PP, and PS containing extra ingredients (metal salts).
Conditions for degradation	Applicable for packaging, EN13432 requires at least 90% disintegration after twelve weeks, 90% biodegradation in six months, and includes tests on ecotoxicity and heavy metal content.[159] EN 14995 describes the same requirements and tests, and applies to plastics in general. Conditions required for biodegradation are rarely met in the natural environment. For example, some need prolonged exposure to temperatures 50°C+.[160] Currently, there is no standard providing clear pass/fail criteria for the degradation of plastics in sea water.[161] US legislation ASTM D7081 defined marine degradable plastics as materials that, besides full biodegradation in a composting test, reach 20% biodegradation in a marine test within 6 months, and at least 70% disintegration within 3 months. However, this standard was withdrawn without replacement.[162]	Some bio-based plastics are also biodegradable (PHA, bio-PBS, bio-PVOH), but this is not a necessary criterion.[164] Many will take as long as conventional plastics to break-down.	A material is industrially compostable if it meets the following criteria (EU standard EN13432):[165] • **Chemical characteristics**: It contains at least 50% organic matter and does not exceed a given concentration for some heavy metals. • **Biodegradation**: It biodegrades by at least 90% within six months under controlled composting conditions (temperature of 58 +/- 2°C). • **Disintegration**: It fragments into pieces smaller than 2 mm under controlled composting conditions within 12 weeks. • **Ecotoxicity**: The compost obtained at the end of the process does not cause any negative effects (which could be measured by the effect on germination and growth of plants). Home compostable must be treatable at ambient temperatures. The timeframes for biodegradation and disintegration can be longer. Parameters such as moisture content, aeration, pH, and carbon	The oxidation process enables faster fragmentation. In theory, this should then accelerate biodegradation. This process depends on multiple criteria, including fragment size, quantity of additives, and the environmental conditions to which the material is subjected (e.g. temperature, biotic factors) - conditions that vary significantly in practice.[166] In the environment, they fragment into smaller pieces, including microplastics which is different from biodegradation. Studies show that the entire process varies and often takes (much) longer than claimed.[167]

Disposable Food Service Ware – Final Report (2007): study proving the oxo-degradable carrier bags on the market remained intact and did not show any sign of biodegradation.

[158] https://newplasticseconomy.org/news/over-150-organisations-back-call-to-ban-oxo-degradable-plastic-packaging

[159] http://docs.european-bioplastics.org/2016/publications/fs/EUBP_fs_standards.pdf

[160] Biodegradability of Plastics https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2769161/

[161] http://docs.european-bioplastics.org/2016/publications/fs/EUBP_fs_standards.pdf

[162] https://www.astm.org/DATABASE.CART/WITHDRAWN/D7081.htm

	"Bio-degradable" plastics	Bio-based plastics	Compostable plastics	Oxo-degradable plastics
	No finished product has been approved as marine biodegradable.[163]		to nitrogen ratio do not need controlling.	
Impact on marine species	Even under the most optimistic biodegradation time horizons, marine debris arising from so called "biodegradable" plastics could still cause death through entanglement and ingestion. A study found that once ingested by sea turtles, the polymer mass of biodegradable plastics reduced by just 4.5 – 8.5% over 49 days.[168]	Similar to critiques of biodegradable plastic, bio-based plastics do not solve the problem of leakage into the ocean, and still pose threats of entanglement and ingestion.	Compostables will pose the same problems as biodegradables and bio-based plastics if they enter the marine environment.	As with other alternatives, oxo-degradable plastics still pose threats to marine life through entanglement and ingestion.
Carbon footprint and natural resource impacts	Under anaerobic conditions (i.e. without oxygen) likely to be found in landfills, anaerobic microbes decompose biodegradable polymers into methane and carbon dioxide.[169] Methane is among the most potent greenhouse gases.	While desirable to decouple production from fossil fuels, it would not be possible to sustainably meet current demand through bio-based sources, given the huge land-use implications. In 2013, bioplastic production required 600,000 hectares of land to produce 1.6 million metric tons of plastics – less than 0.5% of the total demand, which was 322 tonnes in 2015. [170] Land use change associated with converting rainforests,	If disposed to landfill with sufficient moisture levels, they are likely to decompose anaerobically and produce methane, a strong greenhouse gas.[173]	While comprehensive research has not been undertaken, it seems likely that oxo-degradables will have a similar carbon and resource footprint to conventional plastics.

