CONSUMED

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How Big Brands Got Us Hooked on Plastic

Supplementary PDF

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FAQS

Is single-use plastic bad?

It depends on the perspective you're taking. On the one hand, using plastic can save on carbon emissions compared to other materials, and plastic offers clear functional benefits, including helping to keep perishable products fresh for longer, reducing food waste.

On the other hand, single-use plastics – which make up about half of plastics thrown away – are largely derived from climate-warming fossil fuels and are projected to play a bigger role in keeping the oil industry booming as the world turns to using more renewable energy. The majority of single-use plastics today are technologically difficult or uneconomical to recycle, and often end up being littered, dumped or escaping into the environment. Even if plastics are properly managed at the end of their lives, during use they can leach chemicals and microplastics into the food and drinks we're consuming at levels many scientists believe aren't safe.

Rather than giving companies free rein to use single-use plastics mindlessly because they're so cheap and ubiquitous (I recently received a delivery of a plastic-wrapped T-shirt still on its plastic hanger in a larger plastic bag), regulators should put in place

laws that require companies to use plastics far more carefully for a more limited range of applications for which they are truly the best choice.

Should I try to use less single-use plastic?

Given that all materials come with an environmental footprint, the best course of action is to try to use fewer unnecessary items of all kinds – not just less plastic – and create less waste overall.

If you're faced with the choice of replacing plastic with another material, ask yourself some of these questions: Is the alternative you're switching to better for the environment? If so, why? What is it made of? How heavy is it? Can it be easily recycled? Can it be composted and will it actually end up in a composting plant? Can it be reused and, if so, will you actually reuse it many times? Is switching away from plastic likely to be better for your health? Are there unintended consequences to switching away, and if so, can you mitigate these?

Some everyday ways in which I cut down on packaging include choosing unwrapped produce at supermarkets where possible and looking up the best ways to store herbs, salad leaves, fruits and other fresh food at home. (Did you know that loose apples stored in the fridge below 5 degrees Celsius can last 102 days? That's 70 days longer than if you store them at room temperature in the UK.) I also buy the amount I know I'll eat, keep tabs on what's likely to go off and use it up before it does.

My family and I don't regularly get takeout, but when we do, I try to remember to ask restaurants to leave out the single-use cutlery, napkins, straws and condiment sachets. If I'm collecting food, some places will allow me to provide my own reusable container. I usually bring my lunch to work in a reusable glass or stainless-steel container. When I know I'm going to grab food to go, I personally find it easy enough to carry around a reusable water bottle and to

tuck a handkerchief and spoon into my bag. Adding coffee cups to this mix is admittedly harder, which is why I think an Aarhus-style system that lets me conveniently return standardised reusable cups all over London – or, better yet, across the whole of the UK – would be amazing.

I favour using bars of soap over body gel and buy large recyclable containers of cooking oil, vinegar and hand soap, which I decant into smaller reusable containers. Menstrual cups are an easy swap for pads and tampons; they function well and are substantially cheaper over the long run. I don't line individual trash cans with plastic, instead decanting these into a single plastic bag that we hand over to the garbage collector once every few weeks. I scoop and flush my dog's poop rather than bagging it when she goes in our garden.

I also reuse stuff where I can, turning large glass olive jars into food storage containers and plastic bags into packaging for parcels. I used to reuse plastic takeout food containers but do so less nowadays, because I don't feel confident that these are designed to withstand degradation through multiple uses. I've asked my kids' nursery to stop returning soiled clothes in single-use plastic bags and instead put them in a reusable one I've provided that lasts many months.

Beyond packaging, I'm lucky enough to live somewhere in London that sends our food waste to an anaerobic digestion facility. I minimise what I put in food waste by saving vegetable stems and incorporating these into my dog's food. I serve my picky toddlers small portions and give them more as they ask for it. I drop off plastic film for recycling at our large local Sainsbury's. While there are regular media reports about how flexible plastics get incinerated or sent overseas, dropping these off at least gives them a chance of being recycled, while putting them in general waste means they'll definitely be incinerated or landfilled.

