SCALA VITA

LIFE CYCLE ASSESSMENT LAB · TECHNICAL REPORT · CASE 01

Beverage packaging: PET, glass or aluminium?

A cradle-to-gate life cycle comparison of the container needed for 1 litre of carbonated soft drink, using the Environmental Footprint 3.1 method in openLCA on public databases.

Juan Fran Paredes · Scala Vita · Version 1.1 · October 2026

SCOPE
Cradle-to-gate (container manufacture)

FUNCTIONAL UNIT
Containing 1 litre of beverage

IMPACT METHOD
Environmental Footprint (EF) 3.1

SOFTWARE · DATABASE
openLCA 2.5 · BAFU-2026 v1 (RER)

METHOD SENSITIVITY
Eco-costs 2025 V2.1 (monetisation)

DATA
Secondary, public sources

NATURE OF THE STUDY — PLEASE READ

Self-initiated demonstration project with no client. Indicative study based on secondary data from public databases and declared proxies. It is not a certified LCA, has not undergone third-party critical review under ISO 14040:2006 / ISO 14044:2006, and is a methodological exercise that follows their structure and principles. Generic comparison by material; no result is attributed to any branded product. See the full disclaimers in Section 8.

Executive summary

The container most people think of as the "natural" choice — single-use glass — has the largest manufacturing footprint of the three. The decisive variable is not the material but the system around it.

This study compares the environmental footprint of manufacturing the container needed to hold one litre of carbonated soft drink in its three market formats: PET bottle, glass bottle and aluminium can. It is cradle-to-gate: it covers material production and forming of the empty container, and excludes filling, distribution, use and end of life (the latter is treated as a sensitivity analysis).

57 g
PET · 330 ML
g CO_2 eq per container, 25% rPET (legal SUP minimum).

83 g
ALUMINIUM · 330 ML
g CO_2 eq per can, 50% secondary aluminium.

167 g
GLASS · 330 ML
g CO_2 eq per single-use bottle, ~55% cullet. Almost 3× PET.

Glass weighs about ten times as much as PET for the same litre (≈576 g vs ≈61 g) and its melting is energy-intensive. Aluminium sits in the middle and is highly sensitive to its recycled content. Three conclusions structure the report:

- **1 · Single-use glass is the heaviest footprint.** The order PET < aluminium < glass holds across all eight EF impact categories assessed and in a normalised single index (PET 143 · aluminium 184 · glass 445 µperson-equiv./L). There is no cherry-picking of indicators.
- **2 · Impact is in the material, not the factory.** Material production accounts for 72–100% of the climate impact in all three containers. The lever is the material and its recycled content, not plant efficiency.
- **3 · The system beats the material.** Single-use glass, the worst container, becomes the best one when reusable, beating PET from about 9 rotations. At 30 uses it falls to about 36 g CO_2 eq per 330 ml.

INTENDED USE OF THE RESULTS

To inform packaging ecodesign decisions (material selection, recycled content, format, reuse) and environmental communication under the emerging EU framework (SUP Directive, PPWR, Digital Product Passport). Because of their indicative nature, results must not be used for public comparative environmental claims under ISO 14044 §4.4 without a study based on primary data and critical review.

REVISION NOTE · V1.1

Table 9 (hierarchy of ecodesign levers) has been updated to match the model outputs: reuse effect restated as "up to 4.7× less", material row restated with the modelled reductions (-60% PET, -86% can), and plant optimisation restated as conversion = 0–28% of the footprint (previously quoted as 10–15%).

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1 · Study goal

IN ACCORDANCE WITH ISO 14044:2006 — CLAUSE 4.2

The goal is to quantify and compare the environmental footprint of manufacturing the container associated with one litre of carbonated soft drink, for three alternative materials — PET, glass and aluminium — under a single methodological rule, and to identify the ecodesign levers with the greatest capacity to reduce impact.

There are two reasons for the study: (i) to test with data the widespread perception that glass is the intrinsically most sustainable container, and (ii) to build a demonstration piece that illustrates Scala Vita's data treatment and working method. The intended audience is product, packaging and sustainability managers in beverage companies, and technical readers assessing the quality of the analysis.

The study is not intended for comparative assertions disclosed to the public in the ISO 14044 sense, given its indicative nature and the use of secondary data. Its demonstration character is stated explicitly on the cover and in Sections 6 and 8.

2 · Scope of the study

2.1 Function, functional unit and reference flow

The function of the system is to contain and protect the beverage until the point of consumption. The functional unit (FU) is **"containing 1 litre of beverage"**. This choice, rather than "one container", enables a fair comparison between formats of different capacity: more than one 330 ml container is needed to cover a litre.

The reference flow is the amount of 330 ml container required for 1 litre, i.e. 3.03 containers (1000 ÷ 330). Results are shown per functional unit (1 L) and per individual 330 ml container (dividing by 3.03), the latter being the more intuitive reference.

Table 1. Material mass per container and per functional unit.

Container	Weight (g/330 ml)	Mass per FU (g/L)	Recycled input content
PET bottle	20	60.6	25% rPET (SUP legal minimum)
Glass bottle	190	575.7	~55% cullet
Aluminium can	15	45.5	50% secondary aluminium

Reference weights from manufacturer and sector literature (see Section 7). Glass needs ≈10× the mass of PET and ≈13× that of aluminium for the same litre: this mass contrast is decisive for the results.

2.2 System boundary

The system is cradle-to-gate: it covers extraction and production of the material, including recycled input content, and forming of the empty container. The boundary closes at the container factory gate.

Raw materials
Resources + recycled input

→

Material production
PET/rPET granulate · glass · primary and secondary aluminium

→

Forming
Blow moulding · melt-moulding · rolling + deep drawing

→

Factory gate
Empty container

Excluded from the base scope: filling and packing · distribution transport · refrigeration and use · end of life (analysed as a sensitivity in §5.2). Logistics *is* included within the reuse system (return of empties) as it is inherent to that model.

2.3 Cut-off criteria

A mass/impact cut-off is applied: auxiliary flows whose individual estimated contribution is below 1% of the process impact and whose data is unavailable in the database are excluded. Exclusions are declared (§3.3 and §6). Recycled input content is accounted under a **cut-off approach**: recycled material enters free of the burden of its first life.

