Responsible Investing

NOVEMBER 2024

PLATYPUS
ASSET MANAGEMENT

Plastics

Most plastics (~99%) are derived from fossil fuels.

Fossil fuel feedstocks range from oil and coal to natural gas. The basic building blocks of plastic are the monomers ethylene and propylene, and producing these monomers is an energy intensive process that requires high temperatures to 'crack' the hydrocarbon feedstock.

Plastics contribute ~1.79 Gt to global CO_2-e emissions, which is ~3.3%.

Most of these emissions come from the production and conversion of the fossil fuel feedstocks into plastics. However, it is often not obvious whether replacing plastics with other materials will reduce GHG emissions. For example, non-returnable glass has ~3x the GHG emissions of polyethylene terephthalate (PET).

We estimate global plastic production at ~478 Mt.

Approximately 30% of all plastics ever produced are currently in use, and depending on the use case, the lifetime distribution for plastic varies. For example, in construction plastic lifetimes average 35 years, while for packaging the average is 6 months.

About 60% of all plastics ever produced (~9.5 billion tonnes) are discarded or in landfill.

In 2022, of the plastic waste produced, ~23% was mismanaged, ~5.4% was leaked to the environment, and ~0.5% ended up in our oceans. Plastics in the natural environment do not decompose quickly: for example, plastic bags and milk bottles can last up to 250 years on land and up to 58 years in a marine environment.

Exposure to plastics can lead to negative health effects.

Plastics enter the body through ingestion, inhalation, and skin contact. Example chemicals that are released as plastics decompose are benzene, heavy metals, carcinogens, and endocrine disrupting chemicals. Health impacts include a range of cancers, negative neurological impacts, reproductive toxicity, and respiratory system effects.

Microplastics have been detected on Mount Everest and in the Mariana Trench.

Less than 5mm in size, these enter the environment through oxo-degradable plastics. They are ubiquitous with the average adult consuming ~2,000 microplastics per year simply through salt consumption. They are an emergent pollutant and the full health impacts are still being understood.

There is a regulatory trend to address plastic waste and its potential health impacts.

Penalties for companies and consumers that contribute to plastic waste are emerging. Notable examples for putting a price on plastic are the UK and the EU.

At present, we believe the impact of global plastic legislation on the near-term earnings of ASX listed companies is limited.

However, our view is that the trend is towards stricter plastic regulation, especially as the health impacts become better understood. Note that plastic is not currently covered by the EU Carbon Border Adjustment Mechanism.

Contents

What is a plastic?

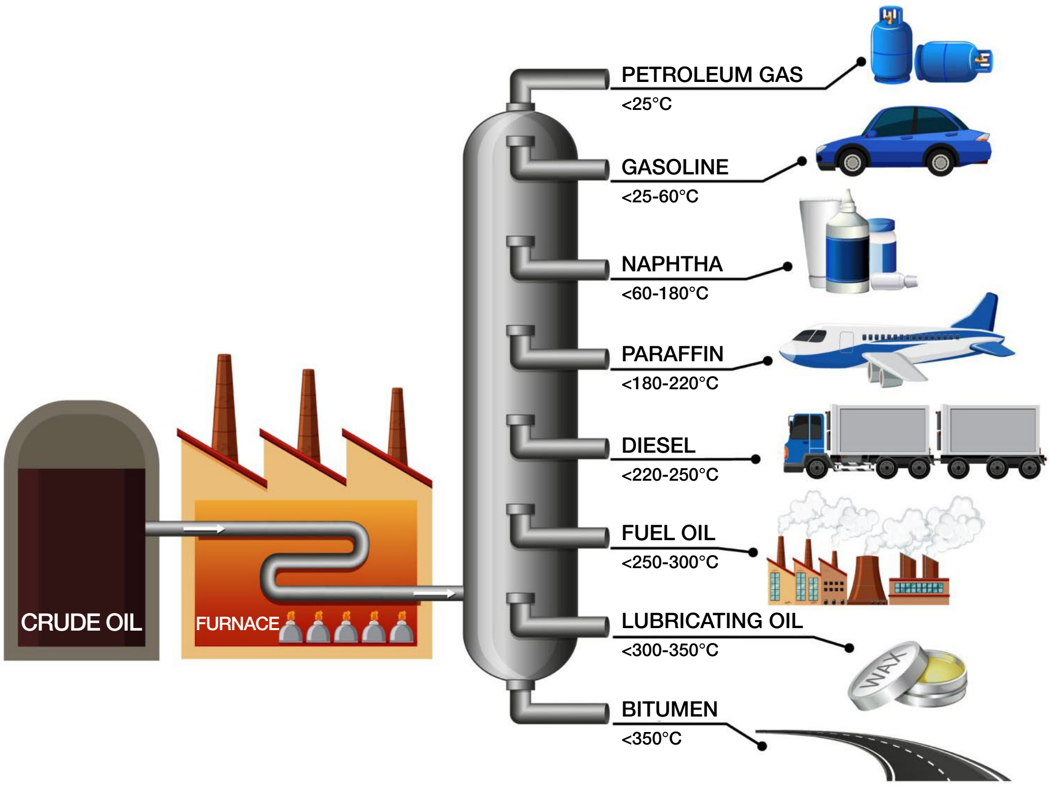
Plastics are polymers generally sourced from fossil fuels

Plastics are materials formed from organic polymers, which are large molecules composed of thousands of covalently[1] bonded atoms. Polymers are created from combining monomers through a process called polymerization.

Most plastics (~99%) are sourced from fossil fuels. We will use oil as an example, but the feedstock monomers for plastics can be derived from natural gas, coal, or plants. Note that the petrochemical industry has a high degree of flexibility in choice of feedstock.

Crude oil is heated, and the resultant mixture is fed as vapour into a column, called the fractional distillation tower. This process takes advantage of the different boiling points and weights of the component parts of crude oil.

Exhibit 1: Fractional distillation of crude oil



Source: British Plastics Federation

The tower separates, or distils, the crude oil into 'fractions' using a temperature gradient: the top of the tower is cooler than the base. The different oil factions flow to different physical points in the tower, and then condense at different temperatures. Smaller, lighter, hydrocarbon molecules condense towards the top and larger, heavier, hydrocarbons condense towards the base.