As a family, our biggest source of waste is disposable diapers. We only use washable wipes at home, but there's no denying how bulky that diaper trash bag is at the end of each week. If a diaper washing service was locally available at an affordable price, I'd spring for one, if only to assuage the guilt.

I buy lots of stuff second-hand, sell or pass on clothes, toys and household items we aren't using (Facebook Marketplace and our online neighbourhood 'freebies' group are both great for this) and check if we can repair appliances before dropping them off for recycling at a collection point. A few months ago, I realised that buying little things online had inadvertently become a tool I was using to destress. Acknowledging this and taking steps to mitigate it, like plugging my phone in away from where I wind down, has been useful. Overall, I just try to be conscious of how much waste I'm producing. I still throw away a lot, but I buy less – and waste less – than I used to.

Is recycling a scam?

The reason so many people think recycling is a scam is that it's been oversold to us: companies have worked hard to give the impression that plastics are widely recycled when in practice only a small slice – mainly rigid PET and HDPE containers – are.

Recycling, despite all its problems, can be worthwhile. It can save resources that would otherwise go into the extraction of new raw materials, often the most energy-intensive part of making a new product. It can also keep materials out of landfills and incinerators, reducing emissions. Whether something should be recycled comes down to whether doing so results in a net-emissions saving – transporting recyclables a long way by truck or using energy-intensive recycling technologies may produce more emissions than using virgin material.

Why are plastics recycling rates so low?

Recycling is a business. It only works if a) there are buyers for recycled plastic, and b) these buyers are willing to pay more than it costs to recycle.[1]

Today, there are problems with both these things. The cost of collecting, sorting, cleaning, trucking and pelletising used plastics is often far higher than buying virgin plastics, and the quality is lower. Unsurprisingly, that translates into a lack of willing buyers.

Of the slice of plastics that are recycled, most are downcycled into lower-quality products like carpets or plant pots that can't be further recycled. One reason for this is it's too expensive to sort plastics by colour. Another is that turning used food packaging into new food packaging requires extra cleaning, which is also expensive. Plus, many packages incorporate multiple kinds of plastics or other materials and so can't be recycled at all using mainstream recycling technologies.

Regulation that requires companies to bear the cost of recycling their products, bans some non-recyclable plastics, requires packages be designed for recycling, charges companies higher fees for using pigments and other additives that narrow end markets, levies deposits on common to-go containers, limits the plastics and additives that companies are allowed to use, standardises containers to create high volumes (which helps end markets develop) and requires packaging to be made from a minimum amount of recycled material could help address some of the big problems that have long plagued plastics recycling.

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[1] This applies to all materials. In the US, the recycling rate for glass containers is just 31 per cent and for aluminium packaging it's 35 per cent, according to the Environmental Protection Agency. That's better than the 13.6 per cent recycling rate for plastic packaging, but it's still pretty terrible.

What can I do to support recycling?

You can help on both the supply and the demand side. To increase demand for recycled plastic, buy recycled packaging where you can. Write to brand owners telling them you'd like them to use more recycled material. You could also choose packaging that's designed to be easy to recycle. Where possible, I favour clear plastic over coloured since the latter will inevitably be downcycled.

On the supply side, pay attention to what you're putting in the recycling bin. If you're unsure whether something is recyclable, check your local council or municipality's website and if you're still unsure, leave it out.

A few rules of thumb: glass, plastic and aluminium drinks containers, along with newspapers and cardboard, are thrown away in high volumes, which makes them widely accepted for recycling.

Scrape all food out and rinse minimally with cold water. Remember that recycling is an emissions game, so if you're scrubbing containers with hot water and soap you're lowering – possibly even negating – the net emissions saved from recycling. For the same reason, try not to drive to places just to drop off recyclables. Instead, save them up and drop them off on a trip you'd need to make in that direction anyway.

If you're out at a park or on the go, try to bring drinks bottles and other recyclables home to put in your kerbside bin. Street-corner recycling bins are often so highly contaminated with cigarette butts, chewing gum and food that entire loads are rejected. Squash down drinks containers and then put caps back on so they get recycled too. Small non-metal items – a good rule of thumb is less than two inches by two inches – usually can't be sorted for recycling, so put those in general waste.