2.4 Impact assessment method and categories

The European Commission's **Environmental Footprint (EF) 3.1** method is used, in its openLCA implementation (openLCA LCIA Methods pack 2.8.0). The main indicator is climate change (kg CO_2 eq). The multi-criteria analysis (§4.3) adds seven further categories: fossil resource use, mineral and metal resource use, water use, acidification, freshwater ecotoxicity, ionising radiation and particulate matter. As an optional method-sensitivity phase, **Eco-costs 2025** is applied, which monetises impact into a single indicator in euros (§5.2.5).

2.5 Data quality requirements and assumptions

European technological coverage (RER region), recent time frame (BAFU-2026 database) and methodological consistency (same method and database for all three containers) are prioritised. Data are secondary. Main assumptions: sector reference weights; recycled input content of 25% (PET), 50% (aluminium) and ~55% (glass); database electricity mix; can forming approximated with a deep-drawing proxy; ~300 g/330 ml returnable bottle and proxy washing data for the reuse scenario. All proxies are declared (§3 and §6).

3 · Life cycle inventory (LCI)

3.1 Data collection and sources

Each container is modelled as a product system in openLCA with a reference flow equal to the container for 1 L. Supplier processes come from the BAFU-2026 v1 database (GreenDelta, on an ecoinvent/KBOB background). Recycled PET is reconstructed from the inventory of the European recycler EcoProfiles (Plastics Recyclers Europe, PRIMUS project), as no operational rPET dataset with background exists in the database (§3.3).

3.2 Inventory recipes per container

Table 2. Main inputs per container (per functional unit = 1 L).

Container	Input flow (BAFU dataset)	Amount	Unit
PET bottle	PET granulate, bottle grade, RER	45.4	g (75% of 60.6)
	rPET pellets (reconstructed)	15.2	g (25% of 60.6)
	Stretch blow moulding, RER	60.6	g
Glass bottle	Packaging glass, white, RER (incl. melting + forming)	575.7	g
Aluminium can	Aluminium, primary, RER	22.75	g (50%)
	Aluminium, secondary, from old scrap, RER	22.75	g (50%)
	Sheet rolling, aluminium, RER	45.5	g
	Deep drawing (can-forming proxy), RER	45.5	g

The container-glass dataset integrates melting and forming in a single process and incorporates a default cullet share. Can forming (DWI) is approximated with a deep-drawing process because the database has no aluminium-specific dataset; this is declared as a proxy. Full flow-by-flow detail is in Annex A.

3.3 Reconstruction of recycled PET (rPET)

The disaggregated EcoProfiles rPET dataset, once imported, returned a null result because its background was linked to an absent ecoinvent version. To resolve this, the rPET process was reconstructed by entering its inventory recipe (energy, heat, water, caustic soda, transport and auxiliaries) on the BAFU-2026 background. The resulting factor is `0.546 kg CO2 eq/kg`, 79% below virgin PET (2.58 kg CO_2 eq/kg), consistent with the mechanical recycling literature. Trace and auxiliary flows (<1%) were excluded under the cut-off criterion.

Table 3. Climate-change factors per kg of material (model output).

Material / process	kg CO_2 eq / kg
Virgin PET (bottle grade)	2.581
Reconstructed rPET	0.546
Primary aluminium	8.910
Secondary aluminium	0.660
Container glass (derived)	0.881

The contrast between primary (8.91) and secondary (0.66) aluminium, a 13× factor, explains why recycled content is the dominant variable in the can.

4 · Life cycle impact assessment (LCIA)

4.1 Characterisation results (midpoint)

Table 4 shows the results for all eight categories per functional unit, for the base scenario (PET 25% rPET, aluminium 50%, glass ~55% cullet). In climate change, the glass bottle (0.507 kg CO_2/L) almost triples PET (0.173) and clearly exceeds aluminium (0.252).

Table 4. EF 3.1 characterisation results per functional unit (1 L). Base scenario.

Impact category	PET 25%	Aluminium 50%	Glass
Climate change (kg CO_2 eq)	0.173	0.252	0.507
Fossil resource use (MJ)	4.356	3.804	7.747
Mineral & metal resource use (kg Sb eq)	2.48E-07	1.71E-07	7.21E-07
Water use (m^3)	0.0151	0.0414	0.0282
Acidification (mol H^+ eq)	0.00055	0.00111	0.00449
Freshwater ecotoxicity (CTUe)	0.750	0.822	2.388
Ionising radiation (kBq U235 eq)	0.065	0.129	0.080
Particulate matter (disease inc.)	5.48E-09	1.24E-08	6.15E-08

Aluminium is the only container that exceeds glass in two minor categories (water and ionising radiation), both linked to its electricity intensity.

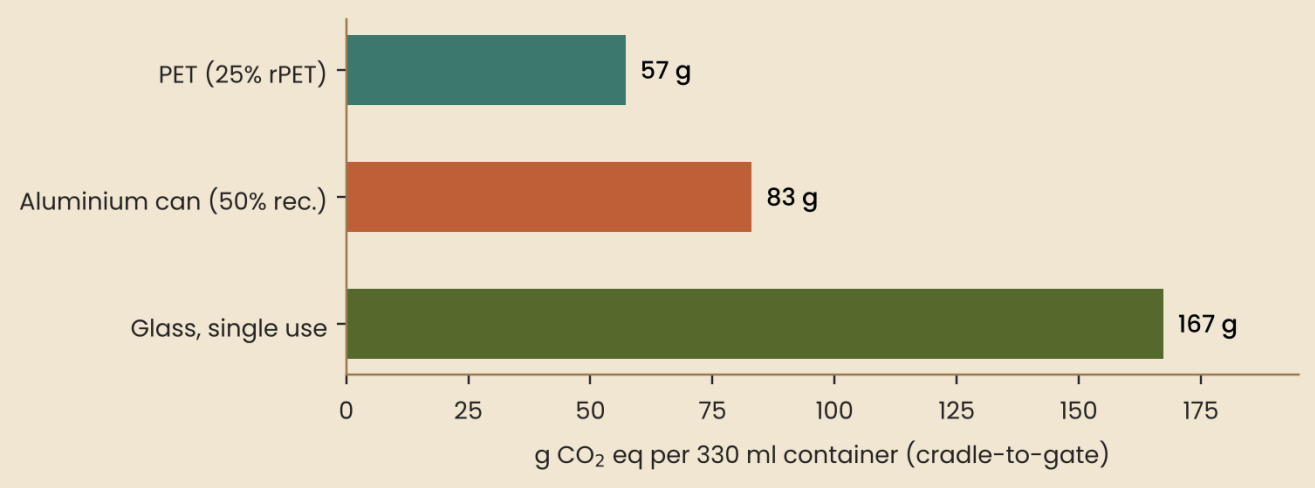


Figure 1. Manufacturing carbon footprint per container (g CO_2 eq / 330 ml). Glass almost triples PET. Cross-checked against Carbon Trust (2021): within range.