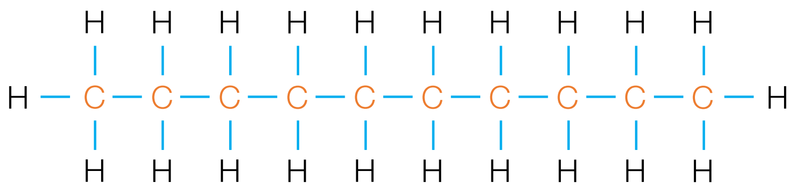
After distillation, the long-chain hydrocarbons are converted into lower mass hydrocarbons (alkenes, alkanes and by products) using high temperature and pressure through a process called cracking.[2] Due to the complexity of the process, steam cracking is one of the most energy-intensive processes in the chemical industry.

[1] A covalent bond occurs when atoms share electrons to form electron pairs.

[2] Cracking can be either steam (mentioned in the text) or catalytic (using a catalyst, allowing the process to occur at lower temperatures and pressure).

Naptha, the feedstock for plastic shown in Exhibit 1, is generally a mixture of C5 to C10 hydrocarbons (see Exhibit 2), but on a chemical basis is hard to define precisely because it can contain paraffin, aromatic, olefin, and naphthene derivatives, all in different proportions.

Exhibit 2: Example chemical structure of hydrocarbon where C represents a carbon atom and H represents a hydrogen atom. The lines represent covalent bonds, with a single line representing one pair of shared electrons. The carbon chain length shown is called C10 (ten carbon atoms).



Source: Platypus

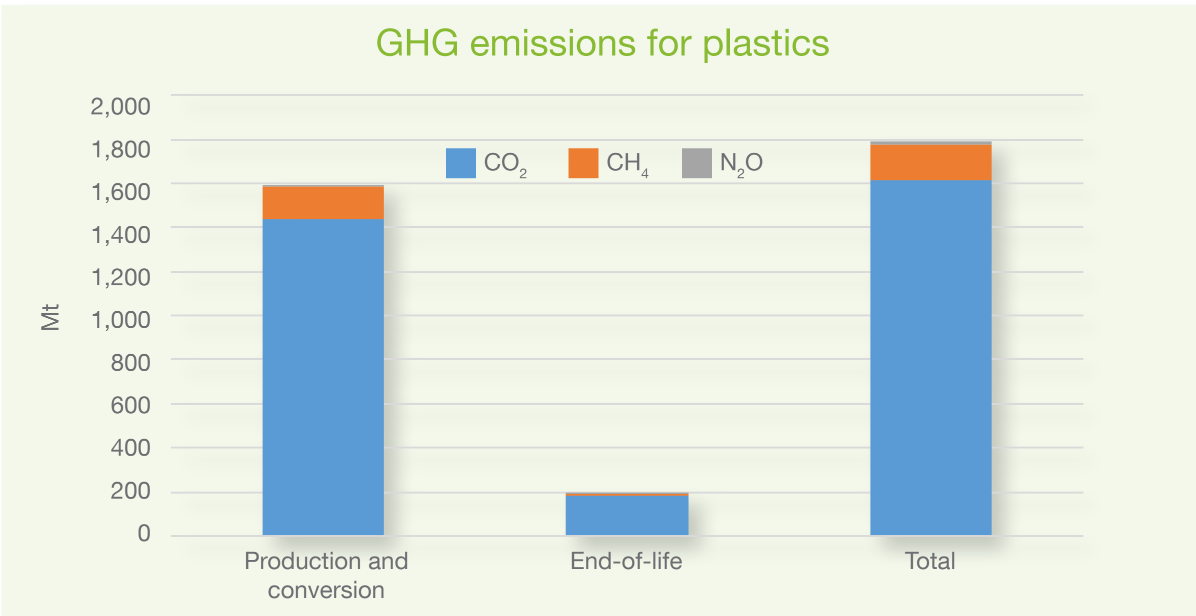
Continuing our example, steam cracking naphtha produces the monomers ethylene and propylene. These are combined with various catalysts to create the polymers: polyethylene and polypropylene. These are then melted and moulded to produce a finished product.

In terms of size, of daily global oil production of ~100 million barrels, about 4-8% is used to produce plastic.

Plastics are polymers generally sourced from fossil fuels

GHG emissions from plastics are concentrated in the production phase. Using 2019 data, of the 54.6 Gt of CO_2-e of global emissions, plastics contribute 1.79 Gt, which is ~3.3%.

Exhibit 3: Plastic production and end-of-life GHG emissions



Source: Platypus, OECD

Exhibit 4: Plastic types and characteristics

Type of plastic	Formula	Melting point (average/range)	Abbreviation	Density	2022 annual production (Mt)
High density polyethylene	$(C_2H_4)n$	130°C	HDPE	0.933 - 0.96 g/cm^3	67
	Characteristics: High strength to density ratio, easily moulded, chemical resistance **Uses:** Milk jugs, detergents, household cleaners, motor oil containers, some garbage bags, butter and yogurt tubs				
Low-density polyethylene	$(C_2H_4)n$	105 - 115°C	LDPE	0.91 - 0.940 g/cm^3	22.8
	Characteristics: Flexible, transparent, and impact resistant **Uses:** Cling wrap, Squeezable bottles, various bags, clothing, furniture, prosthetics, laminates, tubing, plastics in computers				
Linear low-density polyethylene	$(C_2H_4)n$	112 - 124°C	LLDPE	0.91 - 0.940 g/cm^3	37.2
	Characteristics: Flexible, transparent, linear structure stronger than LDPE **Uses:** Plastic bags, sheets, plastics wraps, applications that require stretching				
Polypropylene	$(C_3H_6)n$	160°C	PP	0.895 - 0.92 g/cm^3	79
	Characteristics: Integral hinge property, semi-rigid, heat resistant **Uses:** Pallets, bottles, jars, yogurt containers				
Polystyrene	$(C_8H_8)n$	240°C	PS	0.96 - 1.05 g/cm^3	15.4
	Characteristics: Can be solid or foamed. Hard, brittle. **Uses:** Expanded foam used for cups, insulation and packaging				
Polyvinylchloride	(C_2H_3Cl)	100 - 260°C	PVC	1.16 - 1.45 g/cm^3	60.7
	Characteristics: Rigid or flexible, high impact strength **Uses:** Plastic bottles, packaging, plumbing, cable insulation, flooring, inflatable products, rubber substitutes				
Polyethylene terephthalate	$(C_{10}H_8O_4)n$	250°C	PET	1.38 g/cm^3	55
	Characteristics: Rigid or semi-rigid. Stable, resistant to impact. **Uses:** Packaging and textile production				
Polyurethane resins	Includes C, H, N and O	163°C	PUR	0.008 - 1.39 g/cm^3	26
	Characteristics: Elasticity, insulation properties, tensile and flexural strength **Uses:** Flat roofs, pipes, storage tanks, construction, marine, aerospace				

Source: *Xometry, Chemanalyst, Science*

Plastic production and recycling

Global production

We estimate global primary plastic production in 2022 at ~478 Mt. This is in line with expectations from CAGR estimates applied to 2015 global production in Geyer et al. (2017) and in line with projections from Ritchie et al. (2023).

