Answers by Lauriane Veillard, Policy Officer with Zero Waste Europe, to the "chat" questions asked during the February 8 GLOBE EU event on Chemical Recycling:

Q: What is the "fuel use exempt" model?

The "fuel use exempt" model refers to the accounting and allocation approach discussed in the methodology defining recycled content.
The recycled content methodology is a way to describe which amount of recycled content can be claimed at the end of a recycling process. To do so, several chains of custody can be used, i.e. identity preservation, segregation, and mass balance, with different criteria and requirements, which can be applied to different technologies. To better ensure the highest traceability, identity preservation and segregation models should always be prioritised when possible.
Pyrolysis (which can be defined as "chemical recycling") is a multi-output process and defining where "goes" the recycled content is highly debated. To help ensure the traceability of recycled content, mass balance is a chain of custody model, which is used as it describes the link between a verified unit of production and the claim about the final product.[1] There are different approaches to how to claim the final product, and in this case, recycled content: proportional allocation, polymer only, and fuel use exemption.

- **Proportional allocation** - Recycled content can only be allocated on the basis of what is theoretically present in the specific output product, i.e. recycled content claims cannot be transferred from one output product to another. At the end of the process, claims related to recycled content are reliable.

The proportional allocation is the only approach ensuring a level playing field between different recycling technologies and therefore would not undermine the European recycling landscape. Indeed, pyrolysis and gasification are the only technologies, which would strongly benefit from a looser allocation method. The recycling rate of these thermo-chemical technologies (pyrolysis and gasification) would rise from around 10% up to 80% depending on the mass-balance approach used, while in reality, no changes occur in the system.

- **Polymer only** - the theoretical amount of recycled plastic in outputs that are directly linked to the production of polymers can be freely allocated among these outputs.

With an allocation to polymers only, there is a risk to increase downcycling practices. Such practice will likely make recycled polymers end up being used for other applications than the one they were used to in the first place, which creates a leakage effect. For example, rPET from plastic bottles might be used as recycled fibres for textiles. Currently, 14% of polyester comes from recycled materials and most of it from beverage plastic bottles.[2]

- **Fuel use exemption** - fuel use in the process and co-products produced and used as fuels are excluded with the remaining theoretical amount of recycled plastic being freely allocated among the remaining output products.

This is the most flexible allocation rule possible while remaining in the EU legislative framework considering the definition of recycled states in Article 3 (17) of Directive

[1] ISEAL Alliance, *Chain of custody models and definitions*, 2016
[2] Eunomia, *How circular is PET?*, 2022

2008/98/EC. It results in unfair practices for recycling technologies using less flexible mass balance as it impacts the apparent polymer yield.

The allocation method should ensure a level playing field between the recycling technologies and represent as close as possible the recycling yield of each technology and therefore act as a lever to promote firstly high-yield recycling technologies. Therefore Zero Waste Europe recommend the use of proportional allocation.

Q: When referring to chemical recycling, are all technologies being considered: pyrolysis, depolymerization, glycolysis, enzymatic etc.? Wouldn't there be a difference in energy consumption?

Zero Waste Europe does not recognize pyrolysis and gasification as chemical recycling technologies, but rather as chemical recovery technologies follow the low yield of this technologies and the types of output they are producing (See table bellow)

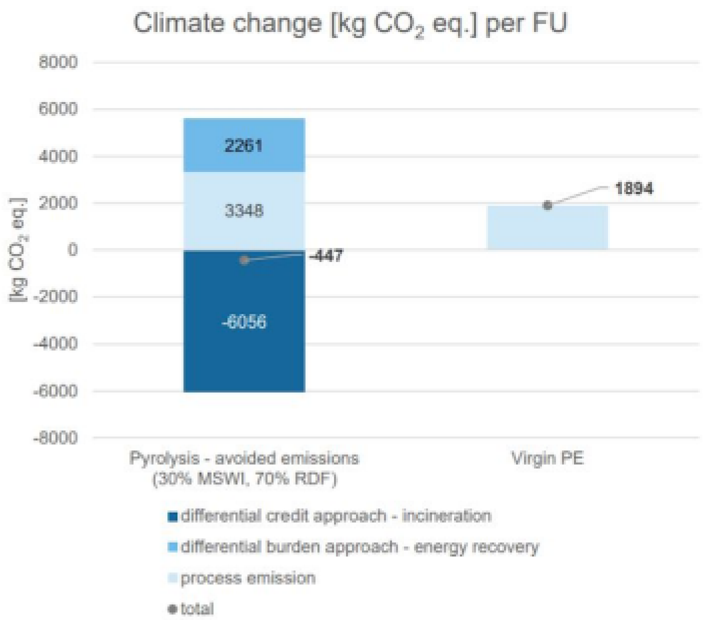
Classification in Waste Hierarchy	Input - Output	Techniques
Physical Recycling[6]	Polymer to Polymer	Mechanical and solvent-based recycling
Chemical Recycling	Polymer to Monomers and/or Oligomers	Thermal depolymerisation to monomers and oligomers, chemolysis and solvolysis
Chemical Recovery	Polymer to Molecules	Thermal decomposition to molecules, pyrolysis and gasification

Source: Zero Waste Europe, *Chemical Recycling and Recovery – Recommendation to Categorise Thermal Decomposition of Plastic Waste to Molecular Level Feedstock as Chemical Recovery*, 2020

Q: Isn't chemical recycling an energy conservation process only when compared with incineration?

