INC-5.2 Statement from Observer Institution

King Abdullah Petroleum Studies and Research Center (KAPSARC)

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Date	August 5, 2025

KAPSARC extends its appreciation to the United Nations Environment Programme (UNEP) for preparing the "Compilation of Draft Text of the International Legally Binding Instrument on Plastic Pollution, Including in the Marine Environment." The Center commends the significant effort to consolidate the diverse inputs from all parties and acknowledges the high quality of the draft.

To avoid a recurrence of the stalemate witnessed during the first part of the fifth session of the Intergovernmental Negotiating Committee (INC-5.1), where several key issues remained unresolved, KAPSARC recommends that all negotiating parties engage with a shared understanding of each other's national circumstances. As an accredited observer, KAPSARC urges all parties to renew their efforts toward achieving consensus.

Prolonged delays risk undermining the global momentum needed for coordinated action to tackle plastic waste pollution. In the spirit of collaboration and constructive dialogue, KAPSARC respectfully recommends that the following points be taken into consideration to help advance the negotiation process.

Focus on Plastic Pollution

The Compilation Draft Text from INC-5.1 includes several provisions (Part II.1 and Part II.3 of the document) that call for reducing the production of plastic polymers. However, this approach has led to disagreement among negotiating parties. To support a more inclusive and consensus-driven process, the following points should be considered:

- **Debates around plastic production risk diverting attention from the core objective of the INC – namely, addressing plastic pollution.** The original mandate was established in March 2022 during the resumed fifth session of the UN Environment Assembly (UNEA-5.2), where a landmark resolution called for the development of an international legally binding instrument on plastic pollution, including pollution in the marine environment. Importantly, the UNEA resolution does not mandate restrictions on virgin plastic production. In this context, the emphasis on production cuts in the INC-5.1 Compilation Draft appears to deviate from the original scope and intent of the UNEA resolution. The primary focus of the INC mandate is on lifecycle pollution from plastics, not on production volumes per se.

- **Life-cycle assessment (LCA) studies suggest that plastics are relatively "clean" materials when compared to many of their virgin material substitutes**. Numerous LCAs have evaluated the environmental footprints of plastic production versus alternatives, such as glass, paper, aluminum, and steel (Meng, Brandão, and Cullen 2024; Pineda 2025; Tamburini et al. 2021; Garfí et al. 2016). While outcomes vary depending on the material, application, and environmental metric used – such as greenhouse gas (GHG) emissions, air and water pollution, or biodiversity loss – most studies highlight complex trade-offs. These trade-offs are often multidimensional and difficult to quantify, let alone monetize, which can lead stakeholders to emphasize only select metrics that support their advocacy positions (World Bank Group 2022). Meta-analyses that synthesize findings from multiple LCAs indicate that, under many conditions, substituting virgin plastic with other virgin materials tends to result in a higher overall environmental footprint.

- **Refocusing INC negotiations from polymers to products and waste management could unlock meaningful progress in tackling plastic pollution**. To effectively curb plastic pollution, it is crucial to identify its origins along the plastic value chain. Virgin polymers, in themselves, are generally safe for human use under standard exposure conditions and doses. Therefore, cutting polymer production does not address the root causes of plastic pollution, which emerge further downstream when polymers are transformed into intermediate and final products. At this stage, product design decisions, chemical additives, and consumer delivery models – tailored to meet demands for characteristics such as composition, color, durability, impermeability, inflammability, strength, flexibility, and lightness – play a decisive role. These factors determine not only how easily plastic products can be reused or recycled, but also how environmentally harmful they can become at the end of their life cycle. By shifting the focus to product-level interventions and waste management systems, policymakers can more effectively target the actual sources and transmission pathways of plastic pollution. This approach promises to be both more effective and efficient in achieving the overarching goal of pollution reduction.

- **Production cuts alone will not reduce the global plastic supply**. In the absence of policies that address product design and promote circular business models, producers will continue to meet consumer demand – even for non-essential products that are difficult to recycle and often contain harmful additives. In such a market context, production cuts by existing petrochemical manufacturers would likely lead to higher polymer prices, incentivizing increased output from other producers. This would merely shift market shares between countries rather than achieve a meaningful reduction in global plastic production. By contrast, targeting the actual sources of pollution – through improved product design standards, extended producer responsibility, and systems for reuse and recycling – can slow global demand for virgin plastic more effectively. This approach would reduce pollution in a less disruptive manner for the economy, environment, and society.