Exhibit 5: Global primary plastic production in million tonnes

Plastic type	2022 production (Mt)
LD, LDPE	60
HDPE	67
PP	79
PS	15.4
PVC	60.7
PET	55
PUR	26
PP&A fibers	68
Other	18
Additives	29
Total	**478**

Source: *Platypus, Science, Our World in Data*

Geyer et al. (2017) estimate that ~30% of all plastics ever produced are currently in use.

Plastic lifetimes

Depending on the use case, the lifetime distribution for plastic use varies. In construction, average lifetimes of plastics used are more than three decades, while for packaging it is less than 6 months.

This is relevant for Platypus discussions with portfolio companies and highlights the different regulatory risks for different use cases.

Exhibit 6: Mean product lifetime for plastics, separated by sector

Sector	Mean life (years)
Packaging	0.5 +/- 0.1
Transportation	13 +/- 3
Building and Construction	35 +/-7
Electrical/electronic	8 +/- 2
Consumer and Institutional Products	3 +/- 1
Industrial Machinery	20 +/- 3
Textiles	5 +/- 1.5
Other	5 +/- 1.5

Source: *Science*

Waste

About 60% of all plastics ever produced (estimated ~9.5 billion tonnes) are discarded or in landfill. Each year, approximately 9% of plastics are mechanically recycled (called post-consumer), with the remainder becoming waste product.

Plastic can only be recycled 2-3x before its quality becomes too poor to use. The OECD estimates that 353 Mt of plastic waste was generated in 2022.

Of this this, 82 Mt (~23%) was mismanaged and littered, 19 Mt was leaked to the environment, 6 Mt was leaked to rivers, and about 1.7 Mt (or 0.5% of plastic waste) was transported to the ocean.

Managing plastic waste correctly leads to reduced pollution and consequently to reduced health impacts to humans (Ritchie et al., 2023). Mismanaged waste management per capita ranges from less than 5 kg per annum to more than 20 kg. Generally, wealthier countries have better waste management: for example, in Australia about 0.21 kg is mismanaged, while in Zimbabwe the figure is around 35.84 kg per annum.

The Philippines discards the largest of plastic waste into the ocean per capita, estimated at 3.3 kg per annum. Australia, in contrast, discards 0.001 kg per annum. While some regions discard more than others, the problem is geographically diverse when modelled specifically in terms of rivers.

Exhibit 7: Number of emissions of plastics into the ocean by percentage

Percentage of emissions (%)	Number of rivers	$m^3 s^{-1}$ of plastic pollution, labelled p
1	6	p > 10,000
2	27	1000 < p < 10,000
22	211	100 < p < 1000
25	582	10 < p < 100
30	830	0.1 < p < 10

Source: *Meijer et al. (2021)*

Meijer et al. (2021) estimate that 1,656 rivers account for 80% of global plastic marine waste. The remainder comes from other sources.

Once plastics have entered the natural environment, they do not decompose quickly. Chamas et al. (2020) estimate that LDPE plastic bags and HDPE milk bottles have half-lives of 5-250 years on land and 3-58 years in marine environments, while HDPE pipes have a half-life of 1,200 years.

Health impacts

Exposure to plastics for humans is both through direct contact and the environment. Plastics enter the human body through ingestion, inhalation, and skin contact.

Exhibit 7: Direct plastic exposure through plastic lifecycle

Lifecycle stage	Emissions	Health impacts
Extraction and transport	Benzene, volatile organic compounds, (VOCs), ~170 toxic chemicals in fracking fluid	Immune system, sensory organs, liver and kidney, neuro and reproductive cancers, developmental toxicity
Refining and manufacture	Benzene, polycyclic aromatic hydrocarbons (PAHs), and styrene	Cancers, neuro-toxicity, reproductive toxicity, low birth weight, eye and skin irritation
Consumer use	Heavy metals, persistent organic pollutants (POPs), carcinogens, endocrine disrupting chemicals (EDCs), and microplastics	Renal, cardiovascular, gastrointestinal, neurological, reproductive, respiratory systems, cancers, diabetes, developmental toxicity
Waste management	Heavy metals, dioxins and furans, PAHs, toxic recycling	Cancers, neurological damage, immune system, reproductive system, endocrine system

Source: *Center for International Environmental Law*

Environmental exposure occurs through microplastics (for example, tire dust and textile fibers) and toxic additives (including persistent organic pollutants, endocrine disrupting chemicals and heavy metals). These can be transported by wind and currents, and reach all parts of the world.

Microplastics

Defined as plastic fragments and particles less than 5mm in size, microplastics have been detected in Antarctica, the Arctic, on the peak of Mount Everest, and even in the Mariana Trench (Li et al., 2023).

They enter the environment through use of plastic products that are oxo-degradable.[3] One example is the wearing and washing of textiles made from plastic fibres, another example is from vehicle tyres. Microplastics also enter the environment through waste.

Waste

When plastics are discarded, UV weakens the plastic material, causing it to fragment into microplastics. These disperse into the broader ecosystem, contaminating food chains through agricultural soils and the water supply. The plastics leach toxic additives into the environment, and as the plastics degrade, new surface areas are exposed, leading to continued leaching.

A second way in which microplastics enter the environment is through municipal wastewater: Murphy et al. (2016) found that a single wastewater treatment works released 65 million microplastics each day. This is after the screening process removed ~98% of microplastics that entered the treatment works, highlighting how difficult it is to prevent microplastics entering the environment.

Health

Microplastics are an emergent pollutant, with the full health impacts yet to be determined. Some of the statistics are confronting: the average adult consumes ~2,000 microplastics a year just through the consumption of salt and recent research has found microplastics in the olfactory bulb, which could act as a pathway for entry into the brain (Amato-Lourenço et.al. 2024).