4.2 Contribution analysis (hotspots)

The breakdown by stage (Figure 2) shows that, in all three containers, material production dominates the impact: **72% in PET, 87% in aluminium and ~100% in glass**. Forming (blowing, rolling, drawing) is secondary. The most telling case is the can: primary aluminium, only 50% of the metal, accounts alone for ≈81% of the container's carbon footprint.

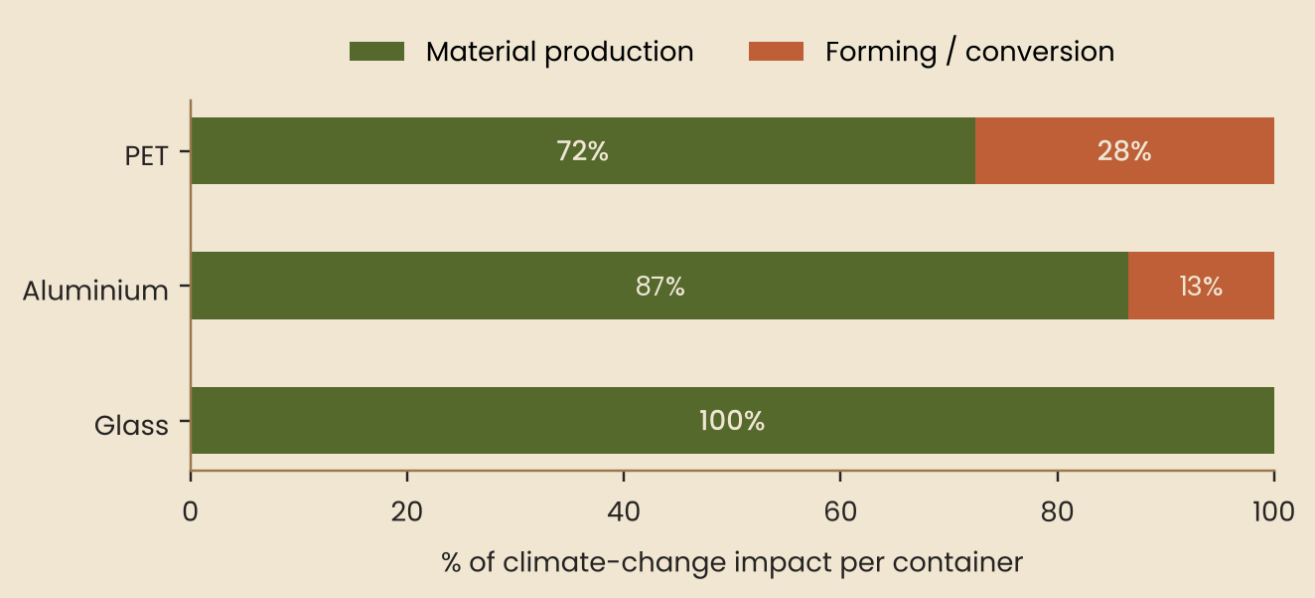


Figure 2. Split of climate impact between material production and factory forming. Design implication: optimising the plant barely changes the result; the lever is the material. For glass, forming is integrated in the single dataset and reported within material.

4.3 Normalisation and multi-criteria profile

To avoid conclusions biased by a single category, the eight indicators are normalised with the EF 3.1 global factors (JRC130796) and aggregated into one index (unweighted sum). The result (Table 5) is unambiguous: **PET 143 · aluminium 184 · glass 445 µperson-equiv./L**. Glass triples PET in the aggregate too. The category profile (Figure 3) confirms that PET is best in 6 of 8 categories and glass worst in 6 of 8.

Table 5. Normalised index by category (µperson-equiv. / L) and single score.

Category	PET 25%	Aluminium	Glass
Fossil resource use	67.0	58.5	119.2
Particulate matter	9.2	20.9	103.3
Climate change	23.0	33.3	67.1
Acidification	9.9	20.0	80.8
Ecotoxicity	13.2	14.5	42.1
Ionising radiation	15.5	30.7	19.0
Mineral & metal resource use	3.9	2.7	11.3
Water use	1.3	3.6	2.5
Single score (Σ)	**143.0**	**184.2**	**445.3**

Unweighted sum (equal weight across categories). It is not the official weighted EF single score; it is used as a comparative profile. The ranking does not change under the official weighting.



Figure 3. Relative multi-criteria profile (value ÷ lowest value in each category; 1.00× = best). PET dominates; glass concentrates the worst values.

