COMPARATIVE LIFE CYCLE ASSESSMENT: NORTH AMERICA

JULY 2020

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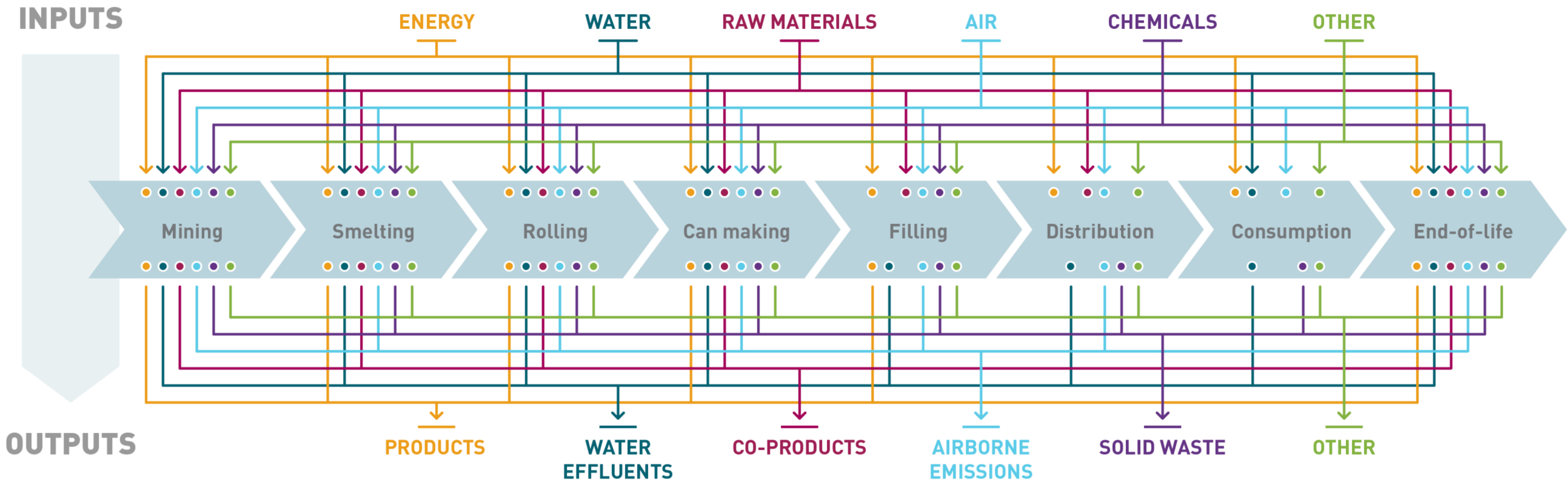
About Life Cycle Assessment

WHAT IS LIFE CYCLE ASSESSMENT (ISO 14040 DEFINITION)

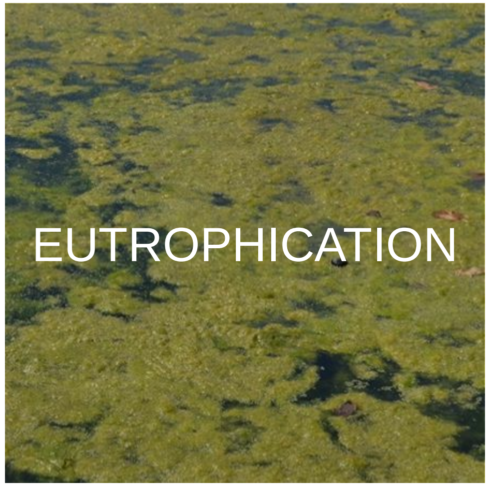
LCA is a technique for assessing the environmental impacts associated with a product, by

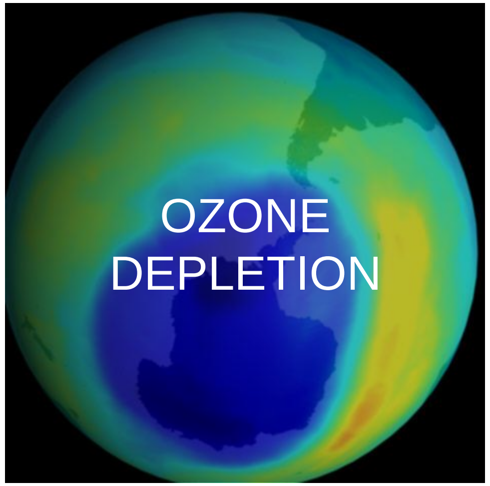
- Compiling an **inventory** of relevant inputs and outputs of a product system,
- Evaluating the potential **environmental impacts** associated with those inputs and outputs,
- **Interpreting** the results of the inventory analysis and impact assessment phases in relation to the objectives of the study.