Presently, our understanding of the threat of microplastics to human health is incomplete. However, some experiments have shown that exposure to microplastics induces a variety of toxic effects (Sangkham et.al, 2022) and experiments with human cells and data generated with mice showed that microplastics did elicit adverse health effects (Lee et. al, 2023).

[3] Oxo-degradation refers to plastic degradation caused by heat, light, or oxygen. The plastics contain additives that accelerate this process.

Regulatory landscape

UN Plastic Pollution Treaty

In February 2022, representatives from UN member states adopted a resolution to develop a legally binding agreement to end plastic pollution by 2024. The fifth Intergovernmental Negotiating Committee (INC) met in Busan, Republic of Korea in November 2024 to finalise the agreement. The draft agreement includes the following areas:

1. Primary plastic polymers,
2. Chemical and polymers of concern,
3. Problematic and avoidable plastic products, including short lived products and microplastics,
4. Product design, including the use of recycled contents,
5. Non-plastic substitutes,
6. Extended producer responsibility,
7. Emissions of plastics throughout the lifecycle,
8. Waste management,
9. Trade, including transboundary movement of plastic waste,
10. Existing pollution, including in the marine environment,
11. Just transition,
12. Transparency, tracking, and monitoring.

A few key points are worth mentioning: microplastics were specifically mentioned as a pollutant, the marine environment was a particular area of concern (which is often not under national sovereignty), and plastic pollution needs to be tackled with a full life cycle approach (even though at present only ~9% is recycled). Additionally, for companies, enhanced producer responsibility could mean increased accountability for downstream impacts of plastic products, leading to increased costs.

Negotiators failed to reach an agreement at the INC in Korea, with progress blocked by some producing nations who argued that curbing output fell outside the mandate of the agreement. They claim that production is not the issue, it's the pollution. Parties agreed to continue discussions in 2025.

European Union

The EU has a history of acting against plastic pollution.

There were two original measures:

1) Directive 2008/98/EC, called the Waste Framework Directive, that defined the legal framework for waste, recycling, polluter-pays principle, and the concepts of waste hierarchy and extended producer responsibility,

2) Directive 94/62/EC, called the Packaging and Packaging Waste Directive that focused on reducing the impact of packaging by setting recovery and recycling targets.

Plastic bags

Directive 2015/720 was introduced to reduce the consumption of lightweight plastic bags. The aim was to reduce annual consumption of lightweight plastic bags from 198 per person in 2017 to 40 by the end of 2025. Each member state has introduced different legislation to achieve this goal, and as at 2022, EU citizens used 67 per person.

Plastics strategy

In January 2018, the EC adopted the plastics strategy, with the aim to change the way plastics are produced, used, and recycled in the EU. Annex 1 detailed the list of measures required to implement the strategy, including revising Directive 94/62/EC. In May 2018, Directive (EU) 2018/851, called the Revised Waste Framework Directive, was passed with the aim to support the establishment of a circular economy within the EU.

The Circular Economy Action Plan, part of the EU Green Deal, added to previous plastics strategies. In addition to improving plastic waste management, this had a number of measures to address microplastics in the environment. It also included improving scientific knowledge on the health risks of microplastics.

Under Directive 2019/904, called the Single-Use Plastics Directive, from July 2021, single-use plastics plates, cutlery, straws, balloon sticks, and cotton buds could not be sold within the EU. Expanded polystyrene and all products made of oxo-degradable plastic were also banned.

Exhibit 8: Timeline for implementation under Directive 2019/904

Year	Target
2021	Labelling of high-risk consumer goods[4] in order to highlight plastic content highlighting plastic content
2024	Lids and caps made to stay on drinks containers and bottles (up to 3 litres)
2025	Plastic bottles made of > 25% recycled plastic and 77% separate collection of plastic bottles (up to 3 litres)
2026	EU countries to achieve cuts in consumption targets of single-use plastics, compared to 2022
2029	90% separate collection of plastic bottles (up to 3 litres)
2030	Plastic bottles made of > 30% recycled plastic

Source: *European Commission*

By the end of 2024, under the Packaging Directive, the EU has established specific targets for recycling, and plastic is included within these.

Exhibit 9: EU targets for recycling percentage under Directive 94/62/EC

Type	Current targets (%)	By 2025 (%)	By 2030 (%)
All packaging	55	65	70
Plastic	25	50	55
Wood	15	25	30
Ferrous metals	50	70	80
Aluminium		50	60
Glass	60	70	75
Paper and cardboard	60	75	85

Source: *European Commission*

Price on plastic

From January 2021, the EC introduced a member tax of €0.80 per kg for non-recycled plastic packaging waste produced in each member state. Individual countries are funding the member tax in different ways. Some examples:

- **Germany** plastic tax to be introduced from 1st January 2025. Planned changes will lead to different costs depending on the product: €0.06 per kg for wet wipes, €3.80 per kg for light plastic carrier bags, and €8.945 per kg for tobacco products. Total expected revenue from the tax €1.4 billion.
- **France** no introduction of a tax for producers or consumers. Banned medical devices containing microplastics from January 2024.

[4] Cups, wet wipes, sanitary pads, tampons, applicators, tobacco products with filters.

- **Italy** plastic tax to enter into effect in July 2026. From WTS Global: 'The tax will apply to products that are intended for the containment, protection, handling or delivery of goods or foodstuffs made using plastics consisting of organic polymers of synthetic origin that are not designed for repeat usage.'
- **Netherlands** no introduction of a tax for producers or consumers. Currently, there is a waste management contribution on plastic packaging for entities that introduce or dispose of 50,000 kg of plastic packaging. Tariffs range from €1.22 to €1.32 per kg.
- **Spain** non-reusable plastic products taxed at €0.45 per kg, paid for by the manufacturer or importer.
- **Sweden** introduced a plastic bag tax of 3 kronor in 2020, reducing plastic bag use from 74 per person in 2019 to 17 in 2023, meeting the 2025 EU plastic bag target. Starting November 2024, this will be repealed.

Currently, plastic is not covered by the EU Carbon Border Adjustment Mechanism.

United Kingdom

From the Environment, Food and Rural Affairs Committee: 'The UK Government has set a target of eliminating all 'avoidable' plastic waste by 2042, with a shorter-term ambition to work towards only recyclable, reusable or compostable plastic packaging being placed on the market by 2025.'