[164] http://edepot.wur.nl/408350

[165] https://www.ellenmacarthurfoundation.org/assets/downloads/EllenMacArthurFoundation_TheNewPlasticsEconomy_15-3-16.pdf

[166] https://wedocs.unep.org/bitstream/handle/20.500.11822/7468/-Biodegradable_Plastics_and_Marine_Litter_Misconceptions,_concerns_and_impacts_on_marine_environments-2015BiodegradablePlasticsAndMarineLitter.pdf.pdf?sequence=3&isAllowed=y

[167] T. O'Brine, R. C. Thompson, Degradation of plastic carrier bags in the marine environment, Marine Pollution Bulletin (2010)

[163] https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_TheNewPlasticsEconomy_19012016.pdf

[168] Experimental degradation of polymer shopping bags (standard and degradable plastic, and biodegradable) in the gastrointestinal fluids of sea turtles http://resodema.org/publications/publication17.pdf

[169] Cho, H.S., Moon, H.S., Kim, M. et al. (2011) Biodegradability and biodegradation rate of poly(caprolactone)-starch blend and poly(butylene succinate) biodegradable polymer under aerobic and anaerobic environment. Waste Management. 31: 475–480.

[170] www.corbion.com/base/DownloadHelper/DownloadFile/7462

[173] http://www.helenlewisresearch.com.au/wp-content/uploads/2014/03/Compostable-DSMG-082013.pdf

	"Bio-degradable" plastics	Bio-based plastics	Compostable plastics	Oxo-degradable plastics
		peatlands and grasslands to produce bio-products has many negative implications. It could release 9 to 170 times more CO_2 than the annual greenhouse gas savings that bioplastics provide by displacing conventional plastics.[171]. Production puts pressure on natural resources, including fresh water, bringing about competition with agriculture and food security.[172] It can lead to biodiversity loss and land rights concerns.		
Recycling challenges	Biodegradable plastics may present recycling complications. While they can be mechanically recycled, this needs to be done separately to other polymers, which requires investment in separating technologies. The lack of a reliable supply of bioplastic waste in large quantities presently makes recycling less economically attractive than for conventional plastics.[174] The contamination of recycled plastics designed for a long service life with those designed to break down in the environment poses significant concern.	There are concerns that the widespread introduction of bioplastics will disrupt recycling systems. While technically, bio-based plastics can be recycled, they generally require recycling in separate streams to fossil-based plastics. Since volumes are currently not large enough to make recycling economic, bio-based plastics regularly end up in waste incineration plants instead.[175] There are also technological challenges. For example, sink and float systems for separating bottles made of PET (which sink) from those made of HDPE (which float) are contaminated by PLA.[176] Failure to	Use of compostable plastics in packaging formats that have established recycling systems (e.g. bottles) are likely to result in contamination of recovered plastics, particularly if consumers cannot readily tell the difference between compostable and non-compostables.[177] There is some evidence that small volumes of compostable plastics entering mechanical waste streams do not significantly impact the quality of the recycling stream.[178]	While producers claim oxo-degradables are recyclable, others in the plastic industry report that they negatively affect the quality and economic value of plastic recyclates. [179] They reported that oxo-degradable plastic packaging cannot be detected by current technology at sufficient scale to be sorted out from conventional plastics. Oxo-degradables are prone to degradation, which is damaging for medium- and long-life products, such as those used in construction. Producers suggest that stabilisers can be added to offset the effect of the oxo-degradable additive, but problems can then arise related to the

[171] *Land-use change emissions: How green are the bioplastics?*. Available from: https://www.researchgate.net/publication/230523937_Land-use_change_emissions_How_green_are_the_bioplastics
[172] https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2017/10/24/biobased-plastics-in-a-circular-economy/biobased-plastics-in-a-circular-economy.pdf
[174] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2873018/
[175] http://www.allthings.bio/dispose-bio-based-plastics/
[176] http://www.green-alliance.org.uk/resources/Novel_Materials.pdf
[177] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3791860/
[178] https://www.ptonline.com/blog/post/up-to-10-compostable-plastic-in-pe-recycle-streams-is-okay
[179] Such as the British Plastics Federation, Website/BPF Recycling group, in DEFRA response to OPA (2012)