In summary, KAPSARC urges all parties to refocus negotiations on the reduction of plastic waste pollution, which remains the core objective of the original INC mandate. KAPSARC's research supports a lifecycle approach to preventing and reducing plastic pollution while promoting circularity across the value chain. Within this lifecycle perspective, policy interventions should be directed at the agents – producers and consumers – who actively generate and influence pollution, rather than entities that lack control over these outcomes.

Moreover, KAPSARC recommends that the draft text be carefully reviewed to assess the potential consequences of reducing plastic production without first ensuring the availability of viable, affordable, and scalable alternatives. These alternatives must be capable of delivering the essential services currently provided by plastics without introducing new sustainability risks or trade-offs.

Responsibility Behind the EPR Systems

The Compilation Text of the International Legally Binding Instrument on Plastic Pollution includes multiple references to Extended Producer Responsibility (EPR) under Part II.7, emphasizing its potential integration into both national and international policy frameworks. The draft text identifies producers, importers, and retailers as key stakeholders in the implementation of EPR systems. It also allows for flexibility in application, proposing that EPR schemes may be made mandatory for certain product categories while remaining voluntary for others, depending on the policy context and national capabilities.

Well-designed and effectively implemented EPR systems have demonstrated value in promoting upstream product design that reduces pollution and enables greater circularity downstream. By assigning appropriate EPR fees, such systems can send price signals to retailers and consumers, encouraging more sustainable purchasing decisions. These fees can also serve as a financing mechanism for improved waste management infrastructure and the development of circular business models.

In this context, KAPSARC supports the principle of shared responsibility among all stakeholders in the plastic value chain and acknowledges the demonstrated effectiveness of EPR schemes in certain regions. However, while consumer engagement is addressed indirectly in the Compilation Text – notably through references to waste segregation, source separation, and behavioral change in Part II.10 – their role is not clearly or explicitly defined. Likewise, although consumers and citizens are recognized as stakeholders in Part II.12, Part II.7 includes only limited and indirect references to consumer involvement within the EPR framework.

KAPSARC recommends further clarifying and strengthening the role of consumers within the EPR system to ensure a more holistic and effective approach to plastic pollution reduction.

Based on the above observations, KAPSARC would like to highlight the following points:

- In successful EPR systems, producer fees are typically paid by the economic entities that place the final product on the consumer market. This approach aligns financial responsibility with control over product design and marketing, where meaningful sustainability decisions are made. Eco-modulation of EPR fees – adjusting fees based on the environmental performance of products – serves as a critical incentive to promote sustainable design and influence consumer demand toward more sustainable choices. However, some parties have proposed shifting EPR fees upstream to plastic polymer producers, deviating from established international best practices. Such a shift would have two major consequences inconsistent with the goals of the INC: (1) it would misplace responsibility for pollution, transferring it from those who can directly influence product design, material use, and post-consumer waste (i.e., final product manufacturers, retailers, and consumers) to polymer producers, who have no control over downstream product design or end-use applications; (2) it would disrupt plastic consumption indiscriminately, potentially impacting critical applications of plastic – such as those used in medical, food, and safety-related products – without distinguishing between essential and non-essential uses.

- KAPSARC recommends aligning with established international best practices by targeting policy measures at actors who have the greatest influence over plastic pollution – namely, those involved in product design, marketing, and end-of-life management. This approach ensures that environmental objectives are met while preserving the essential functionality and societal benefits of plastics, particularly in sectors such as healthcare, food safety, and public protection.

- Accordingly, KAPSARC urges that the compiled draft text adopts an incentive-compatible definition of "producer" that is consistent with international norms. Specifically, the producer should be defined as the entity that places the final product on the consumer market. This definition should serve as a guiding principle for designing policy instruments such as EPR schemes, fiscal tools, and deposit-return systems, ensuring that responsibilities are clearly assigned to the actors best positioned to drive sustainable outcomes.