Price on Plastic

Entities manufacturing or importing 10 or more tonnes of plastic packaging that consists of less than 30% recycled content in the last 12 months are liable for the tax. The tax started in April 2022.

Exhibit 10: UK tax for plastic importers and manufacturers, with the price increasing by 17% over the first three years

Date implemented	Rate per tonne
April 2022	£200
April 2023	£210.82
April 2024	£217.85

Australia

Two waste management plans were introduced, supported by Federal, State and Territory governments: 1) the National Waste Policy Action Plan (NWPAP), introduced in 2019 and 2) the National Plastics Plan (NPP), introduced in 2021.

Included in the NPP and NWPAP are 2025 targets for industry:

Exhibit 11: Australian National Packaging Targets for 2025. Given current trends, it is unlikely these will be met by 2025.

Target	Progress at 2022
100% of packaging is reusable, recyclable or compostable	84%
70% of plastic packaging goes on to be recycled or composted	20%
50% average recycled content within packaging (20% for plastic packaging)	40%
Problematic and unnecessary single-use plastic packaging phased out	Reduced by 33% from 2017-18 baseline

Source: *Australian Government, APCO*

For context, in FY2020 the Department of Climate Change, Energy, the Environment and Water estimated that Australia consumed 1.1 Mt of plastic packaging, which equates to 31.6% of total plastic consumption.

[5] Quoted directly from Plastic waste - Committees - UK Parliament

Australian Packaging Covenant Organisation (APCO)

The APCO is a non-profit, setup with the goal of developing a circular economy for packaging in Australia. Setup as the entity in charge of managing and administering the National Environment Protection (Used Packaging Materials) Measure (2011), the APCO is currently focused on the 2025 National Packaging Targets. The APCO works with governments, industries, and strategic partners across the packaging value chain.

ANZPA Plastics Pact (ANZPAC)

Supported by the Ellen MacArthur Foundation, the global Plastics Pact network is a multi-national response to plastic waste and pollution. The aim is being stakeholders together to:[6]

- Eliminate unnecessary and problematic plastic packaging through redesign and innovation,
- Move from single-use to reuse,
- Ensure all plastic packaging is reusable, recyclable, or compostable,
- Increase the reuse, collection, and recycling or composting of plastic packaging,
- Increase recycled content in plastic packaging.

At the time of writing, 11 countries have signed national plastics pacts, aligned with the above principles. Australia, New Zealand and the Pacific Island Nations (ANZPAC) have come together as a region to commit to four specific targets:

1. Eliminate unnecessary and problematic plastic packaging through redesign, innovation and alternative (reuse) delivery models,
2. 100% of plastic packaging to be reusable, recyclable or compostable by 2025,
3. Increase plastic packaging collected and effectively recycled by at least 25% for each geography within the ANZPAC region,
4. Average of 25% recycled content in plastic packaging across the region.

The ANZPAC is delivered by the APCO and involves more than 100 organisations, including ASX listed businesses Amcor, Pact Group, and Cleanaway.

[6] Quoted directly from The Plastics Pact Network | Ellen MacArthur Foundation

Private companies

There are privately held companies, founded in Australia, that are proposing innovative solutions to plastic waste. We mention three here.

Licella

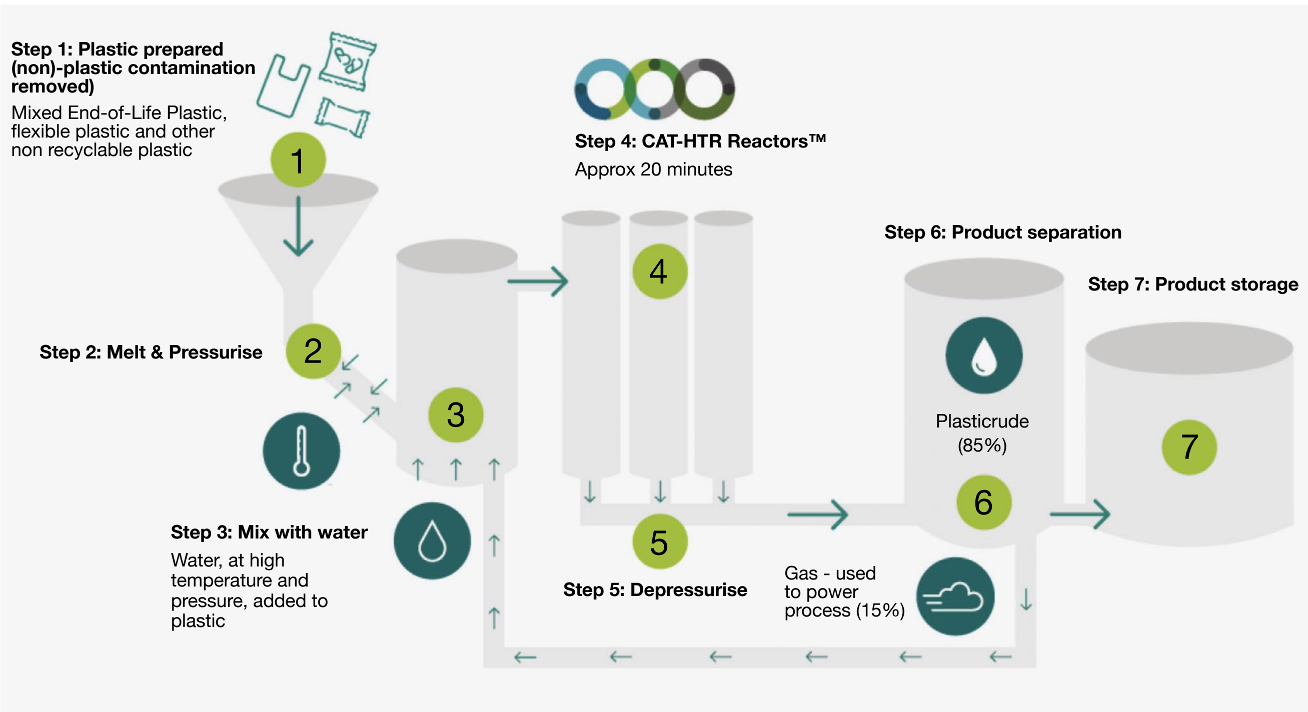
Founded by Dr Len Humphreys in 2007, Licella has developed a catalytic hydrothermal reactor technology, called Cat-HTR, that can recycle all polyolefin plastics into virgin feedstock. To date, Licella have invested ~$120m in developing the process. There are three parts to the process: catalysis, water, and heat.