Don't put plastic bags or other flexible plastics in kerbside bins, since they gum up machinery if not collected separately. Bags can usually be dropped off at supermarket collection points for recycling.

Whether they're recycled in practice depends on there being buyers in place – this could be facilitated by the regulation I outlined previously. Companies are moving towards simpler multilayer packaging, made from plastics that are compatible for recycling, so in time you should be able to drop off a wider range of flexible plastics (or have these collected kerbside as funding from brands under the polluter pays model expands collections).

Multi-material items – like soap top pumps that use metal springs, plastic-lined paper envelopes, blister packs for medicines, and many sachets – can't be easily recycled, so leave these out too.

Many councils today don't accept juice and milk cartons in kerbside bins because they're made from a mix of paper, plastic and aluminium. Minimise your use of these packages, but for the ones you do buy, look online for drop-off programmes.

What's greener: cloth diapers or disposables?

This is an ongoing question that nobody neutral has a great answer to.

Most of the studies that exist are funded by cloth or disposable diaper makers. However, in 2023, the UK government published a study on diapers. It found that disposable diapers have a higher global warming potential while reusable diapers have a higher environmental impact in areas like marine ecotoxicity, in part because of the electricity used to wash and dry them and the water used by washing machines. The results are specific to the UK, where disposable diapers are far more likely to be incinerated rather than landfilled, the grid has become less carbon intensive and washing machines have become more efficient.

The way I see it, the answer depends on where in the world you are. Is water scarce? How much renewable energy does your grid use? Are the diapers likely to be dumped or come into contact with waste pickers? Can you dry cloth diapers outdoors or will you end up using a tumble dryer? Do you have access to a diaper service that

centrally washes and dries? Cost and convenience will undoubtedly play a role too.

Diaper recycling or composting may also yet become a reality, if the economics align. In France, private-label diaper maker Celluloses de Brocéliande has developed a fully compostable diaper (including compostable super absorbers) made from bamboo viscose, cornstarch and corn cellulose. Unsurprisingly, there's still work to be done: the diaper isn't as absorbent as regular disposables are while the resulting compost can't be used to grow food, meaning it doesn't sell for a lot. Eric Vilmen – who heads product development for Celluloses de Brocéliande – is working to convince regulators that high-temperature composting kills all pathogens. 'If we only use it for flowers and parks it doesn't make sense,' he says. 'We need to increase the potential of using it more widely.'

In Wales, a diaper recycling project called NappiCycle is turning used diapers into material to make roads and decking. The project hopes to avoid the pitfalls faced by P&G by selling a higher margin recycled pellet rather than plastic film and cellulose individually. NappiCycle founder Rob Poyer is betting that rising taxes on landfills and incinerator emissions will make diaper recycling more economically viable in the next few years.

The best thing to do, of course, is potty train your child early. There's a method called 'elimination communication' which is based on the underlying philosophy that babies, like other animals, instinctively prefer to avoid soiling themselves. If parents can recognise a baby's signals that she needs to relieve herself – similar to tuning in to sleep and hunger cues – or can take an educated guess based on a baby's usual timings, they can hold her over a potty or sink. It helps to pair this with a sound – like 'psss' – which over time triggers a baby to go.

Christine Gross-Loh, author of *The Diaper-Free Baby*, says parents can start elimination communication with babies who are just

hours old. The key, she tells me, is to help babies retain an awareness of their bodily functions. She advises not being a perfectionist and accepting that there will be misses. 'The best way to think about it is this is another alternative,' she says. 'No matter how much or little I do it, my baby will not think diapers are the only place to go.'

How can I protect myself against greenwashing?

Be sceptical about green claims, pause to think about the whole picture – including both waste and emissions – and try to connect the dots to the end. Paper isn't always better than plastic, biodegradable plastic often goes to landfills or incinerators where it doesn't biodegrade, and while a pricey bottle or shoe made from 'ocean plastic' sounds impressive, it does little to address the root causes of our plastics problems.

Ask yourself: Why is a company making this claim? Is it specific or does the company portray itself as 'eco-friendly' without explaining how? Does a product or package do what it claims? If so, is that good for the environment? And what are the trade-offs?

