



CASE STUDY

Integrating nature into packaging innovation through life-cycle assessment: SIG Group case study



SIG is a global packaging company that develops aseptic carton, pouch and bag-in-box packaging systems, mainly for food and beverage products like dairy and juice, and liquid foods like soups or broths.

Executive summary

SIG's material strategy reflects its ambition to reduce reliance on non-renewable resources and align product development more closely with what nature can sustainably provide. Building on insights that identified aluminium foil as a disproportionate driver of carbon emissions and fossil fuel resource impacts, SIG has started to move away from aluminium to focus on polymers as an alternative barrier solution.

While conventional polymers rely on fossil fuels and are not renewable, SIG sought to address this limitation by changing the feedstock rather than the function, shifting the composition of many polymer applications towards renewable, bio-based inputs. As a result, part of the polymers used today have a certified mass-balanced feedstock link to paper industry by-products, enabling cartons that are almost entirely connected to forest-based raw materials in both fibre and polymer components. This approach reduces dependencies on fossil resources while maintaining product functionality.

SIG's life-cycle assessments (LCAs) support these decisions. Its responsible sourcing strategy complements this by emphasising traceability, certification and close supplier engagement. This ensures the sourcing of renewable materials in ways that support biodiversity and ecosystem resilience.

Why SIG Group is acting on nature

SIG's packaging solutions rely heavily on natural resources, particularly forest-based paperboards, aluminium and other materials. Recognising packaging's role in nature loss – from sourcing to waste – the company has moved beyond compliance to embed nature considerations into product design through transparent and credible action. Stakeholder expectations, regulation and, most importantly, the need to protect ecosystems and resources critical to long-term business viability have driven this shift.

SIG's long-term sustainability vision and ambition is transforming its material strategy to restore nature, strengthen circularity, and deliver resource-positive packaging by design: maximising renewable inputs, reducing fossil fuel-based materials, and keeping resources in use through effective recycling pathways, while striving for the lowest possible CO2 footprint and energy consumption.



What SIG is doing to understand nature impacts and dependencies across its operations and value chain

Its life-cycle assessment (LCA) approach

SIG has always been committed to sustainability.

The company started undertaking LCAs for packaging products over 20 years ago, following the introduction of EU Packaging Directive 94/62/EC. The directive provided the rationale for the use of scientific LCAs, rather than assumptions, to support decisions oriented towards improving the environmental performance of packaging. LCAs became a source of valuable, comprehensive and quantitative information for effective decision-making in the packaging sector.

Box 1: Understanding LCA

LCA looks at the environment-related factors arising during the product's or material's life cycle related to its function. It covers the raw materials being used through to the manufacturing processes, the use phase and product end of life – typically referred to as cradle to grave.

SIG's LCAs for its packaging cover, among others, climate change, eutrophication (land and water), ecotoxicity, land use and resource depletion (minerals, fossil fuel and renewable energy resources, water).

Principles, requirements and guidelines on LCA are internationally agreed within ISO 14040 and ISO 14044.

SIG has found the use of LCAs to be invaluable in both:

- Identifying the best environmental performance across different packaging options delivering the same function, such as glass bottles, PET bottles or metal cans;
- Guiding its own product and material innovations to lower their negative impacts on the environment, including nature.

These assessments have already allowed the company to quantify environmental hotspots specific to the products assessed, such as the high carbon footprint of the aluminium foil it uses, and to think of more sustainable options without introducing other unwanted burdens. Additionally, these results have allowed SIG to consider how to improve its responsibility in the sourcing of raw materials and products.

Box 2: Ensuring trustworthy and comparable LCA data

The independent Institute for Energy and Environmental Research (IFEU) conducts SIG's LCAs and an independent panel critically reviews them. *This ensures:*

- The collection and use of accurate, unbiased data;
- The drawing of conclusions in line with international standards;
- That reporting follows comprehensive requirements to support transparency.

SIG also contributes to establishing robust life-cycle inventory data on beverage carton manufacturing in association with other manufacturers, making useful data available so others can benefit and produce their own LCA studies.



Responsible sourcing

Building on the commitment to develop solutions for materials from renewable resources such as forests, SIG adopted responsible forestry practices in its supply chain by establishing Forest Stewardship Council™ (FSC™) Chain of Custody certification in 2009 and ensuring 100% of its paperboard is FSC certified (FSC license code FSC C020428).