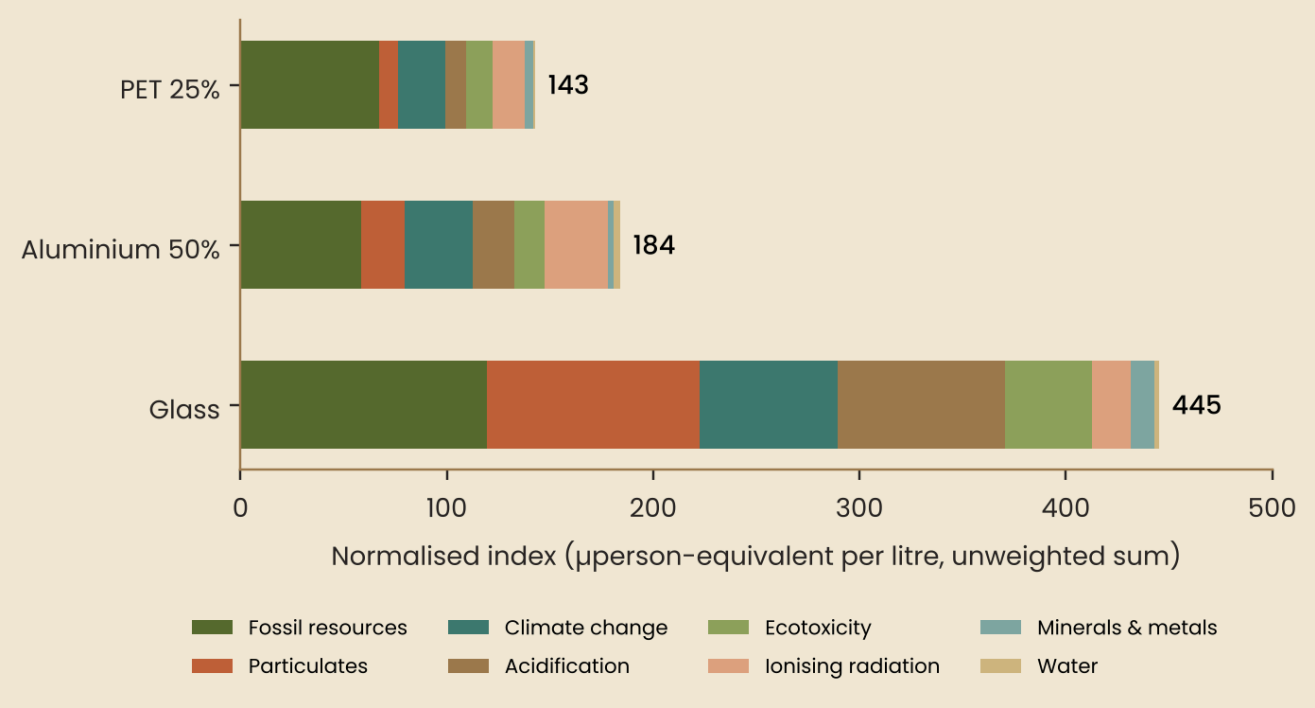


Figure 4. Aggregated normalised index per container (µperson-equiv./L), broken down by category.

5 · Interpretation

5.1 Main findings

The container culturally associated with “natural”, single-use glass, has the highest manufacturing footprint in carbon and in the aggregated multi-criteria score. PET is the most efficient in manufacture, and aluminium sits in between with a position very sensitive to its recycled content. Impact is decided in the material, not in the factory process.

5.2 Sensitivity analysis

5.2.1 Recycled content

Raising recycled content reduces impact almost linearly (Figure 5). PET goes from 67 g (virgin) to 27 g (100% rPET). Aluminium, more sensitive because of the primary/secondary contrast, goes from 145 g (all primary) to 21 g (all recycled). The PET and aluminium curves cross at around **71% recycled content**: since real European cans operate at 50–70%, PET and can are in practice tied. An honest trade-off: more recycled content reduces carbon and fossil resources but increases water use (washing of recyclate).

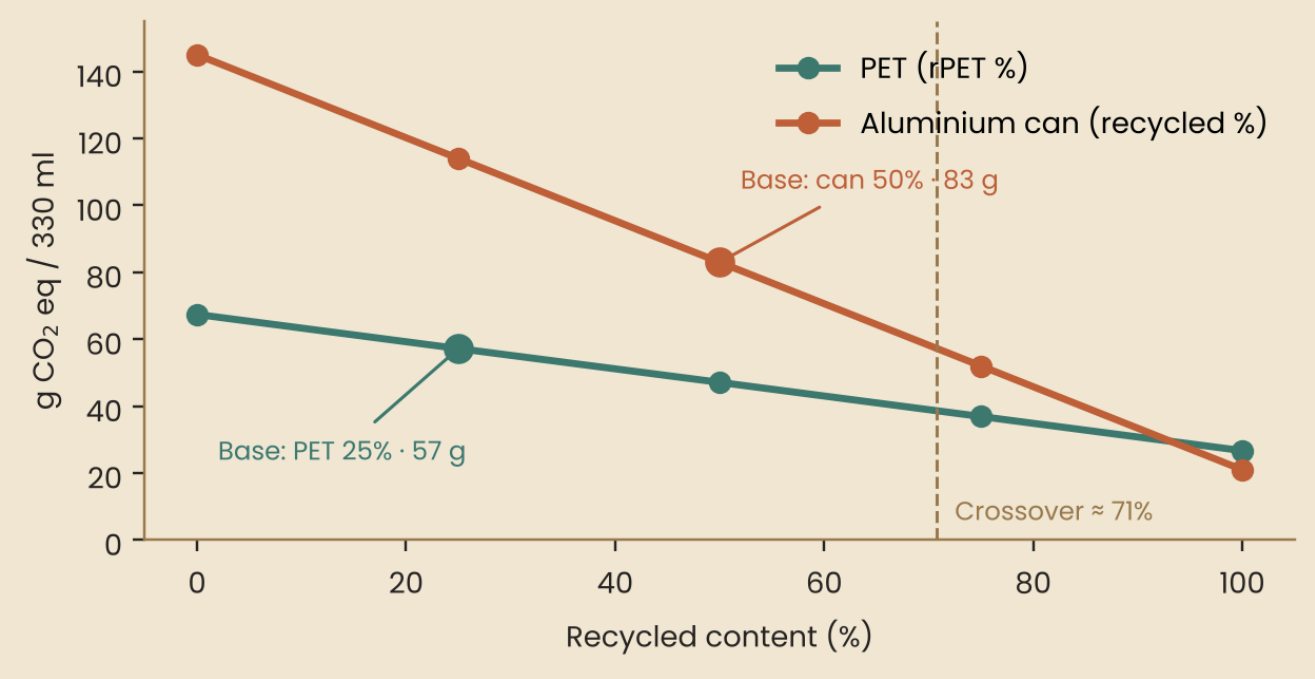


Figure 5. Carbon footprint versus recycled content, PET and aluminium (g CO_2 eq / 330 ml). Crossover at ~71%.