If you think the company's green claims are deceptive, you can complain to the Competition and Markets Authority in the UK – email them at *general.enquiries@cma.gov.uk* or use the online form. In the US, you can complain to the Federal Trade Commission using its 'report fraud' link. If you're a shareholder of a company, you can also complain to the Securities and Exchange Commission, which works to ensure that shareholder disclosures are accurate.

Isn't paper better than plastic?

It can be but it isn't always. Rather than a wholesale shift from plastic to paper, it makes sense to look at each product on a case-by-case basis that attempts to balance waste, emissions and likely health hazards to arrive at the best choice.

Paper is derived from a renewable resource and will break down when littered, but it still has a big environmental footprint. It can cause deforestation and harm an area's biodiversity. It's highly water-intensive, as well as chemical-intensive: a 2021 report found that 256 substances of concern – chemical substances that may pose risks to human health or the environment – can intentionally be used in paper and board packaging.

When it comes to holding food and drinks, paper isn't naturally good at repelling grease or moisture. It needs coatings, which are often made from plastic. Paper food packaging has also been found to use PFAs, the notorious 'forever' chemicals. Companies say they're phasing out the problematic PFAs, but researchers have raised concerns that replacement chemicals that function similarly could be harmful to our health too.

Food waste and non-fibre components – such as coatings – that make up more than 5 per cent of a package can mess with the economics of the paper recycling process. Many countries mandate that paper packaging used for food be made from virgin paper, which means recycled food containers can't be used to make new food containers, but must be downcycled into lower-grade material.

That being said, I do think paper that doesn't use dangerous chemicals could be a good choice in a few areas. One is for disposable packaging that's widely littered – including snack packets, bottle labels, chocolate and energy bar wrappers – and too small to charge a deposit on. Using virgin paper isn't inherently bad as wood can be grown and harvested as a crop.

Two caveats here: the coated paper will likely keep its contents fresh for a shorter amount of time than plastic, so an unintended consequence could be increased food waste if supply chains and consumer communication aren't well managed. And if the coating isn't biodegradable, the package could leave behind long-lasting microplastics if littered.

Paper could also play more of a role in packaging dry products. More companies are stripping water out of laundry detergents, instead shipping concentrated dry pods and sheets in paper boxes. If you stop and think about it, it's mad to ship a product that's mostly water around the world if you can just ship the concentrate. There's potential to sell dry versions of more products, but companies would need to invest the same millions convincing consumers to switch to these as they did hooking them on liquid versions in the first place.

Are reusables the answer to our plastic waste problem?

They're certainly *an* answer but they won't work for everything.

From an emissions and cost point of view, reusables can make sense when replacing some rigid packaging, but supermarkets are unlikely to be selling you potato chips, chocolate bars and salad leaves in reusable containers anytime soon.

Key to keeping emissions and costs down is scale and high return rates – these could be achieved through mandatory reuse targets and deposits that keep pace with inflation. Standardised reusable packaging shared across brands for products like soft drinks, yogurt and shampoo could cut carbon emissions, complexity and costs, since containers can be returned from drop-off points to the nearest factory for washing and refilling, cutting down on travel distances. As I described in Chapter 13, supermarkets making deliveries of online grocery orders have begun experimenting with taking back used containers for refill in vans that would otherwise be returning empty – a modern-day version of the old milkman model.

So far, consumer goods companies that have waded into reusables on their own – for instance, with brand-specific refillable deodorant sticks and cleaning sprays – have seen little success. Uptake is also low at grocery stores that allow people to bring their own containers to refill a limited range of dry goods like

rice and pasta. Consumers need to plan in advance exactly what they're going to buy and remember to bring a range of their own containers with them, while some stores have found that allowing customers to fill their own containers causes spillages and can be unhygienic.

None of this is to say we can't shift to reusables, but when it comes to groceries, prefilled reusable packaging that's professionally washed and refilled by companies is looking like the most promising way forward.

Companies poured millions into shaping our habits and creating new needs. By contrast, their half-hearted attempts so far to spark our interest in reusables that are often less convenient, more expensive and offer little in the way of extra functional benefits have, unsurprisingly, fallen flat. The onus is now on them to devise ways to make reusables more attractive and on regulators to push them to do so in a way that's meaningful.

