Chemical Recycling and Mass Balance

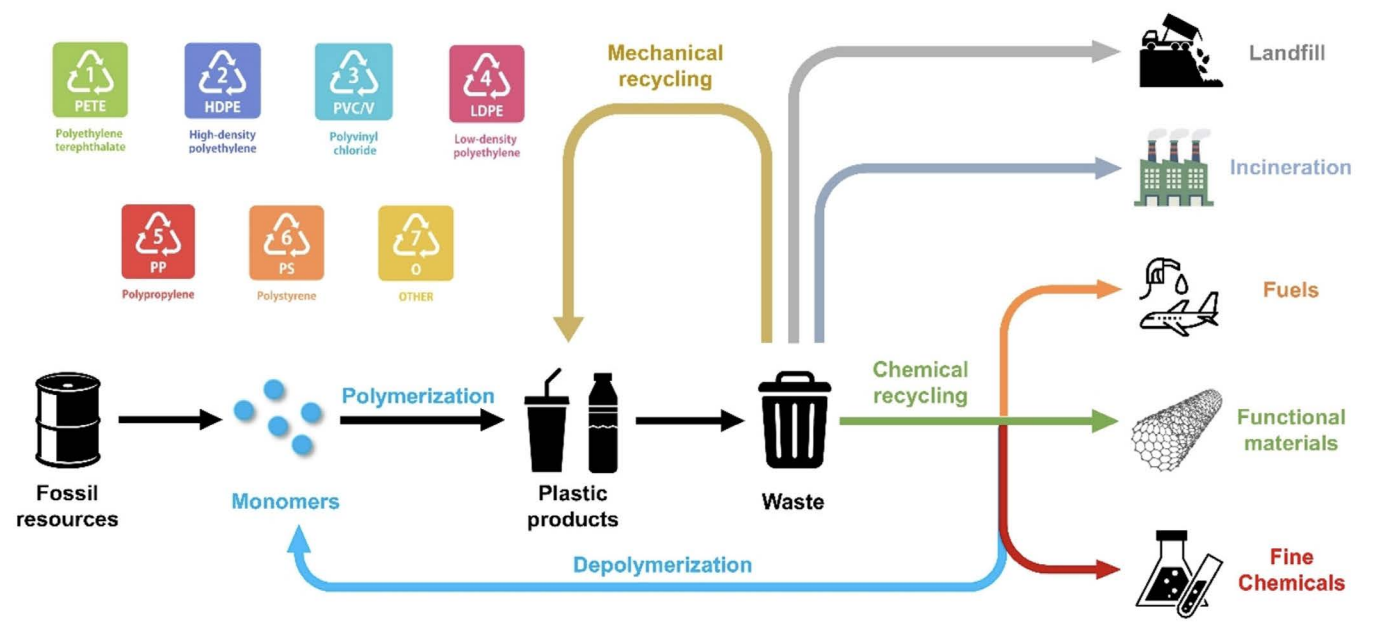
About us

With 96% of manufactured goods relying on chemical processes, the chemical sector plays a critical role in the UK's net zero transition. The industry is considered a high emitting sector, yet it offers a plethora of opportunities to aid efforts toward decarbonisation, particularly within the acceleration of the circular economy. It is therefore imperative that the chemical sector's views are portrayed and understood by policy makers. The chemical industries are at the heart of plastics production and have the capacity to extend the lives of these traditionally hard-to-recycle materials through advanced chemical recycling. This enables waste plastic to be broken down into its chemical components and fed back into the cracking process alongside virgin fossil-based feedstocks to produce new products. As a result, plastic waste is prevented from being sent to landfill or incinerated, subsequently reducing the production of greenhouse gas emissions and supporting the UK in reaching its climate and nature goals.

RECOMMENDATION — CIA are very supportive of mass balance. We believe the UK should adopt a third-party certified mass balance approach, using the fuel exempt allocation method for calculating the recycled content in chemically recycled plastic. We are of the opinion that this should be extended to all plastic products and that mass balance should be technology neutral. There must be a level playing field for all recycling options, with chemical recycling regarded a complementary technology to mechanical recycling. Chemical recycling can increase rates of recyclability, contributing to the advancement of a circular economy for plastics in the UK, driving inward investment and reducing greenhouse gases.

Introduction

Chemical recycling is an umbrella term for a number of different processes which break down plastic waste by changing its chemical structure. This produces chemical substances, including monomers, that can be used to form the chemical building blocks for new plastic materials or the manufacture of other chemical products. These products exclude those used as fuels or meant to generate electricity, as energy from waste should support, not compete, with effective recycling. This is supported by the Department for Environment, Food and Rural Affairs (Defra) positioning the production of energy from waste below recycling in the waste hierarchy (Defra, 2014).