The process can be summarised as follows:

- Plastic feedstock is converted into pellets,
- The pellets go through a process of depolymerisation, converting the pellets into individual carbon molecules,
- This is converted to a hydrocarbon liquid that be used to create plastic. The process can also take other feedstock, e.g., biomass, than can then create sustainable aviation fuel.

The transformation from waste to liquid hydrocarbon takes about 20 minutes. Because the technology reduces the hydrocarbon to individual molecules, the Licella process can recycle plastic as many times as required.

Exhibit 12: Schematic of Licella process for recycling plastics

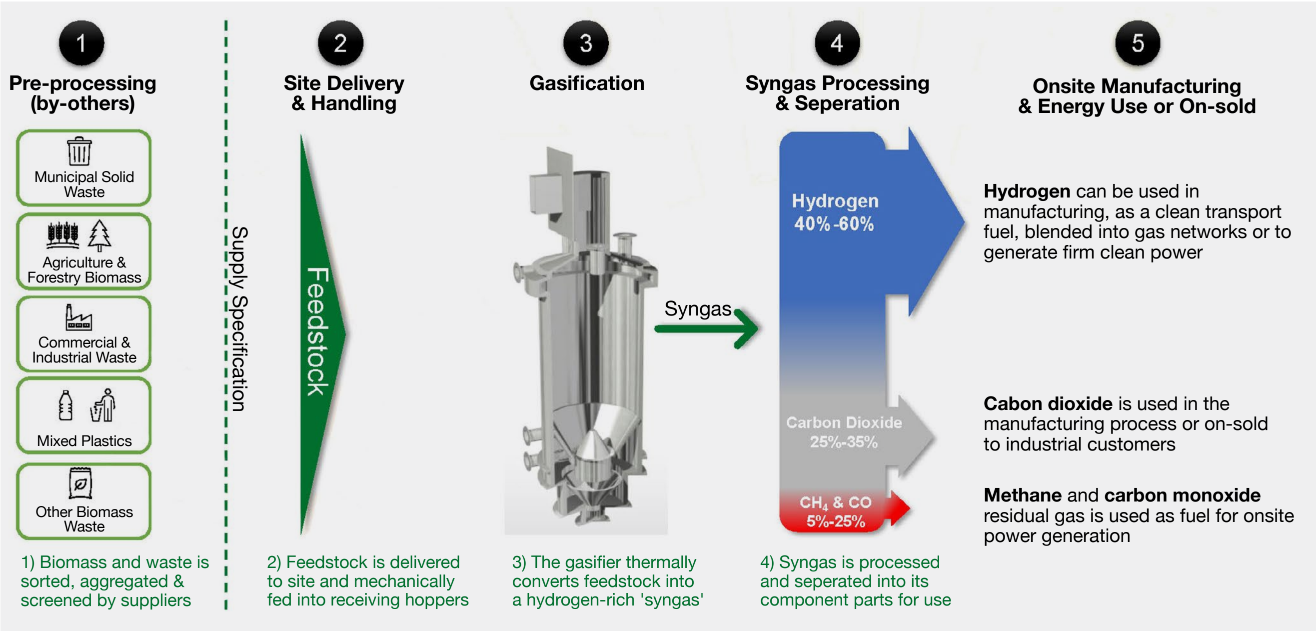


Source: *Licella*

Greenhill Energy

An energy from waste (EfW) startup that is building infrastructure at Tailem Bend in South Australia. Greenhill Energy have constructed a process that converts waste to hydrogen through gasification. While EfW is not a circular solution directly, feedstock into the process includes mixed plastics and the offtake from the process has many possible uses.

Exhibit 13: Schematic of Greenhill Energy waste to hydrogen process.



Source: *Greenhill Energy*

Syngas, short for synthesis gas, is a mixture, including hydrocarbons, that can be used to produce fuel (renewable diesel, sustainable aviation fuel), industrial chemicals (polymers, ammonia, methanol), and energy.

Greenhill was founded by Nicholas Mumford (ex-Santos and Shell) and Dr John Thomas.

Samsara Eco

Developed from research performed at the Australian National University, Samsara Eco is commercialising technology that uses plastic degrading enzymes to break plastic polymers into monomers. Once additives have been removed, these monomers can then be manufactured into polymers, creating brand new plastics. The key part to the business model is that Samsara Eco is scaling the capability to discover and develop new enzymes that will be able to break down any type of plastic.

In 2023, the company announced a partnership with Lululemon to create recycled nylon 6,6 (also known as polyamide, nylon 6,6 is made of two monomers each containing 6 carbon atoms) and polyester. The company grew fast, and in 2024 raised $100 million Series A+ from large global investors to fund the construction of a nylon 6,6 recycling facility. Estimates vary, but the sustainable fabrics market is expected to grow at a high single digit CAGR through to 2030.

Public companies

Breville (BRG)

Breville manufactures and distributes home appliances. In 2025, Platypus estimates geographic revenue split for FY25 for global product as follows: APAC 20%, North America 55%, and EMEA 25%.

In the 2024 annual report, BRG reported on results from a Life-Cycle Analysis (LCA) of their products. BRG state that there is an emissions reduction opportunity from reducing plastic and metal usage in the product manufacturing stage. BRG are a member of APCO.

BRG's current commitments are:

- All packaging to be reusable, recyclable or compostable by end 2025 (aligned to APCO target);
- Removal of expanded polystyrene (EPS) from consumer packaging by July 2025; and
- Removal of non-essential packaging (ongoing target), for example the combination of shipper and inner display box.

In terms of waste diversion, soft plastics remain challenging. However, if BRG meet the APCO targets, we believe they are well positioned in terms of regulatory risk with respect to plastic.

ALS Limited (ALQ)

ALQ is a testing business, split into Life Sciences (61% of revenue) and Commodities (39% of revenue) divisions. Commodities covers minerals and industrial metals testing, and Life Sciences covers environmental, food, and pharmaceutical testing.

