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Mass Balance Plastic Recycled Content Claims

Independent Technical Review of Recycled Content Attribution for Chemically Recycled Polyolefins in Amcor's Portfolio

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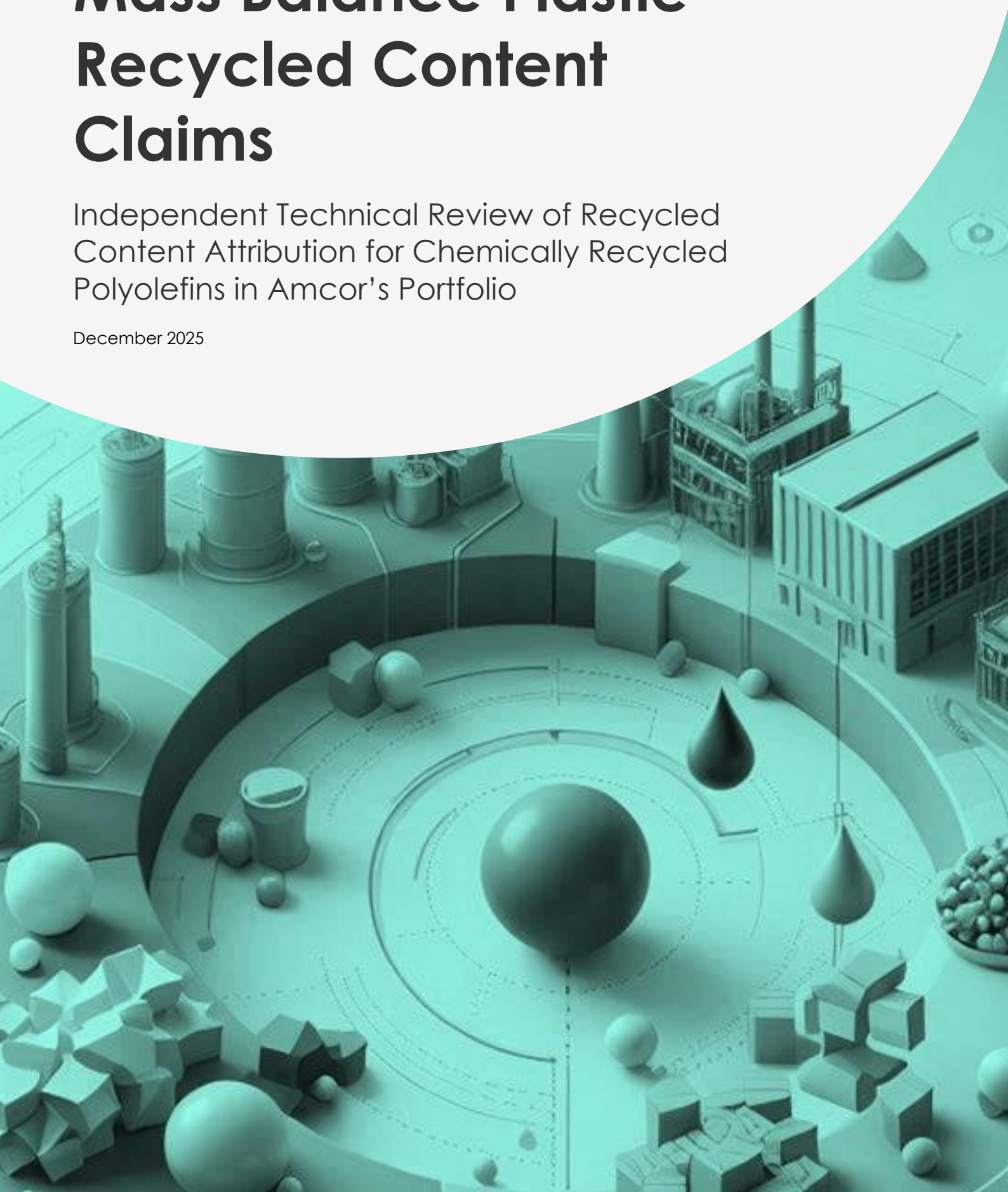