What is chemical recycling and is it as promising as companies say?

Chemical recycling – called 'advanced recycling' by proponents – breaks down plastic into its chemical building blocks so it can be repeatedly turned into new, high-quality plastic.

A variety of processes fall under this umbrella term. Pyrolysis uses high temperatures to degrade polymers in the absence of oxygen into gas, naphtha, oils and a solid char. Gasification heats plastics in a limited oxygen environment to create 'syngas', which can in turn be converted into chemicals to make new plastics. Solvent-based processes use a solvent to target a polymer, dissolving it so it can be separated to make new plastics.

Proponents of chemical recycling – which include chemical makers and consumer goods companies – say it's the only way to get around the limitations holding back mechanical recycling, which involves cleaning, shredding, melting and re-extruding plastic. The

plastic discolours and degrades in quality over time as it's repeatedly recycled. Sometimes it can only be recycled once or twice.

Chemical recycling could also offer a solution for plastic that would otherwise be landfilled or incinerated, like flexible and multilayer plastics. Studies show it generates lower greenhouse gas emissions than using virgin plastic. However, chemical recycling still requires that recyclers get a steady supply of clean, well-sorted material. Most technologies can only handle certain types of plastic, so a big dirty pile of mixed plastic doesn't cut it.

Critics say chemical recycling is little more than smoke and mirrors – it's too energy-intensive and expensive to ever be meaningful, releases toxic emissions, and uses solvents and chemicals that can have negative health impacts. They also say that much of what's touted as chemical recycling is just plastic being turned into fuel rather than new plastic. By one estimate, chemical recycling will only offset 5 per cent of virgin plastic demand by 2040, given the challenges of scaling it.

All this being said, chemical recycling's prospects could improve as the grid decarbonises. Conservation non-profits warn that chemical recycling shouldn't be set up to compete with mechanical recycling by taking higher-quality used plastic – only the real deadbeats that would otherwise go to landfills or incinerators should be chemically recycled. Chemical recycling plants should only be greenlit when it's clear they offer an emissions reduction benefit over virgin plastics and have systems in place to manage any impacts on human health.

The jury is very much still out on chemical recycling. How the chips fall on this one is important. It could decide how reliant on plastics we remain.

Are biodegradable plastics environmentally friendly?

Biodegradable plastics decompose into carbon dioxide, biomass and water. As you know by now, though, the term biodegradable is

virtually meaningless when used to market plastics (and, in fact, is banned in some places) since it says nothing about how *long* it takes for something to break down – virtually everything is technically biodegradable if left for long enough.

Compostable plastics, a more defined subset of biodegradable plastics, are plastics designed to break down *under composting conditions in a specific amount of time*.

Some campaigners I've talked to worry that labelling products as biodegradable will encourage people to litter. If littered, biodegradable or compostable plastics will break down far more quickly than conventional plastics, but many people don't realise that the process can still take several years.[2] In the meantime, the packaging can leach plasticisers, stabilisers and other chemicals, entangle animals or be ingested by them.

Today, compostable products and packaging (many marketed as biodegradable), such as cutlery, straws, cups, plates, wipes and dog poop bags, are rarely composted. In the UK, the majority of kerbside-collected food waste goes to anaerobic digestion facilities, which extract energy from the waste but generally reject compostable packaging. In the US, fewer than 5 per cent of the population even has access to kerbside composting facilities for food waste. A 2024 study of US compost facilities showed that 27 per cent said they would accept some compostable food packaging. Not one indicated they'd take non-food compostable packaging.

One reason composters don't want packaging is that regular plastic sneaks in, contaminating entire batches of compost.

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[2] In a study published in 2019, Richard Thompson and another University of Plymouth researcher exposed compostable bags to air, soil and sea environments similar to ones they'd encounter if littered. They found that compostable bags were still present in the soil after two years. Some bags marketed as biodegradable could still carry shopping three years after being put in soil and seawater.