Via FSC, SIG can ensure the enabling of forest replenishment, that the company converts no natural forests, and that it follows additional sustainability principles, including the maintenance of biodiversity and other ecosystem services.

Because aluminium foil is prevalent in SIG products, the company was an early adopter of Aluminium Stewardship Initiative (ASI) certification. The ASI Chain of Custody certification enables the company to meet the highest environmental and ethical performance standards, including for upstream mining operations. All aluminium foil in SIG aseptic cartons is ASI certified.

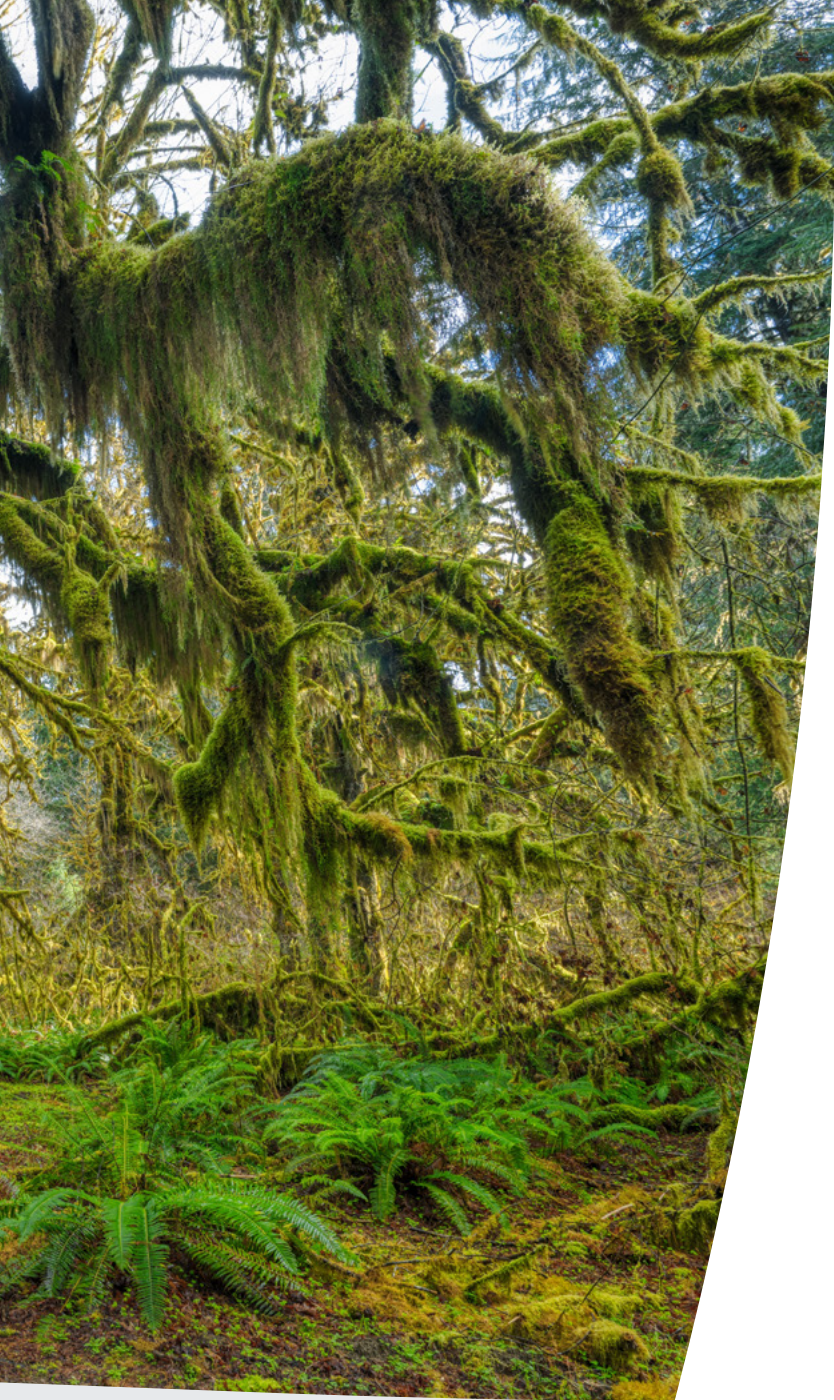
For mass balanced traceability of renewable and recycled feedstock in the plastic value chain, SIG has introduced International Sustainability & Carbon Certification (ISCC) PLUS certification to validate the sustainability characteristics of these alternative feedstocks.