- The INC text should provide greater detail on the role of governments in enhancing consumer responsibility. Effective plastic pollution reduction requires active consumer participation, which can be encouraged through a combination of price incentives, public awareness and information campaigns, behavioral nudges, and supportive infrastructure. These tools can guide consumers toward more sustainable purchasing decisions, proper sorting, and responsible disposal of plastic waste, thereby strengthening the performance of recycling systems and advancing circular economy goals (UNEP 2020; Cai, Tremblay, and An 2022).

Regarding proposals to use EPR systems as a mechanism for transferring funds to low-income countries that import plastic products, KAPSARC recommends prioritizing the development and optimization of national EPR systems first. To gain broad stakeholder support, it is essential that EPR frameworks are well-designed and effectively implemented at the national level before considering cross-border financial linkages.

Design elements such as fee levels, eco-modulation schemes, and revenue recycling mechanisms must be pragmatically tailored to national circumstances, including industrial and market structures, plastic consumption and trade profiles, and the specific characteristics of plastic pollution. Additionally, institutional capacity, fiscal space, and the resource requirements of waste management systems vary significantly across countries, further justifying the need for nationally determined EPR policies.

Moreover, because EPR systems function with quasi-fiscal implications, attempts to internationalize EPR fee design or enable transboundary revenue transfers would likely conflict with the fiscal sovereignty of nation-states – a challenge that could make the INC negotiations extremely complex and politically sensitive.

Instead, there are more pragmatic and faster alternatives to support low-income countries. These include bilateral or multilateral aid mechanisms, technical assistance, and targeted funding programs that can help plastic-exporting high-income countries assist lower-income importers in building waste management capacity and preventing plastic leakage into the environment.

Leveraging All Technologies: Accelerating Innovation and Reducing Costs

The latest draft of the international legally binding instrument discussed at INC-5.1 appears to narrow the range of technology choices and approaches available to prevent and control plastic pollution. Notably, the treatment of chemical recycling in Part II, Section 5(b) raises concerns. The draft places a disproportionate emphasis on the potential risks of chemical recycling compared to other recycling methods.

While the document rightly notes that plastics containing harmful additives can compromise the safety and environmental integrity of chemical recycling, this should not be interpreted as an inherent flaw in the technology itself. With proper regulatory controls and technological safeguards, chemical recycling has the potential to substantially improve recycling rates and reduce landfill and incineration reliance, especially for mixed or hard-to-recycle plastics.

As such, policy support is crucial in enabling the adoption of the most suitable recycling technologies across different contexts. To this end, policymakers involved in drafting the legally binding instrument must consider the following key principles to ensure the framework effectively supports global efforts to enhance plastic circularity:

1. **Technology neutrality:** Allow for a diverse range of recycling technologies, including chemical recycling, to compete and evolve based on performance, safety, and sustainability outcomes.
2. **Risk-proportionate regulation:** Address environmental and health risks based on evidence, without prematurely excluding promising technologies.
3. **Incentivizing innovation:** Design policy mechanisms that encourage investment in and scaling of advanced recycling technologies.
4. **Alignment with lifecycle goals:** Support technologies that contribute to lifecycle improvements in circularity, emissions reduction, and resource efficiency.
5. **Tailoring to national contexts:** Recognize that different countries may require different solutions depending on their infrastructure, waste streams, and policy capacities.

By integrating these principles, the INC can help develop a robust, flexible, and innovative-enabling framework that maximizes environmental and economic benefits in the global effort to combat plastic pollution.

Technology Cost Considerations

- While the Compilation Draft INC 5.1 does not explicitly address the high costs associated with chemical recycling, it does reference, in Part II.2, the significant compliance costs related to managing chemicals of concern. In practical terms, when chemical recycling feedstocks contain harmful substances, facilities must be equipped with advanced air pollution control systems, such as high-efficiency filtration technologies. These regulatory and technical requirements add considerable capital and operational costs, which further challenge the economic viability and scalability of chemical recycling technologies, particularly in developing markets.

- At the same time, the high direct and indirect costs associated with mechanical recycling pose significant barriers to its scalability (Singh and Walker 2024; Han et al. 2025). Despite decades of investment and policy focus, only about 10% of global plastic waste is currently recycled – a figure that falls far behind other materials. For comparison, paper and aluminum achieve recycling rates near 75%, while other metals surpass 30% circularity.