Sustainability revenue

As well as testing for per- and polyfluoroalkyl substances (PFAS), the environmental division also tests for microplastics. Legislation surrounding PFAS contamination of water supplies is becoming increasingly restrictive and the current 1.85% of revenue from PFAS testing is expected to grow. Note that while PFAS are not a type of plastic, microplastics can absorb PFAS. Understanding the toxicity effect of microplastics as a PFAS carrier, however, remains an active area of research (Yu et al., 2024).

ALQ have two methods to detect microplastics:

1) Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR) spectroscopy, used for detection of microplastics 50 μm or larger, and
2) micro FTIR, used for detection of particles between 10 μm and 50 μm.

At present, ALQ do not disclose the revenue portion of the microplastics detection business.

Operational Sustainability

ALQ detail a number of initiatives for removing plastic waste from their operations. Some notable initiatives mentioned in the ALQ 2024 report:

- Perth laboratory has managed to divert 90% of plastic waste from landfill through improved on-site sorting and collaborating with a local waste recycler,
- Geochemistry operations moving away from plastic products, saving ~500,000 single-use plastics per year.

Given ALQ's reduction operationally and revenue opportunity, if plastic regulation becomes more restrictive, we believe that ALQ are well placed to benefit.

Lovisa (LOV)

In the annual report, LOV mention that they are not subject to any significant environmental regulations, and that the directors believe the company has adequate systems in place for managing its environmental requirements. Beyond this, there is little further detail.

For the EU operations, where there is Extended Producer Responsibility for products throughout their lifecycle (including post-consumer) and recycling targets under the Packaging Directive, there is a risk LOV might experience legislative pressure in this context.

Amcor (AMC)

In FY24, AMC had global revenues of US$13.6bn, consisting of 76% flexibles and 24% rigid packaging. AMC spend ~US$100m on R&D, which is ~74bps of global revenue. The revenue mix in terms of primary components is 76% polymers, 14% metals, and 10% fibers. In terms of products, ~US$8.1bn of revenue came from products that meet recyclability guidelines. AMC split this into recyclable packaging (recyclable at scale and in practice) and recycle-ready (designed to be recycled, but the infrastructure may not yet be available. Recyclable packaging represents ~US$4.07 billion in revenue, and recycle-ready represents ~US$4.05 billion in revenue.

As a company, they are exposed to the long term risks of tightening plastic regulation, with 22% of revenue coming from the EU. Because of this, AMC are participating in legislative dialogue regarding the EU Packaging Directives.

There are a number of initiatives and targets that AMC have in place to advance the circular economy.

- AMC are working towards the following targets:
    - 10% post-consumer recycled plastic by 2025
    - 30% recycled content integration across all substrates by 2030
- With respect to the plastic supply chain, AMC are working with Licella and Delterra, a non-profit focused on bringing sustainability to the global south, to advance recycling technologies.
- They are collaborating with the Ellen MacArthur Foundation, the Alliance to End Plastic Waste, the Consumer Goods Forum Plastic Waste Coalition, and the WWF ReSource: Plastic Initiative.

Given the proportion of product that is based on polymers, it is important that AMC are the front foot with respect to the EU regulation and UN Plastic Pollution Treaty.

Orora (ORA)

ORA completed the purchase of Saverglass, a manufacturer of high-end bottles for the premium spirit and wine markets, in December 2023. Saverglass had established an internal program to reduce both waste and carbon emissions. This resulted in Saverglass reporting ~200 tonnes of polyethylene saved in FY24 from using recycled plastic pallet covers and reducing single-wrapping.

Bibliography

Amato-Lourenço LF, Dantas KC, Júnior GR, et al. (2024). Microplastics in the Olfactory Bulb of the Human Brain. *JAMA Network Open,* 7(9):e2440018.
https://doi.org/10.1001/jamanetworkopen.2024.40018

Chamas, A. et al. (2020). Degradation Rates of Plastics in the Environment, *ACS Sustainable Chemistry & Engineering, 8*(9), 3494-3511.
https://doi.org/10.1021/acssuschemeng.9b06635

Decode the Future of Low Density Polyethylene. (2024, October 3). Chemanalyst.
https://www.chemanalyst.com/industry-report/low-density-polyethylene-market-2955#:~:text=The%20global%20Low%2DDensity%20Polyethylene,the%20forecast%20period%20until%202032.

Plastics Pact Network. (2024, Nov 19). Ellen MacArthur Foundation.
https://www.ellenmacarthurfoundation.org/the-plastics-pact-network

European Commission: Directorate-General for Environment, Turning the tide on single-use plastics. (2021). Publications Office of the European Union.
https://data.europa.eu/doi/10.2779/800074

Fuelling Plastics. (2024, September 30). Centre for International Law.
https://www.ciel.org/wp-content/uploads/2017/09/Fueling-Plastics-Fossils-Plastics-Petrochemical-Feedstocks.pdf

Geyer, R., Jambeck, J. R., Law, K. L. (2017). Production, use, and fate of all plastics ever made. *Science Advances, 3*, e1700782.
https://www.science.org/doi/10.1126/sciadv.1700782

Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options. (2024, October 8). OECD.
https://doi.org/10.1787/de747aef-en

Greenhouse gas emissions from plastics lifecycle. (2024, October 3). OECD.
https://data-explorer.oecd.org/vis?tenant=archive&df[ds]=DisseminateArchiveDMZ&df[id]=DF_PLASTIC_GHG_2&df[ag]=OECD&dq=.&lom=LASTNPERIODS&lo=5&to[TIME_PERIOD]=false&ly[cl]=TIME_PERIOD&ly[rs]=PLASTIC_STAGE&ly[rw]=GREEN_HOUSE_GASES&vw=tb

Haribal, P. V., Chen, Y., Neal, L. & Li, F. (2018). Intensification of Ethylene Production from Naphtha via a Redox Oxy-Cracking Scheme: Process Simulations and Analysis. *Engineering, 4*(5), 714-721.
https://pubs.acs.org/doi/10.1021/acs.est.8b04180

How Is Plastic Made? A Simple Step-By-Step Explanation. (2024, September 30). British Plastics Federation.
https://www.bpf.co.uk/plastipedia/how-is-plastic-made.aspx

Kim, S.-J., Lee, H.L., Kim, S.-K. & Kim, H.-J. Global Pattern of Microplastics (MPs) in Commercial Food-Grade Salts: Sea Salt as an Indicator of Seawater MP Pollution. *Engineering Science & Technology, 52*(21).