Alignment with the evolving nature framework landscape

SIG's nature approach has two core pillars aimed at addressing the growing focus on the biodiversity-climate nexus: decisions based on LCA results and responsible sourcing through certification schemes.

While LCA helps the company assess product-level impacts relating to carbon emissions, pollution and resource use, certification and sourcing frameworks provide complementary insights into land use, forest impacts and biodiversity dependencies. Building on nature-related commitments established in 2020, including forest restoration and certification, SIG has further refined its approach in line with emerging nature-related frameworks and approaches:

- A materiality assessment in line with Corporate Sustainability Reporting Directive (CSRD) European Sustainability Reporting Standards (ESRS) supplemental to SIG's longstanding Global Reporting Initiative (GRI) reporting approach;
- Building on the progress the company made on its commitment to align with the Kunming-Montreal Global Biodiversity framework, and In line with SBTN (Science Based Targets Network) requirements, SIG updated its strategy in 2025. This commitment includes assessing value chain impacts on all nature pressures identified in the SBTN framework, such as land-use change, water use and pollution.
- Tools such as ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure), WWF Water and Biodiversity Risk Filters and the SBTN Materiality assessment tool have also supported the company in defining its material risks and hotspots linked to nature.



How LCA insights help SIG understand nature-related risks and opportunities in materials sourcing

Process

SIG first identified pressures on ecosystems, natural resources and human health from cradle to grave. *Then it used LCA to:*

- 1 ***Compare competing substrates and analyse their core materials;***
- 2 ***Demonstrate the benefits of innovation before scaling.***

SIG's product LCAs cover all relevant environmental impacts, including air and water emissions, allowing the company to detect hotspots along the value chain and react. By tackling major pollution sources – from raw material sourcing to water and waste management – the assessment allows SIG to understand where sourcing poses the greatest risks on nature and climate, as well as potential opportunities.

Box 3: Using LCA to identify environmental hotspots in packaging – example

SIG used LCA to analyse the environmental performance of its packaging to deliver 1 litre of beverage. The main drivers are the primary raw materials used in production of its packaging product – liquid packaging board (LPB), polymers and aluminium foil.

In a specific example comparing the contribution of LPB, polyethylene and aluminium foil (see Figure 1), the weight distribution in the SIG system shows LPB at 76%, polyethylene at 19% and aluminium at 5%. However, the environmental impact profile differs significantly: aluminium foil accounts for 41% of the material related carbon footprint (GWP – global warming potential) despite its low weight share, while LPB accounts for 23% and polyethylene 36%.

In terms of fossil resource consumption, polyethylene is the dominant driver at 57%, followed by aluminium foil at 29% and carton at 14%.