- Given these challenges, scaling up plastic recycling must be a central component of any strategy to prevent plastic leakage into the environment and to enhance material recovery rates (Hermann and Flock 2025). Achieving this will require targeted policy support, innovation, and investment across the recycling value chain.

- Numerous upstream barriers continue to elevate costs, constrain scalability, and diminish the quality of output in mechanical recycling, often resulting in downcycling (Singh and Walker 2024; World Bank 2024). These challenges include:
    - **Complex product design**: Many consumer products feature unnecessary multilayer structures, utilize difficult-to-recycle polymers, or appear in forms such as thin films or styrofoam, which are prohibitively expensive, or even technically infeasible, to recycle.
    - **Contaminated and mixed waste streams**: Mechanical recycling is highly sensitive to feedstock purity. Waste contaminated with impurities and non-plastic residues requires cost-intensive segregation, sorting, and preprocessing to yield high-quality recycled material.
    - **Harmful chemical additives**: Plastics often contain additives that enhance functionality (e.g., durability, color, flexibility), but these chemicals cannot be removed through mechanical recycling, limiting both the quality and safe reuse of recycled polymers.

- In some cases, changing the design, material, or composition of certain plastic products is not feasible, particularly in the short to medium term, due to the lack of affordable and functionally equivalent substitutes. However, research suggests that for a significant portion of plastic packaging – which makes up approximately 80% of plastics found in the environment – these barriers could be overcome through dedicated and comprehensive policy packages (World Bank Group 2024).

- Scaling chemical recycling to commercial levels requires substantial capital investment, and in the short term, recycled plastics produced via this method will directly compete with the revenue streams of the virgin plastics industry. While mechanical recycling remains the most widely commercialized recycling method today, it typically incurs operational costs ranging from USD 50 to USD 200 per ton of plastic. In contrast, chemical recycling is significantly more expensive, with estimated costs between USD 300 and USD 1,000 per ton (Hermann and Flock 2025). These higher costs reflect the greater technological complexity, stricter environmental compliance requirements, and t he capital intensity of chemical recycling infrastructure.

Neutrality in Policymaking

- Technology neutrality is essential for fostering innovation and promoting constructive competition among diverse solutions, each adapted to the specific needs, capabilities, and contexts of individual countries. This principle ensures that no single technology is prematurely favored or excluded, allowing the most effective and context-appropriate solutions to emerge.

- Among the emerging recycling approaches, chemical recycling – alongside other novel technologies – holds significant potential, particularly as advancements in process efficiency, environmental safeguards, and economic viability continue to progress (see Table 1). While chemical recycling may not be the optimal choice for all national contexts, it can play a critical role in addressing specific challenges, especially in the treatment of mixed or contaminated plastic waste streams that are not suitable for mechanical recycling.

- The key advantage of chemical recycling is its ability to recover high-quality, virgin-like polymers from a broader range of mixed and contaminated plastic waste, far beyond what traditional mechanical recycling can process. This makes it a promising solution for addressing hard-to-recycle materials that would otherwise be landfilled or incinerated. However, chemical recycling remains an emerging technology, with relatively few commercial-scale facilities currently in operation. Despite this, it holds significant potential for technological innovation, along with future improvements in economic feasibility and environmental performance. With the right policy support and investment, chemical recycling could play a vital role in advancing global circularity goals.

Table 1. Available recycling technologies based on plastic types and end products.

Recycling Technology Type	Plastics Processed	End Products
Pyrolysis (feedstock recycling)	Mixed plastics (mainly PE, PP)	Base chemicals like oils, diesel, naphtha, syngas, char, and waxes
Gasification (feedstock recycling)	Mixed plastics	Synthesis gas (syngas)
Specialty (feedstock recycling)	Various	Base chemicals
Thermochemical depolymerization	PET, PMMA, PS, PUR, PA	Monomers, dimers, oligomers
Enzymolysis depolymerization	PET	Monomers, dimers, oligomers
Specialty depolymerization	Various	–
Solvent-based purification	PE/PP, PET, PS, ABS, HIPS, PVC	Purified polymers

Source: Saxena (2025).

- Policy support is essential to drive innovation in recycling technologies and business models, particularly in countries that face challenges in implementing effective reduction, avoidance, and mechanical recycling systems. Without such support, scaling up plastic recycling rates will remain difficult, especially for harder-to-recycle waste streams. There are already some demonstration projects around the world (see Table 2).