Source: Waste to Wealth: Chemical Recycling and Chemical Upcycling of Waste Plastics for a Great Future

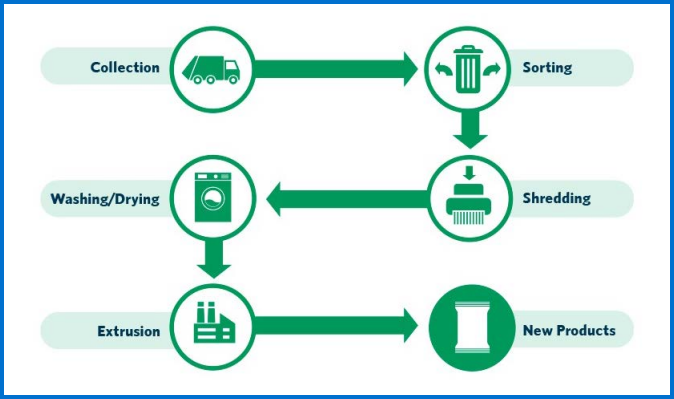
Chemical recycling vs mechanical recycling

CIA view chemical recycling as a complementary, not competitive, technology to traditional mechanical recycling. It should be seen as part of the wider recycling picture below mechanical recycling in a waste hierarchy which prioritises a reduction in production and consumption. Unlike mechanical recycling, chemical recycling enables complex materials, including films and flexibles which must be collected by local authorities by March 2027, to be recycled while producing a higher grade of recycled plastic. Therefore, chemical recycling supports mechanical recycling by compensating for the latter's shortcomings through being able to recycle mixed plastic waste streams, multi-layered products, and contaminate plastics – such as films from food containers.

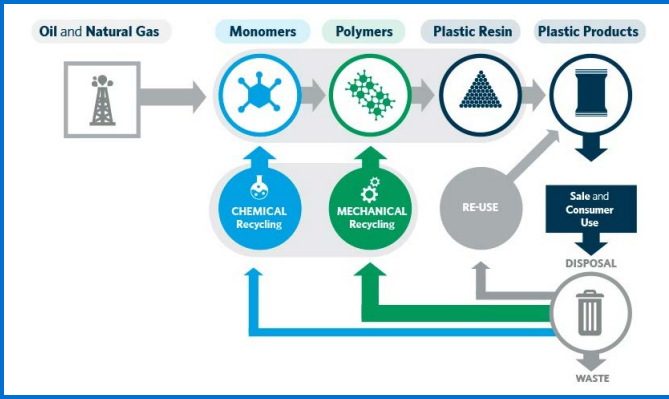
It is important that mechanical recycling continues to be supported and improved through the implementation of more advanced collection and sorting practices. According to the RECOUP 2022 Household Waste Collection Survey, in 2021 833,000 tonnes of plastic remained uncollected for recycling, instead being sent to landfill or for energy recovery. A more robust collection and processing system can reduce contamination, reduce time-associated costs, and achieve higher recycling rates. Improved systems for collecting and sorting waste also serve to benefit advanced recycling as it provides higher quality feedstock flows to be recycled and turned back into plastic products. Therefore, it is imperative that we improve collection and processing to increase materials entering the circular economy and to ensure adequate plastic waste feedstock.

When used in conjunction with mechanical recycling, chemical recycling can help to achieve higher levels of reuse and recycling. Subsequently, chemical recycling prevents plastic waste from being incinerated or going to landfill and can substitute significant amounts of fossil feedstock with recycled feedstock. As a result, chemical recycling leads to a reduction in greenhouse gas emissions, contributing toward the UK's climate and nature goals.

MECHANICAL Recycling



ADVANCED Recycling



Source: Amcor

Why mass balance?