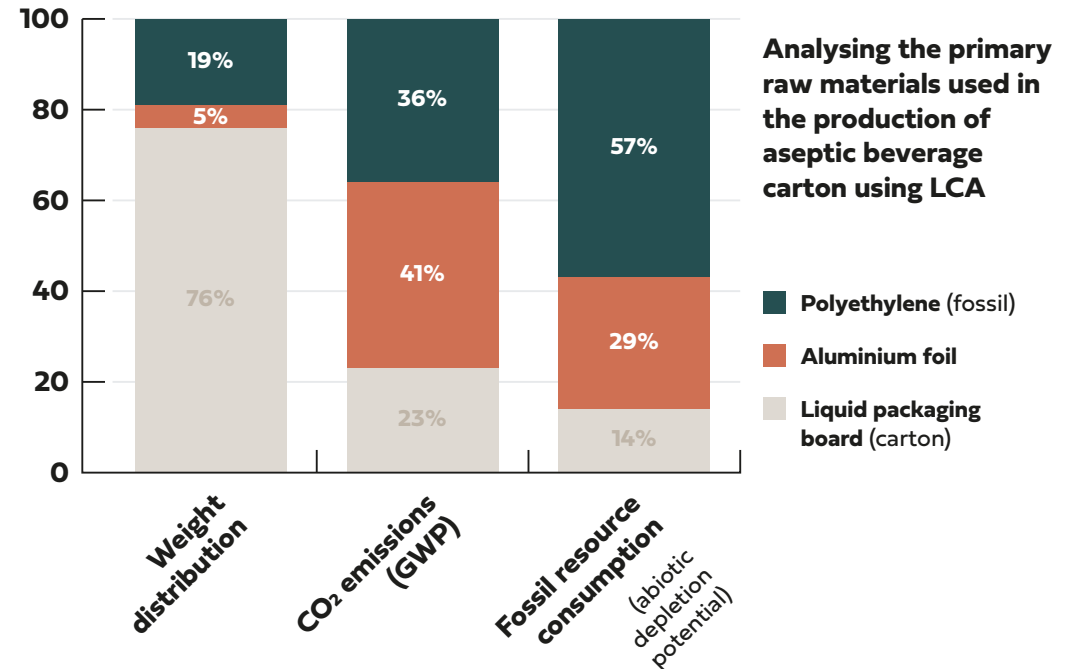


Figure 1: Example analysis of the primary raw materials used in the production of aseptic beverage carton using LCA

Source: Illustration based on SIG's LCAs on www.sig.biz

The three materials (cartonboard, polyethylene and aluminium) account for 63% of the overall GWP and 70% of fossil fuel consumption (abiotic depletion potential) associated with the beverage carton. These results provided an indication of the relative importance of these materials to the carbon and resource footprint of the assessed packaging.

Results and decision logic of the example (Box 3)

- ✓ **Substitution of aluminium foil with renewable polymers, a low-carbon functional barrier:** The LCA identified aluminium foil as a major environmental impact driver in SIG's packaging. The company investigated if it could replace aluminium with a low-carbon functional barrier to lower the product's overall carbon footprint while maintaining the high barrier performance required for food packaging. Phasing out raw materials that are high in fossil fuel resources and switching to renewable feedstocks shifts the carbon balance considerably and prevents the depletion of abiotic resources.
- ✓ **Adapting beverage cartons to include higher renewable content:** SIG developed aseptic cartons with no aluminium layer, increasing renewable content and simplifying recycling, while maintaining full barrier performance.
- ✓ **Prioritising lightweighting and recyclability:** SIG uses LCAs and compatibility with recycling systems to guide design innovations, supporting circularity and reduced resource use, focusing on materials that directly enter its packaging.
- ✓ **Managing tradeoffs:** Shifting towards more materials from renewable resources typically involves using more land and freshwater, as is the case in papermaking. Responsible sourcing practices for land are typically less intensive and show even higher land occupation rates than intensive land uses. LCA data, which relies on impact assessment methods and often uses average datasets, tends to indicate higher impacts as land use increases – even in cases where the land is demonstrably managed in ways that maintain biodiversity. This is where responsible sourcing becomes important.
- ✓ **Preserving nature by preserving foods:** By improving food preservation and reducing food waste, its packaging solutions are helping to avoid food loss and food waste – an indirect but significant biodiversity and resource benefit.

How strengthening traceability, supplier engagement and consumer choice prioritises nature

Strong responsible sourcing standards, including performance related to the maintenance of biodiversity, are valuable tools in global supply chains.

Standards for forestry, aluminium and polymers include strict criteria related to nature protection that the company can trace through product systems along the chain of custody. They also allow SIG's Customers to label their packaging to inform consumers related to sourcing practices and add credible sustainability characteristics.

SIG refers to the raw materials that go directly into its packaging (paperboard, polymers/films, aluminium foil, ink and solvents (for aseptic cartons)) as A-materials. The company prioritises them for sustainable sourcing, identifying priority suppliers based on potential environmental, social and governance (ESG) risk and impact.

- 1 Traceability:** SIG continuously investigates location and activity data, and performance information. For forests, SIG maps and reports forest supply regions and species used annually to enable in-depth assessments of potential biodiversity risks and to increase transparency.
- 2 Supplier engagement:** All suppliers of A materials also receive annual questionnaires on greenhouse gas emissions. Where feasible, SIG engages with them more deeply on de-carbonisation and nature-related topics, such as water and deforestation, linked to sourcing. The company tailors this engagement to the characteristics of the commodities and their specific pressure profile on nature. This engagement sits alongside broader routines to assess significant suppliers across a wider range of ESG topics, including human rights.
- 3 Consumer choice:** Certification schemes ensure that consumers are able to assess sustainability aspects in their product choices and to make better decisions based on product labelling. It allows also SIGs customers to demonstrate their commitment to responsible supply chains.