Note: LCA schematic for an aluminum beverage can

ENVIRONMENT IMPACT CATEGORIES ASSESSED IN LCAS





While this presentation focuses on Global Warming Potential and some other environmental impact categories, the Sphera LCA considered all categories recommended by TRACI Guidelines

PURPOSE

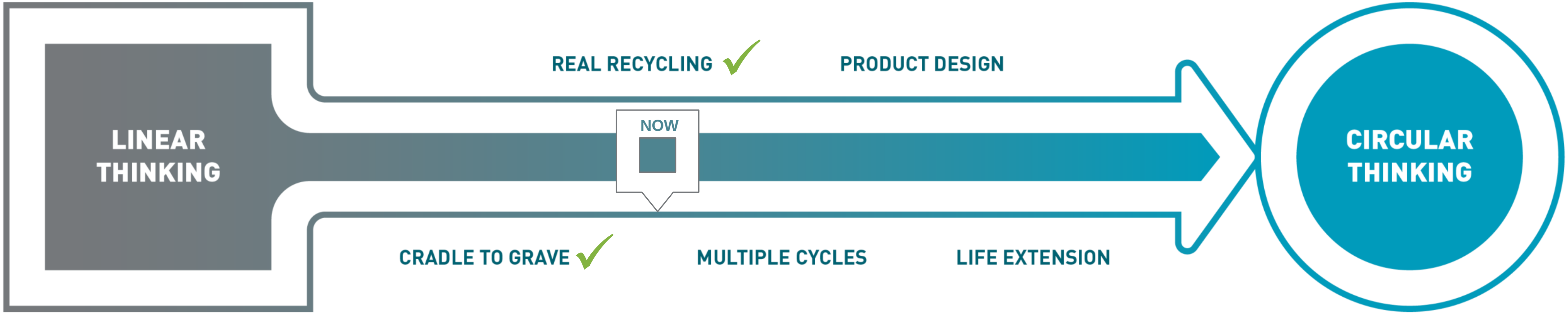
- Identify environmental hotspots along a product's life cycle.
- Add an environmental dimension for decision-makers to explore new design solutions.
- Monitor environmental footprint improvements of a product over time.
- Inform internal decision makers.
- Compare existing products with alternatives.
- Inform and educate external stakeholders, incl. legislators.
- Support product claims.

LIMITATIONS

- Not an exact science (methodologies, models and assumptions shape results).
- For the same product, different LCAs can suggest opposing findings.
- Not the single answer to all environmental questions.
- Circularity, real recycling rates, recycling yields, economics of recycling, and impacts of e.g. microplastics on the environment and human life are not considered in LCAs.
- Describe one specific situation, cannot be generalised for all.

> **A high level of transparency and offering various sensitivity analysis and scenarios in a LCA is important to allow readers to understand the study design, interpret results and draw their own conclusions**

- LCAs today are mostly linear instead of **applying circular thinking**, which would be more appropriate for fast moving consumer goods such as beverage packaging.
- That is why Ball is sponsoring a multi-year PhD program at the University of Barcelona to research limitations of packaging LCAs and develop **new and scientifically sound approaches** to overcome these limitations.
- Ball will build on these findings and **initiate discussions with stakeholders** to ensure future LCAs adequately capture the true sustainability performance of beverage packaging.



Less representative of FMCG packaging

✓ *Has been explored to some extent in the LCA performed by* sphera

More representative of FMCG packaging

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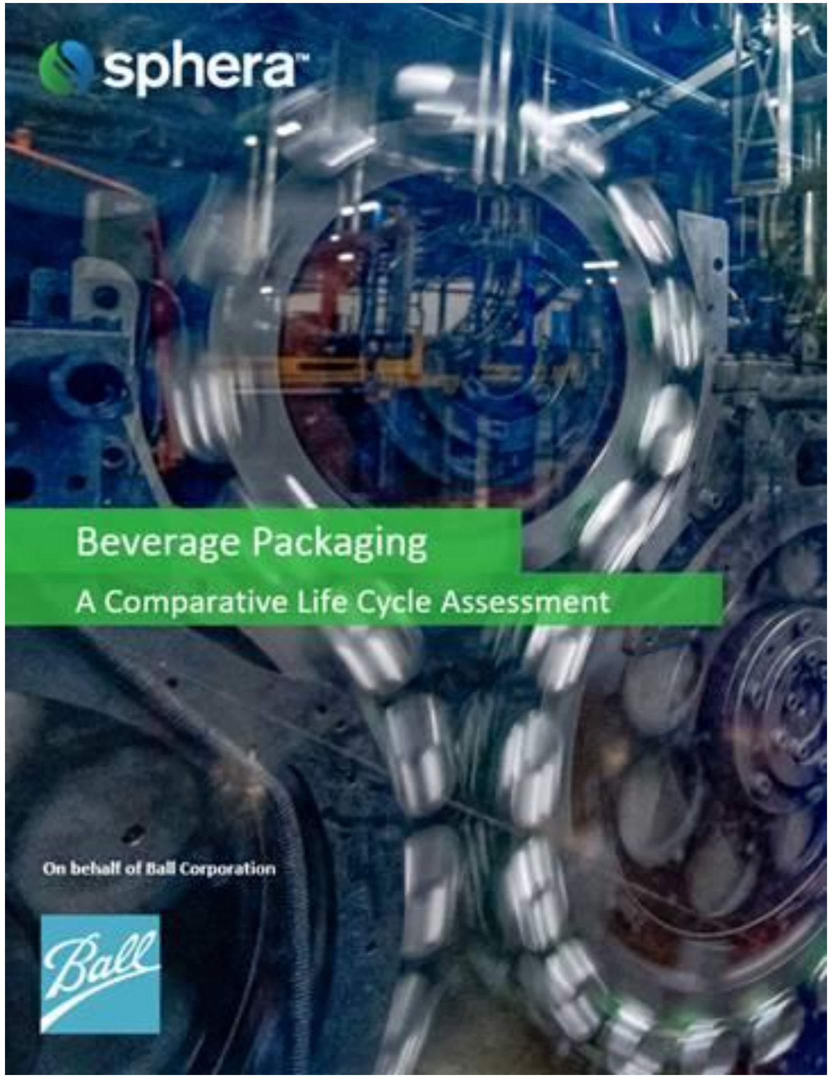
Sphera Comparative LCA study