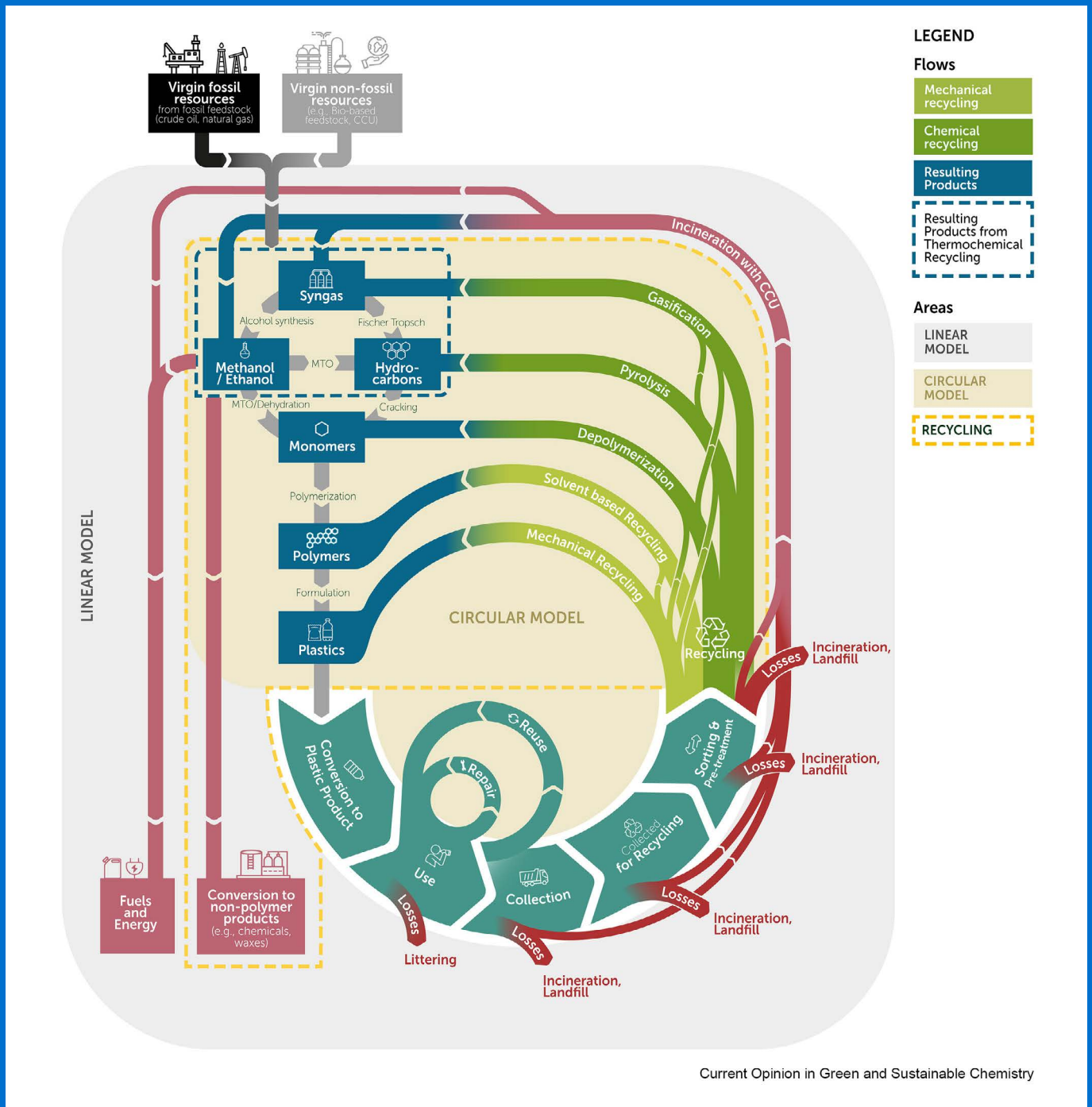
Once co-fed into the cracking process, virgin and recycled feedstock cannot be separated. Therefore, a verified approach to calculate chemically recycled content in plastics is needed; mass balance offers the solution. As a chain of custody approach, mass balance can track materials through a complex value chain, allowing recycled inputs which are mixed with virgin materials during the process to be allocated to particular outputs.

There is a growing demand from stakeholders for products to have greater green credentials. To meet this demand and ensure chemical recycling can effectively contribute to the UK's circular economy, Government must entice investment with secure and consistent regulations. Up until now the UK has not had specific standards in place for the process of chemical recycling and the allocation of recycled content. It is highly probable that this lack of consistency and stability will have driven away potential investment. Therefore, the acceptance of the mass balance approach for the purpose of chemical recycling – and other technologies which seek to fuse recycled and virgin feedstock – is likely to drive investment into the UK and benefit both our economic and environmental credentials.

A recent report from the Institute for Public Policy Research (IPPR) has warned that the UK is failing to seize the economic advantages presented by the global shift towards a net-zero carbon future. The report argues this is primarily due to the lack of a green industrial strategy and the UK's public investment commitments to low-carbon technologies being among the lowest in the G7. It is therefore not surprising that the UK is experiencing a divestment of funds for green technologies because there is the lack of certainty around the UK as an attractive green investment zone. Other jurisdictions have concrete finance schemes to provide investors with the security they need to put money into the UK. This is most apparent in the US and the EU with the introduction of their green finance packages, the Inflation Reduction Act and the Net Zero Industry Act, respectively. We are still awaiting a response from the UK Government to our overseas competitors. We urge

the government to publish a comprehensive response to these financial plans to assure investors that the UK is both a safe and prosperous place to invest in green technologies, not only for our own economy but for the state of the UK's climate and natural surroundings.