Lee, Y., Cho, J., Sohn, J. & Kim, C. (2023). Health Effects of Microplastic Exposures: Current Issues and Perspectives in South Korea. *Yonsei Med J. 64*(5):301-308.
https://doi.org/10.3349/ymj.2023.0048

Li, Y., Tao, L., Wang, Q., Wang, F., Li, G., & Song, M. (2023). Potential Health Impact of Microplastics: A Review of Environmental Distribution, Human Exposure, and Toxic Effects. *Environment & Health, 1*(4), 249-257.
https://doi.org/10.1021/envhealth.3c00052

Meijer, L. J. J. et al. (2021). More than 1000 rivers account for 80% of global riverine plastic emissions into the ocean. *Science Advances, 7*, eaaz5803.
https://www.science.org/doi/10.1126/sciadv.aaz5803

Murphy, F., Ewins, C., Carbonnier, F. & Quinn, B. (2016). Wastewater Treatment Works (WwTW) as a Source of Microplastics in the Aquatic Environment. *Environmental Science & Technology, 50*(11), 5800-5808.
https://doi.org/10.1021/acs.est.5b05416

Plastic Taxation in Europe. (2024). WTS Global. (refer to page 9)
https://wts.com/wts.com/publications/climate-protection-green-tax-energy/2024/wts-global-plastic-taxation-2024-updated.pdf (refer to page 9)

Plastic and Human Health: A lifecycle approach to plastic pollution. (2024, Oct 11). Center for International Environmental Law.
https://www.ciel.org/plasticandhealth/

Revised draft text of the international legally binding instrument on plastic pollution, including in the marine environment. (2024, Nov 4). United Nations Environment Programme.
https://wedocs.unep.org/bitstream/handle/20.500.11822/44526/RevisedZeroDraftText.pdf

Ritchie, H., Samborska, V. & Roser, M. (2023). Plastic pollution. Our World in Data.
https://ourworldindata.org/plastic-pollution

Sangkham, S., Faikhaw, O., Munkong, N., Sakunkoo, P., Arunlertaree, C., Chavali, M., Mousazadeh, M., Tiwari, A. (2022). A Review on Microplastics and Nanoplastics in the Environment: Their Occurrence, Exposure Routes, Toxic Studies, and Potential Effects on Human Health. *Mar. Pollut. Bull., 181*, 113832.
https://doi.org/10.1016/j.marpolbul.2022.113832

Sustainable Fabrics Market Size, Share, Growth, Trends, and Global Industry Analysis: By Product (Organic, Natural, Recycled and Regenerated), By Application (Furnishing, Clothing, Medical and Others) and Region. (2024, Nov 18). Precision Business Insights.
https://www.precisionbusinessinsights.com/market-reports/global-sustainable-fabrics-market

The New Plastics Economy: Rethinking the Future of Plastics. (2024, Nov 26). Ellen MacArthur Foundation.
https://emf.thirdlight.com/file/24/_A-BkCs_skP18I_Am1g_JWxFrX/The%20New%20Plastics%20Economy%3A%20Rethinking%20the%20future%20of%20plastics.pdf

What is High Density Polyethylene (HDPE)? (2024, October 3). Xometry.
https://www.xometry.com/resources/materials/high-density-polyethylene-hdpe/#:~:text=High%20Density%20Polyethylene%20(HDPE%20for,chemical%20formula%20(C2H4)n.

Yu, F., Wu, J., Wang, H., Bao, Y., Xing, H., Ye, W., Li, X. & Huang, M. (2024). Interaction of microplastics with perfluoroalkyl and polyfluoroalkyl substances in water: A review of the fate, mechanisms and toxicity. *Science of The Total Environment, 948*, 175000.
https://doi.org/10.1016/j.scitotenv.2024.175000

PLATYPUS ASSET MANAGEMENT

Disclaimer

Wholesale Clients Only. The information contained in this presentation is made available only to persons who are wholesale clients for the purposes of section 761G of the Corporations Act 2001 (Cth) (Wholesale Clients), and this information is only intended for Wholesale Clients. It may not be distributed or replicated in any form, to anyone who is not a Wholesale Client. The information contained in this presentation is intended for recipients in Australia only.

General Advice. As the information has been prepared without considering your objectives, financial situation, or needs, you should, before acting on the information, consider its appropriateness to your circumstances. Prior to investing in any financial product, an investor should determine, based on its own independent review and such professional advice as it deems appropriate, the nature and extent of economic risks and merits, the legal, tax accounting characteristics and risk, and the consequences of an investment in the financial product.

No Reliance. This document is produced by Platypus Asset Management Pty Limited (Platypus) ABN 33 118 016 087, AFS Licence No 301294 and based on information available at the time of the first presentation. The information herein is believed to be accurate as at the time of the first presentation and any opinions, conclusions or recommendations are reasonably held or made but no warranty is made as to accuracy, reliability or completeness. To the extent permitted by law neither Platypus, or any of its related parties, or any of their respective employees or any other person accept any liability for any claim in respect of anything stated herein, and of the consequences of anything, done or omitted to be done by any person acting in reliance, whether wholly or partially, upon the contents of this presentation. No person shall act or omit to act on the basis of any information presented during the course of this presentation without considering and if necessary, taking appropriate professional advice upon his or her own particular circumstances.

Illustrative information only. This presentation is not, and is not intended to be, an offer or invitation for subscription or sale, or a recommendation, with respect to any financial product discussed herein, nor is it to form the basis of any contract or commitment. Such an offer would only be made by distribution of an offering memorandum relating to any such financial products offering recipients of this presentation should therefore place no reliance on the content of this presentation when making any decision to invest. Any examples or information provided in this document are for illustrative and discussion purposes only and do not represent a recommendation or Platypus' view on future events and in no way bind Platypus. The presentation and this document do not purport to be a complete statement or summary. Past performance is not a reliable indicator of future performance.

Third Party Data. Where this presentation contains, refers to or relies upon, whether wholly or partially, third party data, third party collative or comparative methodologies or third party data constructs (Third Party Data), Platypus does not and cannot confirm, warrant or guarantee the accuracy, completeness or reliability of such Third Party Data or any contents of this presentation prepared in reliance, whether wholly or partially, upon such Third Party Data, and accept no responsibility or liability whatsoever in respect of such Third Party Data or any contents of this presentation prepared in reliance, whether wholly or partially, upon same.