5.2.2 End of life (Circular Footprint Formula, two bookends)

The base scope is cradle-to-gate; end-of-life recycling credit is explored as a sensitivity through two extreme scenarios bounding the CFF: cut-off (no credit, = base) and avoided burden (full credit for avoided virgin material, weighted by the end-of-life recycling rate). Aluminium cuts most when its recycling is credited. The ranking does not flip: glass remains last and PET first.

Table 6. End-of-life sensitivity (g CO_2 eq / 330 ml). Bookends bounding the CFF.

Container	Cut-off (base)	Avoided burden	EoL recycling rate (R2)
PET bottle	57.2	45.0	55%
Aluminium can	83.0	58.2	70%
Glass bottle	167.3	147.5	74%

Pure avoided burden (no A factor). The official CFF blends both approaches with A = 0.5 (PET) and 0.2 (aluminium and glass), so the real result would lie between the two columns. The PET–aluminium gap narrows (from +45% to +29%); with a primary-aluminium electricity mix more intensive than the European one, the can could reach PET.

5.2.3 Reuse and break-even

The scenario with the greatest effect on the conclusions is glass reuse. Modelling a returnable bottle (amortised production A = 0.80 kg CO_2/L plus one washing cycle B = 0.082 kg CO_2/L per rotation), the footprint per use falls with the number of rotations (N): `footprint/use = A/N + B`. Break-even points are **~1.9 uses** against single-use glass, **~4.7** against the can and **~8.8** against PET (about 12 when a 3% breakage per trip is considered). At 30 rotations, within the real range of 25–44, the footprint falls to ~36 g/330 ml, below any single-use container.

Table 7. Footprint of reusable glass by number of rotations (g CO_2 eq / 330 ml).

Rotations (N)	1	2	5	9	20	30	50
Footprint per use	291	159	80	56	40	36	32

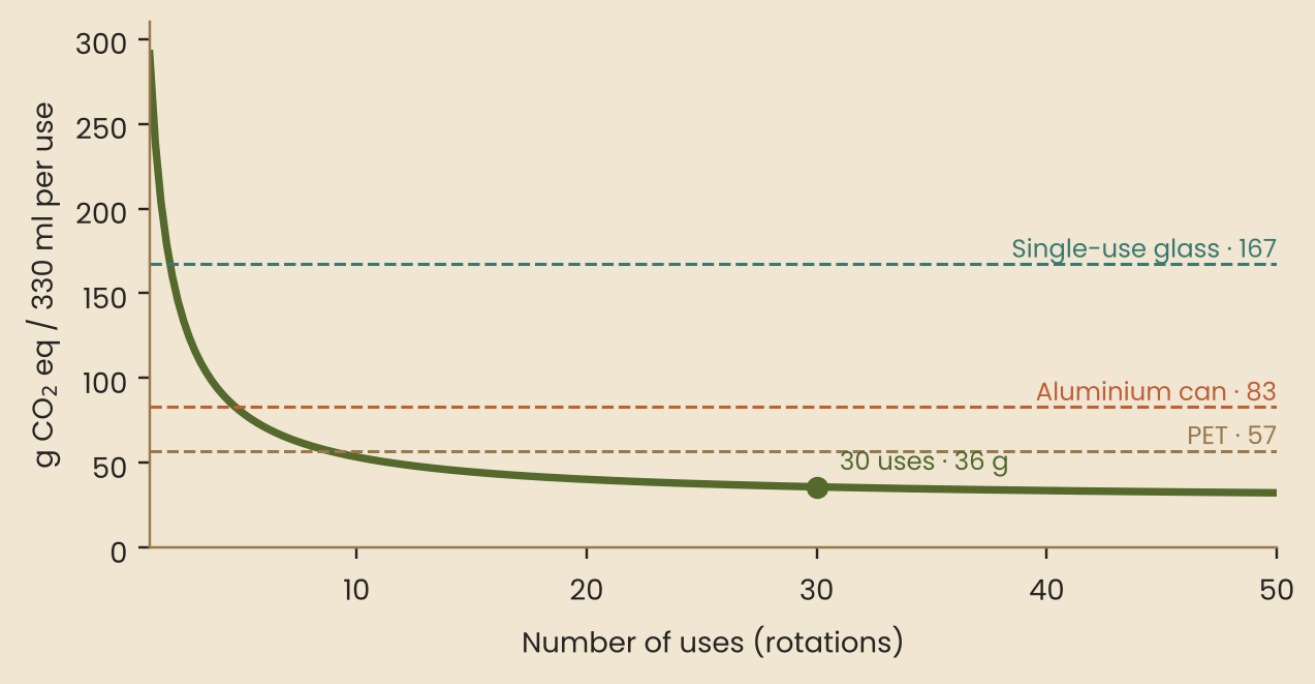


Figure 6. Footprint per use of reusable glass versus rotations, with reference lines for PET, can and single-use glass. Cross-checked against NORSUS (2021).

5.2.4 Lightweighting and format

Reducing weight lowers impact proportionally but within limits: a glass bottle 30% lighter falls to ≈117 g, still twice PET, without changing the ranking. PET and the can already operate close to their lightweighting limit. Format has a relevant geometric effect: moving from 330 ml to 1 L reduces the footprint per litre by ≈30% thanks to a better surface-to-volume ratio.

5.2.5 Complementary scenario: eco-costs (monetisation)

As an additional lens, the same product systems were assessed with the Eco-Costs 2025 method (Sustainability Impact Metrics, TU Delft), a monetised indicator that expresses impact as the prevention cost of environmental damage in euros, in line with ISO 14008. It does not represent manufacturing cost or a market price. Results per 330 ml container are in Table 8.

Table 8. Eco-costs per container (€ cents / 330 ml) and weight of the two dominant categories.

Container (330 ml)	Total eco-cost	Water	Carbon
PET bottle 25%	4.1 ¢	71%	21%
Aluminium can 50%	4.2 ¢	57%	30%
Glass bottle, single use	8.6 ¢	47%	29%
Reusable glass (30 uses)	2.9 ¢	–	–

Monetisation keeps the study's order (single-use glass remains worst, ≈2.1× PET), but in euros PET and the can are tied: once damage is monetised, the dominant category is no longer carbon but water. The reusable bottle at 30 uses is the cheapest option.