	"Bio-degradable" plastics	Bio-based plastics	Compostable plastics	Oxo-degradable plastics
		separate bioplastics from other polymers restricts recycling and could cause contamination.		quantity of stabiliser required and how it affects the recycling process.[180] If added to a composting stream, they adversely affect the quality and market value of the compost, and potentially enable the release of plastics into the natural environment.
Disposal, littering and leakage into the marine environment	There is some evidence to suggest that labelling a product 'biodegradable' will result in a greater inclination to litter, although this theory is not widely tested.[181] A UNEP report concluded that the adoption of biodegradable plastic "*will not bring about a significant decrease either in the quantity of plastic entering the ocean or the risk of physical and chemical impacts on the marine environment, on the balance of current scientific evidence*".[182]	There is often confusion around the difference between 'bio-based' and 'bio-degradable' plastics, which could lead to incorrect waste disposal. While not widely tested, this could lead to higher littering rates.	'Compostable' packaging and plastic wastes can be collected in the UK in compost waste streams if the product is certified as conforming to the relevant standards. Many compostable plastics take around 60 to 90 days to compost in an industrial facility, but some facilities operate on much shorter cycles (i.e. 30 days).[183] This leads to concerns that not all plastics will necessarily compost at every commercial composting facility, if not all facilities operate at an appropriate level.	Oxo-degradable plastics are not considered a solution to plastic packaging pollution, and are not suited for effective long-term reuse, recycling at scale or composting. Oxo-degradable plastics are sometimes marketed as an environmental solution by claiming they are degradable but this can confuse consumers and may increase littering.[184]
Other challenges	*Impact on value recovery.* Using biodegradable plastics in applications for which there are good recycling systems could undermine attempts to maximize value recovery, as composting or anaerobic digestion recovers less of the embedded energy in the material than recycling. *Cost.* Biodegradable	*Waste feedstock complications.* The economic viability of the process using waste feedstocks will depend on the volume, quality and cost of transportation to reprocessing facilities. This can be further complicated by seasonal changes in the availability of certain feedstocks. Many of the processes for converting waste feedstocks into chemicals and then into bioplastics	*Disposal challenges.* Not all households have composting facilities, and even when they do, it is possible that home-based composting will often fail to achieve the heat or moisture levels to trigger biodegradation.[187]	*Heavy metal pollution.* Concerns have been raised about the release of 'heavy metals' from the oxo-degradable additives into the soil. Additive producers respond to this by saying that the metals used are transition metals (iron, nickel, cobalt and manganese) and are not 'heavy' metals.[188]

[180] https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/13941/4/warm165-133.pdf
[181] http://unesdoc.unesco.org/images/0024/002475/247517e.pdf
[182] https://wedocs.unep.org/bitstream/handle/20.500.11822/7468/-Biodegradable_Plastics_and_Marine_Litter_Misconceptions,_concerns_and_impacts_on_marine_environments-2015BiodegradablePlasticsAndMarineLitter.pdf.pdf?sequence=3&isAllowed=y
[183] https://serc.berkeley.edu/compostable-plastics-are-they-playing-you/
[184] https://newplasticseconomy.org/assets/doc/Oxo-paper-13.03.18.pdf

	"Bio-degradable" plastics	Bio-based plastics	Compostable plastics	Oxo-degradable plastics
	polymers tend to be significantly more expensive. Their adoption should only be encouraged for well-justified purposes (e.g. key components of a fishing trap with a high probability of getting lost at sea) may require financial inducement.[185]	depend on enzymes that can themselves be very resource intensive to produce.[186]		

[187] http://www.helenlewisresearch.com.au/wp-content/uploads/2014/03/Compostable-DSMG-082013.pdf
[188] https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/13941/4/warm165-133.pdf
[185] https://wedocs.unep.org/bitstream/handle/20.500.11822/7468/-Biodegradable_Plastics_and_Marine_Litter_Misconceptions,_concerns_and_impacts_on_marine_environments-2015BiodegradablePlasticsAndMarineLitter.pdf.pdf?sequence=3&isAllowed=y
[186] Green Alliance, 2018. Novel Materials presentation. (Obtained over email).