Report For

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Eunomia Research & Consulting is recognized internationally as a leading independent authority on plastics policy, advanced recycling technologies, and recycled-content verification. We have delivered major assignments for governments, industry and NGOs, combining technical expertise with practical policy insight across the full plastics value chain. Our work for the European Commission under the Single-Use Plastics Directive (SUPD) developed the official methodology for calculating, verifying and reporting recycled content in beverage bottles. This included integrating mass balance principles, clarifying allocation rules and setting out the evidentiary standards required for legally defensible recycled-content claims—work that informed the Commission's draft Implementing Act and shaped EU-level thinking on chemical recycling and chain-of-custody systems.

Our wider portfolio reinforces this expertise. We have assessed global recycled-content standards for the Standards Council of Canada, advised multinational brands on future claims strategies, and produced feedstock-quality guidelines for chemical recycling for the Alliance to End Plastic Waste. In the United States, we delivered a first-of-its-kind mass balance systems analysis for the Association of Plastic Recyclers, modelling the economics and attribution implications of scaling pyrolysis for flexible packaging.

Collectively, these projects demonstrate Eunomia's unique ability to bridge technology, policy and market realities. This depth of experience underpins the present assessment and ensures that the analysis, conclusions and recommendations reflect both the technical complexity of chemical recycling and the regulatory expectations governing recycled-content claims in global markets.

Introduction

Amcor has requested an independent report regarding their current approach for recycled-content claims for products derived from chemically recycled plastic. Specifically, this report responds directly to three points:

1. Describe how mass balance recycled-content claims are calculated.
2. Translate those mass balance claims into their traditional physical-accounting equivalents, including explanation of alternative chain-of-custody systems and why they do not apply to chemical recycling.
3. Recommend potential corrective measures to be taken if appropriate.

1. How Amcor's Mass balance Recycled-Content Claims Are Calculated

Mass Balance as a Chain-of-Custody Model

The primary focus of this assessment is post-consumer recycled polyolefins (polyethylene and polypropylene) produced through pyrolysis. Pyrolysis is the principal chemical-recycling route for these polymers, converting waste plastics into an oil that can be re-introduced into existing petrochemical infrastructure. The recycled pyrolysis oil is typically co-processed with virgin feedstocks in refineries, steam crackers, or polymerization units. Because the recycled and virgin molecules become fully blended at multiple stages and in varying proportions, the material cannot be physically segregated or traced. It is this integration into legacy petrochemical systems that makes physical tracking impossible and necessitates the use of mass balance as the only viable chain-of-custody approach for attributing recycled content to final products.

Amcor uses the ISCC PLUS certification scheme across its chemically recycled polyolefin portfolio. ISCC PLUS is the most widely used voluntary scheme for chemical recycling and governs how recycled inputs from pyrolysis oil are accounted for and allocated. Amcor's ISCC-certified sites operate within defined mass balance system boundaries. Certified recycled inputs entering these boundaries generate "recycled-content credits", which Amcor can allocate to product outputs according to ISCC rules.

How Allocation Rules Influence Credit Generation and Attribution

The allocation rule applied in a mass-balance system determines how certified recycled feedstock is accounted for at the point of credit generation, especially in chemical-recycling and co-processing systems. Two variants are commonly referenced in policy discussions:

- **Free allocation**, under which all outputs from a co-processing system can generate allocable recycled-content credits, including outputs that are ultimately used as fuels or energy.
- **Fuel-use-excluded (FUE) allocation**, under which recycled-content credits may not be generated from feedstocks that become fuels or energy. This results in a smaller pool of credits available for downstream allocation.

The difference between these two approaches lies in which outputs can generate credits and therefore how many credits enter the allocation system. The distinction does *not*, by itself, limit Amcor's ability to distribute credits across its products.

Once credits have been generated within a certified boundary, ISCC PLUS chain-of-custody rules govern how those credits may be allocated to specific products, regardless of whether the upstream methodology was free allocation or FUE. Under ISCC PLUS, Amcor can allocate credits to eligible outputs within its certified system boundary in line with the certification rules.