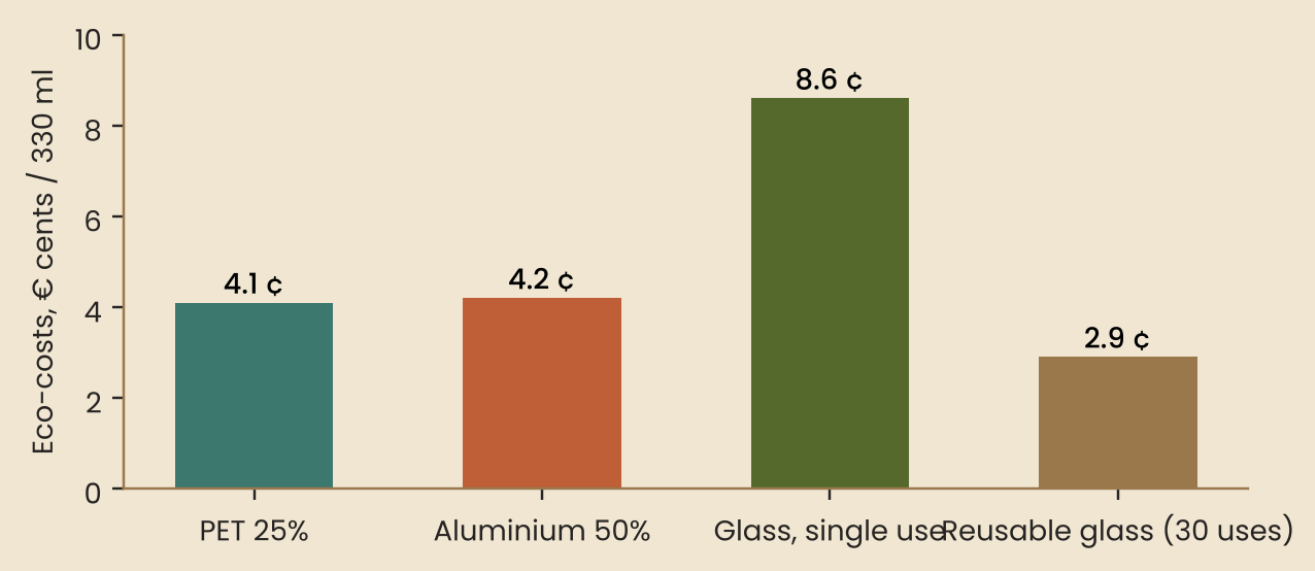


Figure 7. Eco-costs per container (prevention cost, € cents / 330 ml). Glass remains worst; PET and can tie.

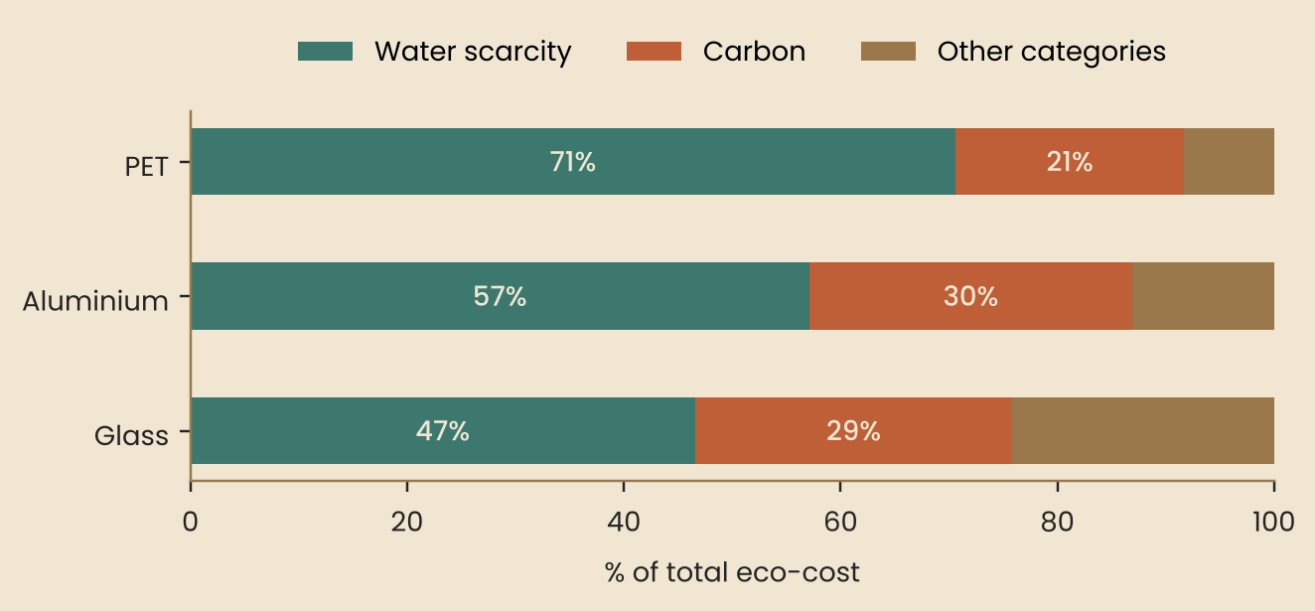


Figure 8. Eco-cost composition. Water scarcity is the costliest category in all three containers; water and carbon together make up 76–92%.