Table 2. Advanced Chemical Recycling Demonstration Projects.

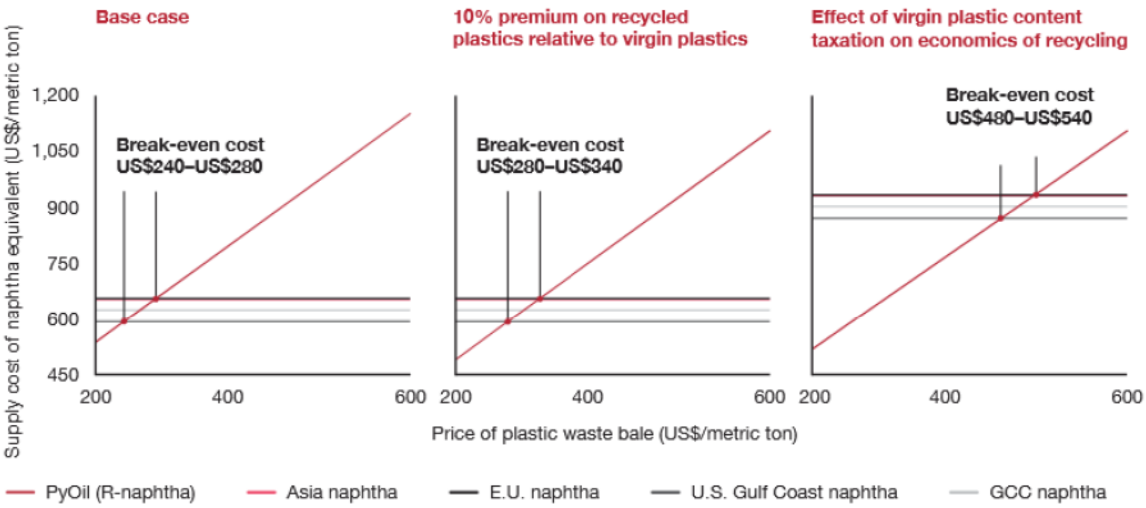
Company	Location	Technology	Product	Capacity (t/d)
Agilyx	Oregon, U.S.	Pyrolysis	Fuel (synthetic crude oil)	10
Green Earth Institute	China and Japan	Gasification	Syngas (hydrogen and synthetic natural gas)	20
Recycling Technologies	Scotland, U.K.	Pyrolysis	Feedstock (pyrolysis oil)	20
Plastic Energy	Seville, Spain	Pyrolysis	Fuel (synthetic crude oil)	41
SABIC (Saudi Arabia)	Geleen, The Netherlands	Pyrolysis	Feedstock (pyrolysis oil)	20
Licella/iQ Renew	NSW, Australia	Depolymerization	Fuel (synthetic crude oil)	55
PETROKEMYA	Jubail, Saudi Arabia	Pyrolysis	Feedstock (pyrolysis oil)	--

Source: Umeozor et al. (2025).

- KAPSARC analysis identifies several potential pathways to make chemical recycling both commercially scalable and environmentally sustainable. For instance, policies aimed at improving the homogeneity and cleanliness of waste feedstock – through enhanced collection, sorting, and contamination controls – can significantly lower operational costs and improve the feasibility of commercial-scale facilities.

- Moreover, economic incentives such as recycled content mandates, eco-modulated EPR fees, or fiscal instruments that create a price premium for recycled content can strengthen revenue streams. These measures help make chemical recycling financially viable, encouraging private investment and accelerating the deployment of advanced recycling technologies on a commercial basis.

Figure 1. The effect of government policies and corporate commitments on plastic waste management through circular economy.



Source: Umeozor et al. (2025).

Note: The graph illustrates which policy interventions can make the final product of chemical recycling (recycled naphtha) cost-competitive (break-even) with the equivalent virgin materials used to produce plastic polymers. In the Base Case, the cost of plastic waste feedstock to chemical recycling needs to be very low to outcompete virgin naphtha. With a price premium assigned to recycled content or a higher policy cost of virgin plastics, chemical recycling can be cost-competitive even if the plastic waste feedstock is higher.