Compostable non-food packaging also doesn't contribute nutrients to the resulting compost. While some proponents say compostable packaging can help sequester carbon in the soil in the form of biomass, evidence suggests that about half of compostable plastic is lost to carbon dioxide air emissions as it breaks down. Another issue is that compostable packaging that doesn't fully break down could contribute microplastics to the resulting compost.

Brands have dealt with the lack of industrial composting facilities by marketing their products as 'home compostable'. But few people compost in their own gardens; doing so requires a commitment to regularly turning the compost pile to promote aeration, ensuring there's a good balance of nitrogen and carbon and that moisture levels are around 50 per cent. It can take months or even years for compostable plastic to break down at home, and even then, plastic fragments can linger in the compost.

Another tactic brands have used is telling consumers that their biodegradable plastic products will break down in landfills. While lab tests simulating landfill conditions may embolden them to make this claim, it's hard to guarantee that anything breaks down in a real landfill. If it does, it releases methane, a potent greenhouse gas. In the US and many other countries today, some of this methane is captured – but not all. Municipal waste landfills are the third largest source of human-related methane emissions in the US according to the Environmental Protection Agency.

Brands also promise that biodegradable plastics will break down in the oceans, but variations in temperature and micro-organisms in seawater make it very difficult to promise how quickly this will happen. The plastics could hang around for years and, in the meantime, still get stuck in an unsuspecting turtle's nose!

One disposal option in which compostable packaging does have an advantage over conventional is incineration. If incinerated, the net emissions from compostable packaging are likely to be less

than for conventional plastic, assuming the compostable material is bio-based.

So are there any applications for which compostable products make sense?

Compostable tea bags, coffee pods, the stickers on fruit peels, ready-meal trays that have food baked on and bin liners for food waste could all make sense. They help ensure more food waste flows to composting facilities, adding nutrients to soil and keeping food out of landfills.

Any product wanting to market itself as compostable should go through an approvals process that requires proof that it does in fact fully break down and that it does so within the timelines industrial composting facilities adhere to. Compostable packaging should only be sold in areas served by industrial composting facilities that say they accept such packaging for composting.

To reduce contamination, one idea I've heard is requiring all compostable packaging use a unique colour – like bright pink – that no other packaging is allowed to use. Another option is to use compostables in closed venues, like movie theatres, stadiums and airports. In the absence of industrial composting facilities, compostable products marketed as home compostable should be sold only in locations where it is demonstrated that a majority of people are actively composting at home. Compostables should also be labelled with warnings telling consumers that the product won't break down into compost if littered or put in general waste.

Are bio-based plastics a good alternative to fossil-fuel-based ones?

Bio-based plastics are made from biological resources like sugarcane or corn. They've been around for many decades – cellophane counts as a bio-based plastic – but most haven't been able to compete against fossil-fuel-based plastics on price.

Bio-based plastics aren't necessarily biodegradable. Confusingly, plastics that biodegrade can be made from fossil fuels, and plastics that last for hundreds of years can be made from bio-based materials. About 44 per cent of bioplastics are not biodegradable.

Bio-based plastics can still create many of the same problems as fossil-fuel plastics, and some additional ones. They can take up valuable land or otherwise compete with food. Studies show that some bio-based plastics can take more energy to produce than conventional plastics. Pesticides, PFAs and other chemicals of concern have been found in bioplastics. Some bioplastics – like PLA – can hinder recycling if they mix with PET, the plastic widely used to make drinks bottles.

While bio-based plastics can have far lower carbon emissions than ones derived from fossil fuels, whether they do in practice depends on where they're sourced and how they travel. Locally sourced bioplastics, or ones that travel by sea, will create lower emissions than ones flown in from further away.

Despite the various challenges, incentivising the development of bio-based plastics while seeking to minimise the risks they pose is important. Even PET bottles can only be mechanically recycled a couple of times before they must be downcycled into lower-value products that can't be recycled again, so we're always going to need some virgin plastics.

Scientists are experimenting with making alternatives to conventional plastics from agricultural waste, wood left over from construction projects, seaweed and even carbon dioxide, which can be electrochemically reduced to create oxalic acid that's converted into monomers like glycolic acid to make new plastics. Which materials become commonplace will depend on their relative costs, efficiency and ability to scale. A carbon tax on fossil-fuel-based plastics could help bio-based plastics better compete. Bio-based plastics that offer superior functional

benefits to conventional plastics and are easy to recycle could also gain traction.