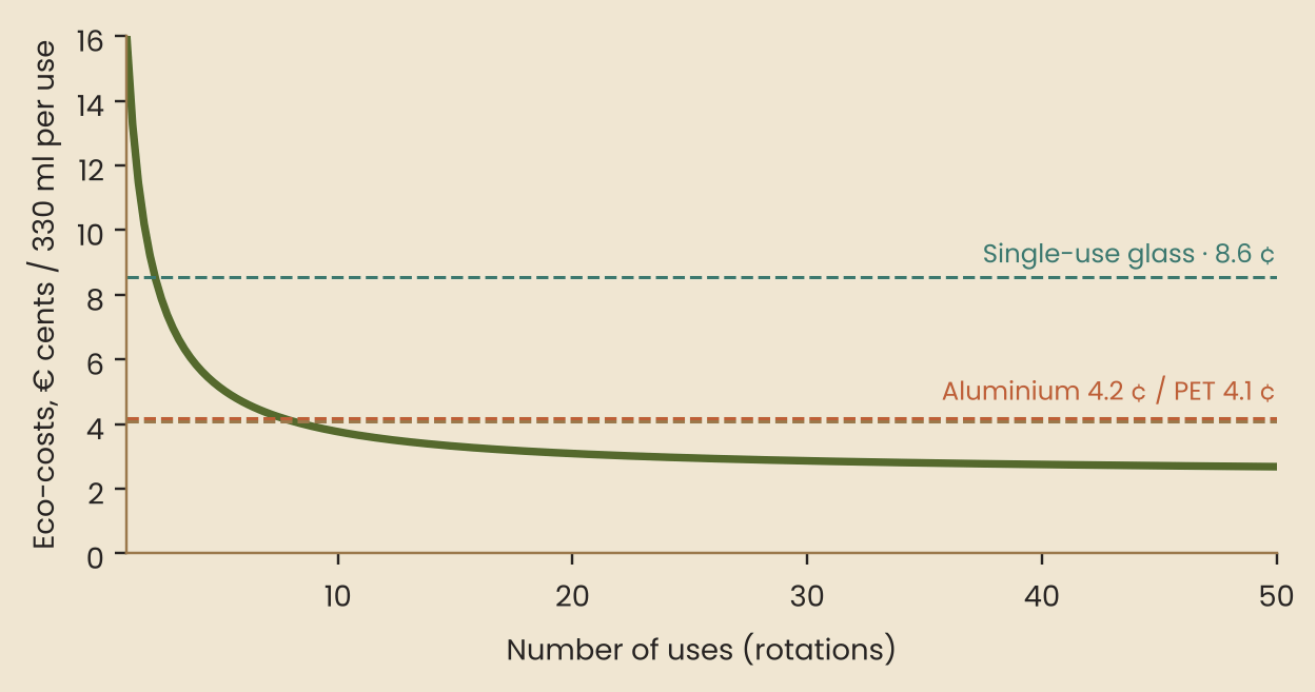


Figure 9. Break-even of reusable glass in euros. It beats single-use glass at about 2 uses and PET and can at about 8.

CAUTION ON THE DOMINANCE OF WATER

The prominence of water should be taken with reservations: the prevention cost of water is among the most debated parameters of the method, and the water inventory of the background database is among the most uncertain data. It is presented as an indicative finding, not a closed figure. Eco-costs are the prevention cost of environmental damage, not a price or a life cycle cost (LCC) analysis.

5.3 Completeness, sensitivity and consistency assessment

Completeness: relevant processes are covered for each container; exclusions (trace auxiliaries, distribution transport) are declared and justified. **Consistency:** the three systems share method (EF 3.1), database (BAFU-2026), region (RER) and functional unit, a necessary condition for a valid comparison. **Sensitivity:** the

qualitative conclusions (single-use glass worst; material dominant; reuse decisive) are robust to the tested variations in recycled content, end of life and weight; the only method-sensitive comparison is PET versus aluminium, which is declared. Climate-change results are cross-checked against Carbon Trust (2021) and the reuse scenario against NORSUS (2021), falling within range in both cases.

5.4 Conclusions and decision toolkit

From greatest to smallest capacity to reduce impact, the ecodesign levers for a beverage container rank as follows:

Table 9. Hierarchy of packaging ecodesign levers UPDATED v1.1

Ecodesign lever	Effect	Note
1 · Reuse (returnable glass)	`Up to 4.7× less`	The dominant lever: 167 g → 36 g CO_2 eq per use at 30 rotations versus single-use glass. Requires a collection and washing system.
2 · Material and recycled content	`−60% PET · −86% can`	0% → 100% recycled content. Material production is 72–100% of the footprint; recycling is decisive in aluminium (primary emits 13× more than secondary).
3 · Larger format	`≈ −30% per litre`	Moving from 330 ml to 1 L, by geometry (estimate, not real weights).
4 · Lightweighting	`−10 to −20%`	Real but bounded; PET and can are already near their limit.
5 · Plant optimisation	`Marginal`	Forming is 0–28% of the footprint (PET 28%, aluminium 13%, glass ≈0%); only part of it can be cut.

Effects refer to manufacturing climate impact in the base scenario. Values are indicative orders of magnitude; the order of the levers is the finding, not the exact percentages.

Most of the impact is decided at the design stage — material, recycled content, format and reuse — not at the manufacturing plant. These are precisely the variables that European regulation (PPWR, Digital Product Passport) will require to be documented with data.

6 · Limitations

- Indicative study with secondary data from public databases. It is not equivalent to a certified ISO 14040/14044 LCA with manufacturer primary data, nor has it been subject to panel critical review.
- Generic comparison by material, without brand. No figures are attributed to any named product, in line with the Green Claims approach.
- Cradle-to-gate scope: manufacture of the empty container only. Distribution transport and use are excluded; end of life is treated solely as a sensitivity.
- Recycled input content under a cut-off approach. The end-of-life sensitivity uses cut-off / avoided-burden bookends; it does not implement the full official CFF with its A factors.
- Declared proxies: can forming (deep drawing as an approximation), returnable-bottle weight (~300 g/330 ml) and washing data for the reuse system.
- The EcoProfiles rPET was imported without an operational background (null result) and reconstructed on the BAFU background; trace auxiliaries (<1%) were excluded under the cut-off criterion.
- The glass dataset is flagged “obsolete” in the database but is considered valid for the purpose of the study; it integrates forming.
- The normalised single score aggregates categories with equal weight; it is not the official weighted EF single score. The format study is a geometric estimate, not real weights per size.
- The eco-costs scenario (§5.2.5) is a complementary monetisation (prevention cost, ISO 14008), not an economic cost. Its dominant category, water, depends on a debated prevention factor and an uncertain water inventory; it is offered as an indicative finding.