Some elements of proposed EU regulation could, depending on implementation, affect attribution at product level — for example, rules on system boundaries, site-level accounting, or restrictions on cross-product allocation. These potential changes, however, relate to broader regulatory design choices and are not inherent features of the FUE method or Amcor's current allocation choice.

Policy Context – the Shift Towards Stricter Rules

Amcor's use of ISCC PLUS with free allocation remains legal and permissible under voluntary standards, but policy direction is shifting:

- **EU legislation** (SUPD, PPWR, chemical recycling workstreams) is moving towards **fuel-use-excluded** and **site-level restricted allocation**, with strong emphasis on claim clarity.
- **US states**, notably California, are beginning to take a stricter view of claims implying physical content.
- **Global trends** indicate regulators are increasingly differentiating between free allocation and other allocation methods.

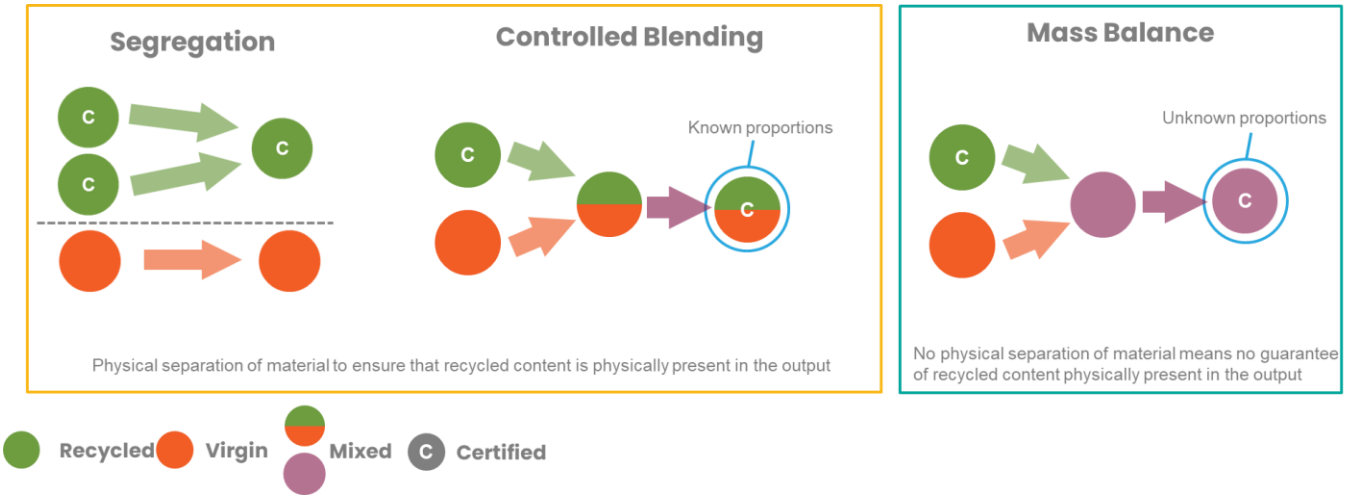
Understanding these evolving expectations will assist Amcor in assessing the risk associated with future claims.

2. Translating Mass Balance Claims into 'Traditional' (Physical) Accounting

Understanding the physical-accounting equivalent of mass balance claims helps investors contextualize how chain-of-custody rules shape headline recycled content figures. This requires considering other chain-of-custody models and why they are not appropriate for chemically recycled materials:

Physical Segregation: Recycled material is kept entirely separate from virgin feedstock. Identity and characteristics are preserved throughout. This method is used in some limited mechanical recycling scenarios but is impossible once plastics are converted into pyrolysis oil, as polymer identity is lost.

Controlled Blending: Recycled polymer is mixed with virgin polymer in verifiable, measurable proportions. Again, this applies to mechanical recycling, where the recycled polymer remains intact. It cannot apply to pyrolysis oils because no identifiable "recycled polymer" remains to measure from usable outputs.