Who SIG is collaborating with across internal teams and external partners

Internal collaboration

✓ **Establishing sustainability governance and leadership commitment:**
SIG has embedded sustainability across internal teams through clear governance and shared reference points. It established a Responsibility Steering Group (RSG) that brings together the Group Executive Board and all relevant business functions to support the implementation of the sustainability strategy. Biodiversity later emerged as the priority topic, championed directly by the CEO. Ongoing reporting to ESG-related disclosure and assessment platforms, such as CDP, EcoVadis and CSA, has strengthened an internal network of topic owners who are increasingly aware of and responsive to emerging nature-related requirements.

✓ **Coordinating sustainability requirements across functions:**
Increasing specialisation and overlapping demands have created complexity, leading SIG to centralise supplier requests across its strategic focus – climate, nature, circularity and food – as well as human rights, while adapting its customer offering. Its internal LCA culture helps translate these topics and align them via familiar lenses such as climate, enterprise risk management, reporting obligations, NGO concerns and resilience.

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- ✓ **Embedding LCA across sourcing, design and customer communication:** SIG integrates LCA results into company-wide information flows, prioritising A-materials as the main consumer-facing inputs and the focus of LCA studies. Customer demand for life-cycle data, increasingly used for on-pack claims, informs marketing teams which studies are needed and for whom. Sourcing teams and the corporate LCA unit then structure procurement, analysis and supplier engagement around these materials, ensuring studies are accurate, robust and fully aligned with the materials purchased and the way the company designs and produces packaging systems.
 - ✓ **Leveraging synergies with corporate tools (climate/emissions accounting):** LCA data also feeds SIG's Greenhouse Gas emissions accounting and decarbonisation actions in line with SIG's corporate decarbonisation pathways approved by SBTi. Data out of this accounting informs LCA studies in return. This creates a two-way link between product-level assessment and corporate climate accounting, aligning LCA with the corporate climate strategy.

- ✓ **Applying internal tools and external studies:** In parallel, SIG has internal LCA tools to calculate and test scenarios across activities and departments. Its externally published studies rely on fully aligned and verified data to ensure credibility and consistency.

External collaboration

- ✓ **Externally, SIG works with targeted advisory and partnership models.** The Responsibility Advisory Group (RAG) enables direct exchange between SIG's C-suite and external advisors, providing input on sustainability topics and broader trends. In addition, SIG's partnership with WWF Switzerland plays a key role by bringing in a trusted and highly credible external voice. This both strengthens strategic direction and helps employees build confidence in the relevance and legitimacy of the sustainability agenda.

What this means for SIG's nature-driven product design and innovation

Embedding nature goals into product specifications

The four action areas of SIG's strategy – climate, nature, circularity and food – deepen its understanding of where the value chain may negatively interact with nature and help identify key levers to drive positive outcomes.

While the nature action area focuses on direct drivers and dependencies in the supply chain, the climate area addresses decarbonisation as another major pressure on natural systems. Circularity supports lower-footprint product design, keeps resources in circulation, and helps prevent materials from entering the natural environment at their end-of-life. SIG pursues all of this while maintaining product functionality, with the broader goal of improving food system resilience and reducing food loss across manufacturing, distribution and consumption.



What SIG has learned

- ✓ **Don't wait for perfect data and guidance – start now and refine over time.** Delaying action until guidance is fully mature risks missing critical opportunities to conserve and protect nature.
- ✓ **Prioritise traceability for the most important materials.** Understanding where nature impacts occur is foundational to designing meaningful solutions.
- ✓ **Use certification and partnerships.** Leveraging credible standards and collaborating with NGOs strengthens both strategy and stakeholder confidence.
- ✓ **Integrate cross-functional decision-making.** Aligning procurement, R&D and sustainability teams ensures trade-offs are addressed holistically.
- ✓ **Be transparent.** Honest communication through labels and reporting builds trust and drives market transformation.
- ✓ **Act now while bringing consumers along on the journey.** Supporting market transformation requires enabling consumers to make informed choices by translating complex risk-based information into clear and accessible insights.





Project partners:



A-Track is a four-year, €11 million project that will accelerate action for nature by business, financial institutions and government.

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