7 · References

1. ISO 14040:2006. Environmental management — Life cycle assessment — Principles and framework.
2. ISO 14044:2006. Environmental management — Life cycle assessment — Requirements and guidelines.
3. GreenDelta (2026). BAFU-2026 v1 LCI database (on ecoinvent/KBOB background), RER region. openLCA 2.5.
4. European Commission, JRC (2023). Environmental Footprint (EF) 3.1 reference package and method. openLCA LCIA Methods 2.8.0 implementation.
5. European Commission, JRC (2023). JRC130796, EF 3.1 global normalisation factors.
6. Plastics Recyclers Europe (PRIMUS project, rev. VTT). EcoProfiles of Recycled Plastics (rPET), inventory. Licence CC BY 4.0.
7. Carbon Trust (2021). Carbon footprinting of beverage packaging (reference values for validation).
8. Sustainability Impact Metrics / TU Delft (2025). ECO-COSTS 2025 V2.1 (monetised prevention-cost indicator, in line with ISO 14008). Implemented in openLCA LCIA methods.
9. NORSUS (2021). Review of life cycle assessments of reuse systems for beverage bottles.
10. Reference weights: Petainer (PET), Coca-Cola / edie (glass), Ace Breakers (aluminium).
11. Directive (EU) 2019/904 (SUP): 25% rPET in bottles from 2025, 30% from 2030.
12. Regulation (EU) 2025/40 (PPWR) on packaging and packaging waste; applicable from 12 August 2026.

8 · Disclaimers

This report is a demonstration of method, not a certified assessment. Please read the points below before using, citing or redistributing any figure from it.

01 **Indicative, not certified.** This is an indicative LCA exercise built with secondary data from public databases and declared proxies. It is not a certified or verified LCA and does not claim conformity with ISO 14040:2006 or ISO 14044:2006; it follows their structure and principles only.

02 **No critical review.** The study has not been subject to critical review by an independent expert or panel, as would be required for comparative assertions disclosed to the public (ISO 14044, clause 6).

03 **No public comparative claims.** Results must not be used as the basis for comparative environmental claims in marketing, labelling or advertising. Doing so would require a study with primary data, critical review and compliance with applicable consumer-protection and green-claims rules.

04 **Generic, not brand-specific.** The comparison is by material and generic container. No figure refers to, or may be attributed to, any specific product, brand or manufacturer. Real results vary with weight, recycled content, supply chain, energy mix, geography and technology.

05 **Self-initiated, no client.** This is an own-initiative demonstration project by Scala Vita. It was not commissioned, funded or influenced by any third party, and it does not represent the position of any company or sector body.

06 **Scope-bound results.** Results apply only to the stated functional unit, cradle-to-gate scope, method (EF 3.1) and database (BAFU-2026 v1, RER). Distribution, filling, use and end of life are outside the base scope; end of life appears only as a sensitivity and the full CFF is not implemented.

07 **Data and proxies.** Inventory data are secondary. Declared proxies include can forming (deep drawing), returnable-bottle weight and washing data. The rPET process was reconstructed from EcoProfiles inventory on the BAFU background, and trace flows (<1%) were cut off. The glass dataset is flagged obsolete in the source database.

08 **Normalised index.** The single score is an unweighted sum of normalised categories. It is not the official weighted EF single score and should not be quoted as such.

09 **Eco-costs are not prices.** Eco-costs are a monetised prevention-cost indicator (ISO 14008). They are not manufacturing cost, market price or life cycle costing. The dominance of water rests on a debated factor and an uncertain water inventory, and is an indicative finding only.

10 **Scenario figures are illustrative.** Reuse break-evens, lightweighting and format effects are scenario estimates under stated assumptions (e.g. 30 rotations, ~300 g returnable bottle, geometric format scaling). Table 9 gives orders of magnitude and a ranking of levers, not guaranteed reductions for any specific product.

11 **Regulatory references are informational.** References to the SUP Directive, PPWR and the Digital Product Passport reflect the author's understanding at the date of issue. They are not legal advice and should be checked against current official texts.

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Annexes

A · Detailed inventory of reconstructed rPET

Recipe entered in openLCA to reconstruct 1 kg of rPET on the BAFU-2026 background, from the EcoProfiles inventory.

Table A.1. Inventory of the reconstructed rPET process (per 1 kg of rPET).

Input flow (dataset)	Amount	Unit	Note
Electricity, low voltage, RER	2.535	MJ	Sum of three voltage levels
Heat, natural gas, industrial furnace 1 MW, CH	1.128	MJ	Drying / washing
Diesel, burned in building machine, GLO	0.197	MJ	—
Extrusion, plastic film, RER	0.0297	kg	Pelletising
Transport, freight, lorry 16–32 t, RER	0.40	t·km	Recycling logistics
Tap water, RER	3.065	kg	Washing
Polyethylene LDPE granulate, RER	0.0291	kg	Auxiliary
Steel, low-alloyed, RER	0.00983	kg	Auxiliary
Sodium hydroxide, 50% in H2O, RER	0.00909	kg	Caustic soda
Feedstock PET + traces	excluded	—	Cut-off (<1%) declared

B · Reuse system (returnable glass)

Table A.2. Washing-cycle inventory per rotation (per 1 L).

Flow	Amount	Unit
Returnable bottle production (packaging glass, white), amortised	0.909	kg
Heat, natural gas, industrial furnace 1 MW (hot wash water)	0.50	MJ
Electricity, low voltage, RER (washing machine)	0.30	MJ
Tap water, RER	2.00	kg
Sodium hydroxide, 50% in H2O, RER	0.003	kg
Transport, freight, lorry 16–32 t, RER (return of empties)	0.05	t·km

C · Full recycled-content curves and break-even points

Table B.1. Climate change of PET by % rPET.

% rPET	0%	25%	50%	75%	100%
kg CO_2 eq / L	0.204	0.173	0.143	0.112	0.081
g CO_2 eq / 330 ml	67.4	57.2	47.1	36.9	26.7

Table C.1. Climate change of the can by % recycled aluminium (g CO_2 eq / 330 ml).

% recycled	0%	25%	50%	75%	100%
g CO_2 eq / 330 ml	145	114	83	52	21

Table C.2. Reusable-glass break-even (rotations needed to beat each single-use container).

Reference	Single-use glass	Aluminium can	PET bottle
Rotations to beat it	~1.9	~4.7	~8.8

DOCUMENT CONTROL

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