Bio-based plastics should have a clear end-of-life option before they're launched, whether that be recycling or composting. While we definitely need innovation, the more different materials that companies put on the market, the harder it is to monitor them for chemicals, sort them into separate streams for recycling and find buyers.

Given we burn fossil fuels to generate electricity, isn't making plastics from fossil fuels and then burning the used plastics actually a pretty good idea?

The electricity generated from burning waste is relatively inefficient compared to getting it from other methods. Incinerators are hugely expensive to build and can also create a lock-in effect – they're designed to be fed continuously with waste over a period of about 25 years. That can disincentivise municipalities, who are bound by contracts, from pursuing waste reduction and recycling. Burning used plastics also means that new plastics will need to be made from virgin resources rather than from recycled plastics.

Burning plastic waste releases carbon. It can also lead to the release of dioxins, furans and halogenated flame retardants among other emissions. These are linked to a wide range of health issues, including increasing the risk of heart disease, asthma and cancer. Incinerators also produce hazardous ash that must be safely landfilled. While in wealthy countries, facilities are likely to be closely monitored and emissions cleaned and partly captured, in countries with loose regulations, incinerators could release large amounts of dangerous fumes.

Is landfilling conventional plastics bad for the environment?

For a long time, it's been thought that plastics are inert and so landfilling them doesn't release greenhouse gas emissions or create other harms. That view is starting to change as studies have found

microplastics in landfill leachate, and concluded that the additives used to make some plastics can migrate into leachate. If landfills aren't managed properly and if liners erode – which is increasingly likely over time – groundwater can get contaminated.

It's likely that there will always be a need for some landfilling and incineration of plastic waste. In these cases, the focus should be on ensuring this is done safely, that plastics don't escape into the environment and that the leachate and gases from landfills and incinerators are carefully monitored and contained.

Should I worry about chemicals in plastics?

I'm pretty concerned. After talking to scientists in Europe and the US, it's clear that existing regulations are falling well short of protecting us against potentially hazardous chemicals. The fact that plastics can contain multiple chemicals that were never intended to be in there, and for which safety data doesn't exist, is particularly worrying. Even where chemicals are known and regulated, the levels regulators once thought were safe are later deemed to not be safe as new evidence emerges.

A growing body of research shows that exposure to some chemicals like bisphenol A and other bisphenols, even in small doses, can potentially have sizable impacts. While bisphenols get flushed out of our bodies in a few hours, their widespread nature means they're always present in our bodies. Other chemicals, like PFAs, stick around far longer, accumulating in our lungs, liver and other tissues.

Scientists are calling for far stricter regulation, including requiring companies to test mixtures of chemicals that leach from a package rather than simply testing individual chemicals. They also want testing to look for signs of developmental neurotoxicity, immunotoxicity and endocrine disruption, rather than narrowly looking for cancer risks. They want chemicals periodically tested

after they're put on the market so that those previously approved can be re-evaluated based on new evidence.

Today – as plastic moves through the supply chain, from resin makers to packaging makers to recyclers and reprocessors – it's often unclear which chemicals have been added at what stage. One idea to address this is introducing a labelling system for packaging – similar to ingredient labels on food – so that packaging makers, recyclers and consumer goods companies know what's in the plastics they're buying.

So far in Europe, reusable packaging must be tested for just three rounds, with the onus being on companies to show that migration of chemicals decreases with each one. Scientists want testing to be expanded to encompass the entire projected time reusable containers will be used for. They say testing should also reflect the conditions under which the products are actually used; for instance, if plastics are put in the dishwasher, they're subject to high heat which can encourage faster degradation.

How can I minimise my exposure to chemicals in plastics?

Since learning more about chemicals in plastics, I buy less canned food and drinks since I know they use plastic liners that can contain bisphenols. I no longer heat food in plastic containers or put plastic in the dishwasher since heat encourages chemicals to leach. I avoid putting hot, greasy and acidic food in plastic for the same reason.

