“Chemical recycling” and plastic-to-fuel

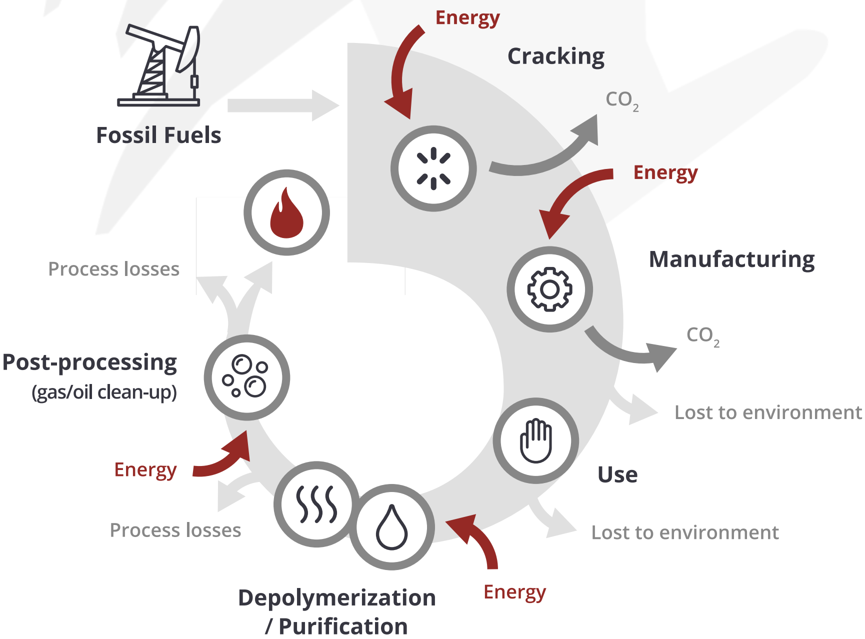
Issues and concerns

The vast majority of plastic produced is not recycled. Mechanical recycling technologies can recycle a few polymers and struggle to cope with additives, fillers, and contaminants. With plastic production doubling every twenty years, virgin polymer is cheap and abundant, creating an economic challenge to recycling.

Industry proposes to address these issues with a set of technologies called “chemical recycling,” “molecular recycling,” or “advanced recycling.” These are primarily pyrolysis- or solvent-based technologies that aim to strip out additives and impurities and break plastic down into its building blocks (monomers). These could then be used to make new plastic.

However, after billions of dollars and decades of development, chemical recycling does not work as advertised. It requires huge energy inputs, which translate into a carbon footprint on par with virgin plastic production. Much of the plastic is lost in the process, impairing a true circular economy in plastic. The product is highly contaminated with metals and heteroatoms, including toxic compounds such as dioxin. This then requires substantial cleaning and upgrading before use—processes that add even further to the energy demands, carbon footprint, and waste stream.

The low quality and high levels of contamination of pyrolysis oil mean that it is more likely to be burned as fuel than used as plastic feedstock. However, the contamination is also a problem for advanced engines, and the fuel is typically mixed with higher quality fossil fuels to bring it up to specification. Using plastic waste as fuel does nothing to avoid the production of new plastic or create a circular economy in plastic.



▲ Geenhouse gas emissions associated with “chemical recycling” and plastic-to-fuel throughout the full lifecycle of plastic

Recommendations

The global plastics treaty must:

- Clearly define recycling as plastic-to-plastic processes that have a smaller carbon footprint than virgin plastic, thereby excluding plastic-to-fuel.
- Limit plastic production to those plastics for which post-consumer recycling markets exist. This means phasing out some polymers and many additives and fillers.
- Mandate that national action plans be based on current markets and technological capabilities rather than tenuous future technologies.

Pitfalls to avoid

- Policymakers should not rely on industry claims that technological capabilities will be available at the time and scale needed to address the plastic crisis.
- Policies should not incentivize chemical recycling or plastic-to-fuel technologies unless certain plastic-to-plastic processes meet stringent circularity and climate criteria, which would exclude plastic-to-fuel.

Further reading

- Rollinson, Andrew Neil, and Jumoke Oladejo. 2020. "Chemical Recycling: Status, Sustainability, And Environmental Impacts." Global Alliance for Incinerator Alternatives. https://doi.org/10.46556/onls4535
- Moon, Doun and Shanar Tabriz. 2022. "Plastic-To-Fuel: A Losing Proposition." Global Alliance for Incinerator Alternatives. https://www.no-burn.org/resources/plastic-to-fuel-a-losing-proposition
- Rollinson, Andrew Neil. 2021. "The Reality of Waste-derived Fuels: Up In the Air." Global Alliance for Incinerator Alternatives. https://www.no-burn.org/jetfuels
- Tabrizi, Shanar. 2021. "Designing for Real Recycling, Not Plastic Lock-in." Zero Waste Europe. https://zerowasteeurope.eu/library/designing-for-real-recycling-not-plastic-lock-in