- Local policies that support efficient end-of-life plastic management are crucial to enabling chemical recycling at competitive break-even costs. By improving waste collection, segregation, and processing systems, these policies help ensure a secure, reliable, and cost-effective feedstock supply for chemical recycling facilities (Base Case – see Figure 1).

- In parallel, corporate commitments, business practices, and recycled content mandates are driving a growing imbalance between the demand for and supply of recyclates, which contributes to a price premium for recycled plastic content. This market dynamic improves the commercial outlook for chemical recycling by unlocking competitiveness even at higher break-even cost levels.

- Furthermore, offtake market interventions – such as taxing virgin plastic content – can amplify this price premium, making advanced chemical recycling technologies more competitive relative to virgin polymer production. These types of regulatory signals offer powerful incentives for investment and accelerate the economic viability of chemical recycling pathways (Umeozor et al. 2025).

- A policy focus that centers exclusively on mechanical recycling risks severely limiting the volume of plastic that can be effectively processed and recycled. While mechanical recycling remains critical, it cannot address the full spectrum of plastic waste, particularly mixed, contaminated, or non-recyclable plastics. To overcome these limitations, chemical recycling must be supported alongside mechanical recycling, especially in contexts where it is both environmentally and economically viable.

- Policymakers should prioritize the development of robust environmental safeguards for chemical recycling, such as stringent controls on hazardous emissions and pollutants, while also establishing enabling policies, incentives, and infrastructure to foster its responsible deployment.

- Moreover, all sustainable plastic management pathways, including both mechanical and chemical recycling, would benefit from global efforts to phase out unnecessary harmful chemical additives and promote international coordination on product design for recyclability. Such upstream measures can greatly improve downstream recycling outcomes and reduce environmental risks.

- Scaling up chemical recycling will likely require significant capital investment and technical capacity building, particularly in low- and middle-income countries. Targeted international support, both financial and technical, will be essential to ensure that these countries can effectively participate in and benefit from a broader circular plastics economy.

Chemical Recycling Can Complement Other Circular Technologies

- Chemical recycling, particularly through pyrolysis, offers a promising solution for processing plastic waste that is too difficult or uneconomical to recycle mechanically, converting it back into chemical feedstocks that can be used to produce virgin-quality polymers. This capability is particularly valuable for managing contaminated, multilayered, or composite plastics, which are often excluded from traditional recycling streams.

- Lase et al. (2023) found that Europe's potential recycling rate could reach 49% by 2030 with mechanical recycling alone. However, when chemical recycling is included, the potential recycling rate jumps to 80%, highlighting its critical role in achieving circular economy targets.

- Projections by Sustainable Plastics further support this outlook. According to Santos (2023), Europe's chemical recycling capacity is expected to expand from 3 million tonnes in 2030 to over 12 million tonnes by 2050. This anticipated growth reflects a broader recognition of chemical recycling's strategic importance in scaling plastic waste management solutions and reducing environmental leakage (Santos 2023).

Environmental Concerns in Different Recycling Technologies

- Numerous studies have assessed the environmental impacts of chemical recycling, often in comparison with mechanical recycling, energy recovery, and direct incineration. A notable example is the study by Jeswani et al. (2021), which compared chemical recycling with energy recovery (primarily incineration, as commonly practiced in Europe) and with mechanical recycling. The study found that chemical recycling produces 42% fewer CO_2-equivalent emissions than incineration, while mechanical recycling achieves a 46% reduction in emissions over the life cycle of plastics (Jeswani et al. 2021). Additionally, the study demonstrated that producing one ton of virgin-grade low-density polyethylene (LDPE) via chemical recycling leads to a remediation of climate change impacts compared to producing it from fossil-based virgin polymers. These results suggest that chemical recycling can play a meaningful role in climate mitigation efforts.

- While chemical recycling remains an emerging technology, and legitimate concerns remain regarding its technical limitations, environmental trade-offs, and economic feasibility, these challenges can be addressed through continued innovation, regulation, and investment.

- If policymakers and industry stakeholders are committed to achieving ambitious recycling and circularity targets, chemical recycling will likely need to be part of the solution (complementing rather than replacing mechanical recycling) to manage a broader range of plastic waste streams and reduce environmental impacts at scale (World Bank Group 2025).

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