Why Mass Balance Is the Only Practical Option for Pyrolysis-Based Polyolefins

Chemical recycling fundamentally differs from mechanical recycling. Once materials pass through pyrolysis, hydrolysis or other depolymerisation processes:

- they no longer carry physical markers of recycled origin;
- no physical chain-of-custody method can track or measure their distribution in final products; and,
- crucially, they are **chemically indistinguishable** from virgin feedstocks at polymerization stages.

Mass balance is therefore the only suitable chain-of-custody model for pyrolysis-based recycling. It captures the decoupling of molecular identity from final products and provides a recognized system to attribute recycled content to outputs via accounting rather than physical tracing.

The key conceptual difference is: **Physical accounting reports the *actual proportion* of recycled material present in the product; mass balance reports an *allocated proportion* based on *certified inputs* entering the system.**

Neither method is inherently superior as they answer different questions. Physical accounting describes physical content; mass balance describes certified contribution. How this difference is transparently communicated it therefore a critical aspect of deploying mass balanced recycled content.

Mass Balance in Other Industries – A Well-Trodden Path

Mass balance is also used in several other sectors where certified or recycled inputs are co-processed with conventional feedstocks and physical segregation is not technically feasible. Examples include:

- **biofuels**, where certified sustainable biomass is co-processed with fossil feedstocks under the EU Renewable Energy Directive (RED) and similar national schemes that permit mass balance chain-of-custody models;
- **food and agriculture**, where certification programs such as the **Roundtable on Sustainable Palm Oil (RSPO)** allow mass balance models to allocate sustainability attributes when certified palm oil is blended with conventional material;
- **sugar and bio-based materials**, where certification programs such as **Bonsucro** use mass balance to track certified sugarcane through processes that involve mixing and conversion.

These examples show that mass balance accounting is used in multiple industries where co-processing results in complete mixing and physical identity cannot be preserved.

3. Recommendations and Corrective Measures

The following recommended actions address potential concerns and reflect emerging regulatory expectations whilst improving internal procedures and increasing external transparency.

Transparency and Communications

- **Ensure transparency in recycled content claims**, clearly describing chain-of-custody boundaries, allocation rules, and assurance processes.
- **Publish a clear external explanation of Amcor's mass balance approach**, including the allocation rule used and the meaning of attribution-based claims.
- **Consolidate recycled-content allocation records into an auditable system** to enable product-level traceability and provide physical-equivalent context when requested.

Products and PCR Use - Internal

- **Update internal claims guidance** with standardized approved language and examples tailored to mass balance attribution.
- **Implement a formal claims review and approval process** involving sustainability, legal, and commercial teams.
- **Audit all customer-facing recycled-content claims** to identify and correct any that imply physical content where mass balance applies.

Stakeholder Engagement

- **Issue guidance for supply-chain partners**, clarifying acceptable claim language and expectations for mass balance attribution.
- **Engage key customers to align wording and prevent downstream misrepresentation** of mass balance claims.

Regulations & Compliance

- **Establish an ongoing regulatory and enforcement monitoring system** to track emerging requirements for chemical recycling and co-processing.
- **Monitor the EU Commission's final decisions on SUPD and related mass balance rules**, interpreting implications for Amcor's approach.
- **Assess the feasibility and commercial impact of transitioning from flexible allocation to more conservative rules** (e.g., fuel-use-excluded) where required.
- **Conduct scenario analysis across major jurisdictions** to anticipate claim changes under different regulatory pathways.
- **Adopt geographic differentiation of allocation methods** where regulatory conditions diverge, ensuring claims remain compliant across markets.
- **Include recycled content claims in Amcor's risk-mitigation and response protocol** for potential investigations or challenges related to mass balance claims.

Conclusion

This report explains how Amcor's mass balance recycled-content claims are generated, translates those claims into the context of physical accounting and alternative chain-of-custody models, and sets out recommended actions. It provides readers with the clarity needed to interpret mass balance claims responsibly and establishes a pathway for Amcor to align its practices with investor expectations and emerging regulatory trends.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