Chemical recycling using mass balance is a relatively novel concept, therefore there is an opportunity for the UK to capitalise on this technology. If the UK were to make significant investments, we may be able to take a leading role culminating in job creation and potentially finding ourselves in a position to export recycled feedstock outside of the UK. The UK has a history of exporting plastic waste; 0.48 million metric tonnes were exported in 2022 with the Netherlands and Turkey among the top destinations for UK plastic waste exports. However, countries are beginning to refuse receival of plastic waste exports, providing yet another reason for the UK to become more adept at handling waste through improved processing facilities. It is important that we stop regarding this as waste and begin to see it as a valuable resource.



Current Opinion in Green and Sustainable Chemistry

Source: sciencedirect.com

Allocation method

We recognise that any potential investment in chemical recycling is enormously dependent upon a robust mass balance allocation model not just the principle of mass balance itself being introduced in the UK. We support the adoption of the fuel use exempt allocation model which enables a credit-based mass balance method using actual conversion factors to correct for process losses and outputs consumed as fuel.

The free allocation method provides too broad a scope, enabling businesses to allocate the recycled feedstock to any output product, including those used to make fuel. As stipulated by the waste hierarchy, recycling should be prioritised over energy from fuel; a free allocation model does not provide a suitable incentive to use the recovered hydrocarbons generated by chemical recycling to make new recycled plastics and in turn, retain existing carbon in the plastic lifecycle. Proportional balance and polymer-only allocation methods are restrictive; they would hamper the acceleration of the circular economy by leading to low amounts of recycled content for technologies and processes with several outputs. These recycled contents would initially be too low to create any meaningful effect, eventually diminishing market demand and technology progress. These allocation methods would mean that chemical recycling facilities would not be economic to run, as for the same amount of plastic waste input you're reducing the number of credits which can be allocated and subsequently limiting materials that can be used within a circular economy. The expected outcome would be a slowing down of the uptake of chemical recycling which we know is necessary to drive circularity. Transitioning to a stricter level of allocation, such as proportional balance, *might* be a longer term aim once the volumes of recycled raw materials have increased, and collection and sorting techniques improved. It is also imperative that extraneous variables are aligned to ensure economic viability and the continued long-term investment in chemical recycling technologies.

Calculation level

To ensure transparency and credibility, the boundaries within which the mass balance system lie must be verified, clearly defined and applied consistently across the plastics value chain. While using the batch level calculation provides the strongest link between inputs and outputs, the administrative burden is incredibly high. This would take time and resources from companies – especially SMEs – as they would need to have adequate numbers of trained staff to oversee and verify the calculations. It is also plausible that, due to the restrictive nature of this level, investment into the UK may be discouraged.

On the other side of the divide, despite the group level providing the weakest link between the recycled feedstock inputs and outputs, it is less resource intensive. In the UK chemical sector there are pipelines which various chemical companies feed into (e.g. ethylene pipeline) and customers extract material from. As such, it would not be practical to have a site or batch level calculation. Because the group level records the total amount of recycled feedstock received across all sites, a proportion of that recycled feedstock can be allocated to the output products produced across the company. As such, the administrative burden is greatly reduced. Nonetheless, we understand this means there is no guarantee the output products from a particular cracking process or site would contain any recycled feedstock, opening companies up to greenwashing critics. Therefore, we would propose that the government enable the group level allocation of mass balance however restrict it to sites within the UK. Ensuring credit transfers emanating from a plant/cracker within the UK will enable the UK government to maintain a degree of regulatory control and strengthen the link between the recycled inputs and outputs.

Third-party certification

Third party auditing schemes should be adopted to provide quality assurance of recycled content claims. This will guarantee the correct and transparent use of appropriate chain of custody methods along the plastics value chain; avoid double booking; substantiate recycled content claims; and provide credible and transparent information to the market and consumers. Nevertheless, it is important that the certification process is used consistently and is globally aligned in approach, terminology, requirements and guidance on the application and certification of mass balance.

There are a number of existing certification schemes for the mass balance approach. However, each has a different methodology, accounting unit, and levels of mass balance. Therefore, our recommendation would be to permit a certification scheme like that of the ISCC PLUS which is internationally recognised; encompasses a broad range of products; and is flexible in meeting the demands of other markets. This would be of great benefit should mass balance be applied to other plastic products beyond packaging. It is important that Government closely review the existing certification schemes to ensure that whichever ones they choose to adopt are aligned to ensure consistency across the plastics value chain. This will facilitate the scaling up of advanced recycling to expand the scope and volume of plastics recycling.

We believe that all businesses in a supply chain, from the recycler to the packaging manufacturer, should be certified – however, they do not all need to be under the same scheme. As long as a set of minimum requirements are met and that the certification schemes are compatible then there should be consistency across the value chain which enables consumers or regulators to easily digest the sustainability credentials of the product across its whole lifecycle. Not depending on just one scheme allows for free market flows and the faster scale up of chemical recycling and recyclate.

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