I have replaced my everyday plastic cooking utensils (black ones particularly since they are more likely to be made from e-waste and contain hazardous chemicals) with wooden ones, bought wooden chopping boards and slowly swapped many of my plastic food storage containers for glass ones – though these still use a bit of plastic to seal at the top. I've contacted the suppliers of the non-stick cookware I use to check it doesn't contain PFAs and I use my cast-iron pans more often. I use a stainless-steel reusable water bottle and a ceramic coffee cup rather than plastic ones. I've swapped my kids'

plastic cutlery, plates, bottles and cups for stainless-steel ones too. I haven't been able to convince them to stop putting plastic toys in their mouths though, and wooden ones don't last long.

How concerned should I be about microplastics and nanoplastics?

While there's ample evidence that microplastics and nanoplastics harm animal health, their impact on human health is still unclear. There isn't an internationally accepted definition of these plastic particles, while testing methods differ widely, opening researchers up to criticism.

Scientists worry that plastic particles could have far-reaching effects on human health because they act as sponges for chemicals, including those that disrupt the endocrine system. Researchers have also raised concerns that persistent exposure to low levels of microplastics in the air could lead to respiratory and cardiovascular diseases, inflame the gastrointestinal tract and change the intestinal microbiome to create an imbalance between beneficial and harmful bacteria. Beyond the 2024 study I mentioned in Chapter 12 that linked microplastics with an increased risk of humans having a stroke or heart attack, there's ongoing research aimed at uncovering how microplastics impact human health in real life.

Using less plastic food packaging – particularly small packages like sachets, since the ratio of plastic to contents is high – and moving away from plastic kitchenware, like chopping boards, could help. But studies show that microplastics and nanoplastics enter our bodies through a variety of sources, including the soil, air and our skin, so there's not a huge amount any of us can do individually.

Ultimately, the solution lies in regulatory measures that mandate companies to make design changes to products known to leach microplastics – like tyres, paints, synthetic clothes and plastic containers – and put in place filters in washing machines and water

treatment plants to stop tiny plastic particles escaping into the environment. As researchers learn more about plastics, they're getting a better sense of the mechanisms that make them degrade. For instance, a 2024 study found that brightly coloured plastics degrade more quickly than white or black ones, indicating that some additives may unintentionally promote degradation.

Are some plastics safer than others?

The science on plastics is still developing, but evidence today suggests that PET, HDPE, LDPE and polypropylene – which go by the resin codes 1, 2, 4 and 5 – are on the safer end of the spectrum, while polyvinyl chloride and polystyrene (which are 3 and 6) have known issues.

PVC can use plasticisers that contain endocrine-disrupting phthalates, while polystyrene has been shown to leach styrene – classified as probably carcinogenic to humans by the World Health Organization – into food and drinks, particularly when used for anything hot or greasy.

The resin code 7 encapsulates a host of other plastics that use various chemicals – including polycarbonates which are known to use bisphenol A – so many public health researchers suggest avoiding plastics with this code.

Many of your answers to these FAQs contain lots of caveats. Is there anything you can say to leave me feeling hopeful?

Yes! For starters, we can rethink the way we do things – it doesn't have to be this way.

We can incentivise companies to be more thoughtful about whether and how they use plastics – and all packaging.

We can use a far smaller subset of materials and standardised designs that are easier to reuse, recycle and monitor for potential health harms.

We can raise recycling rates by ensuring products are designed for recycling and that companies make new products from recycled content.

We can cut litter – and raise collection rates – by putting a refundable deposit on common packaging.

We can develop better plastics from more environmentally friendly alternatives to fossil fuels.

We can switch away from plastics entirely in some cases where alternatives make sense.

We can develop the infrastructure to handle compostable plastics where these make sense.

We can ensure waste collection has enough funding by getting companies whose products comprise the waste to pay for it.

We can ramp up reusable packaging through the right regulation.

We can use technology to meld the benefits of old business models with the convenience of new ones.

We can shift to packaging that's free of chemicals known to be dangerous and that release fewer microplastics.

We can have systems in place to trap more of the microplastics that are released.

We can continue to be consumers without being consumed.