The overall environmental impact of pyrolysis is not properly shared as most life cycle assessments (LCAs) consider the climate impact of such technologies in comparison with incineration using the concept of avoided emissions.

This misleading accounting practice allows for theoretically reducing the environmental impact of technologies by comparing them with the worst-case scenario, i.e. in the case of waste with incineration (see graph below).



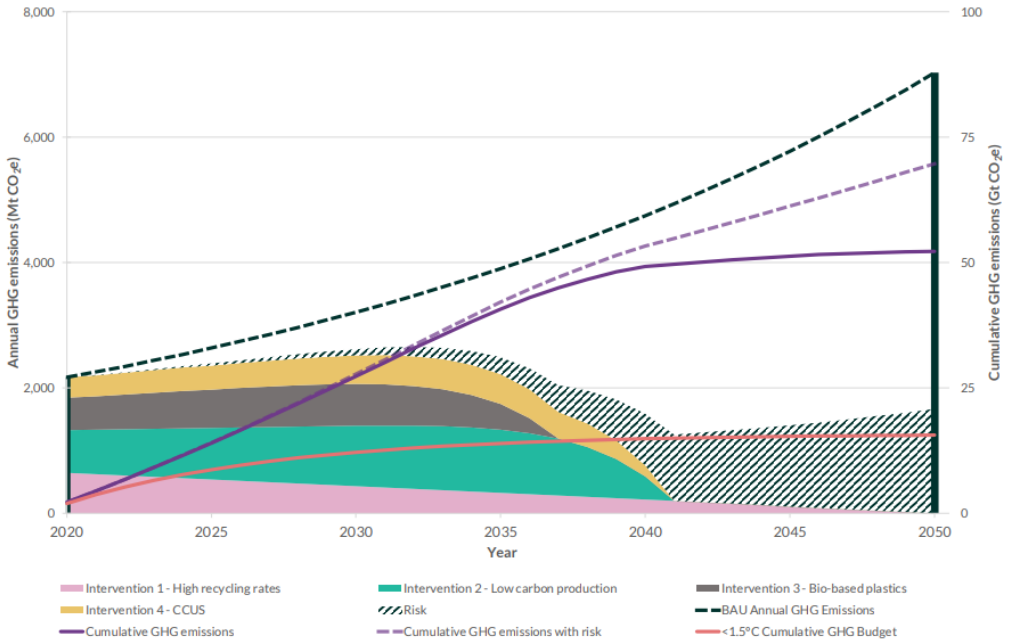
Source: Zero Waste Europe, *Understanding the Environmental Impacts of Chemical Recycling – Ten concerns with existing life cycle assessments*, 2020

Q: We currently produce 460 Mt of plastic annually. By 2050, we will produce more than 1,2 billion tons of plastic annually. The accumulated CO2 emissions between 2020 and 2050 will be 56 Gt set against a total carbon budget of less than 400 Gt during the same period. How do you think chemical recycling helps to address this challenge?

The plastic sector is inherently unsustainable as it is based on more than 90% of fossil resources, and when keeping the current strategy, plastic alone will exceed the carbon budget defined for the 4 most material-intensive industries (Aluminium, Concrete & cement, Iron & steel, Plastics) to remain aligned with the Paris Agreement target of 1.5 degrees of global warming.

Changes to meet the targets will not be met with the use of chemical recycling, the plastic industry shall rethink entirely its business model, and not adjust it marginally. The solution is to reduce material consumption and/or drive a shift in material consumption to less carbon-intensive sectors.

Figure 3.7: Modelled GHG Emissions Pathway for the Plastics Sector - Fossil/Bio-based Mix Scenario



Source: Zero Waste Europe, *Is net zero enough for the materials sector?*, 2021

Q: Doesn't chemical recycling act as a disincentive to "Design for Recycling" ?

Design for recycling intervenes at the production phase and has a strong potential in reducing the impact of handling plastic products at the end-of-life stage. This concept should be based on the best available technology with respect to a 'waste recycling hierarchy', i.e. priority is given to mechanical recycling with no competition with other technologies for the same plastic waste stream. Furthermore, policy measures and standards for recyclability should include specifications with regard to environmental performance and prepare products for recycling processes which ensure an overall positive environmental and climate performance, from a full life cycle perspective, clearly excluding fuel and energy recovery operations. To ensure strong incentives, the design for recycling shall be based on technologies at scale.

Q: Will big plastic producers pay for the collection of plastic to be chemically recycled ? Consumers pay for products and their collection only to pay again for the new product and finance recycling technologies with tax money, etc. This is not ecologically and socially sustainability.

Legislative framework should include clauses for holding companies responsible for the cost of managing the plastics they produce and put into the marketplace during the transition phase to much less plastic, including but not limited to the cost of recycling and disposal. Corporations should have to internalize costs associated with plastic pollution (such as mitigating health impacts, litter clean up, waste management costs, etc.) and invest in solutions. On the same line, corporations should be liable for all de-pollution costs arising from historical plastic waste/pollution.