Critical Peer Review Panel

Dr Pere Fullana

Director of the UNESCO Chair in Life Cycle and Climate Change. Recent research on LCA for packaging and effects of recycling

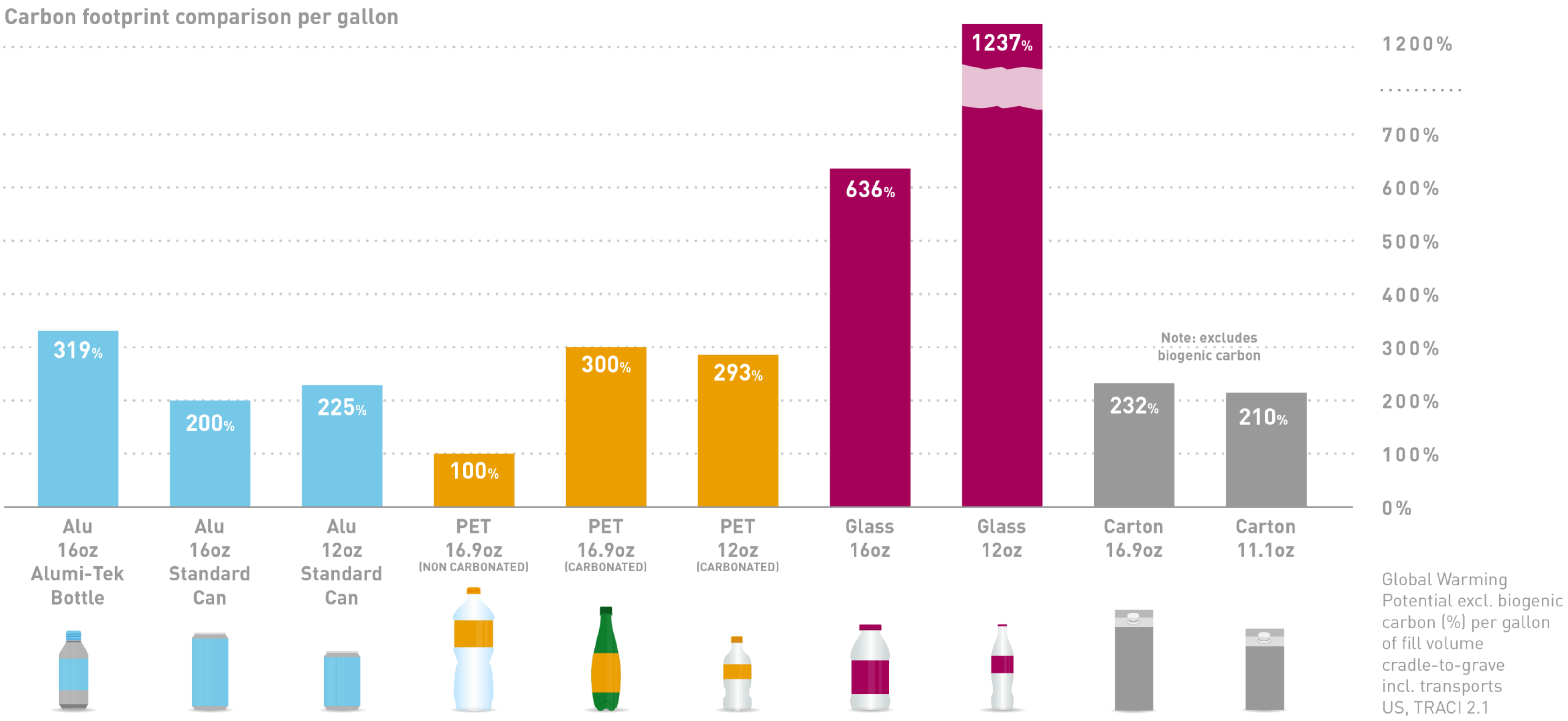
Ivo Mersiowsky

Sustainability and leadership consultant, LCA expert (focus chemical and plastics industry)

Angela Schindler

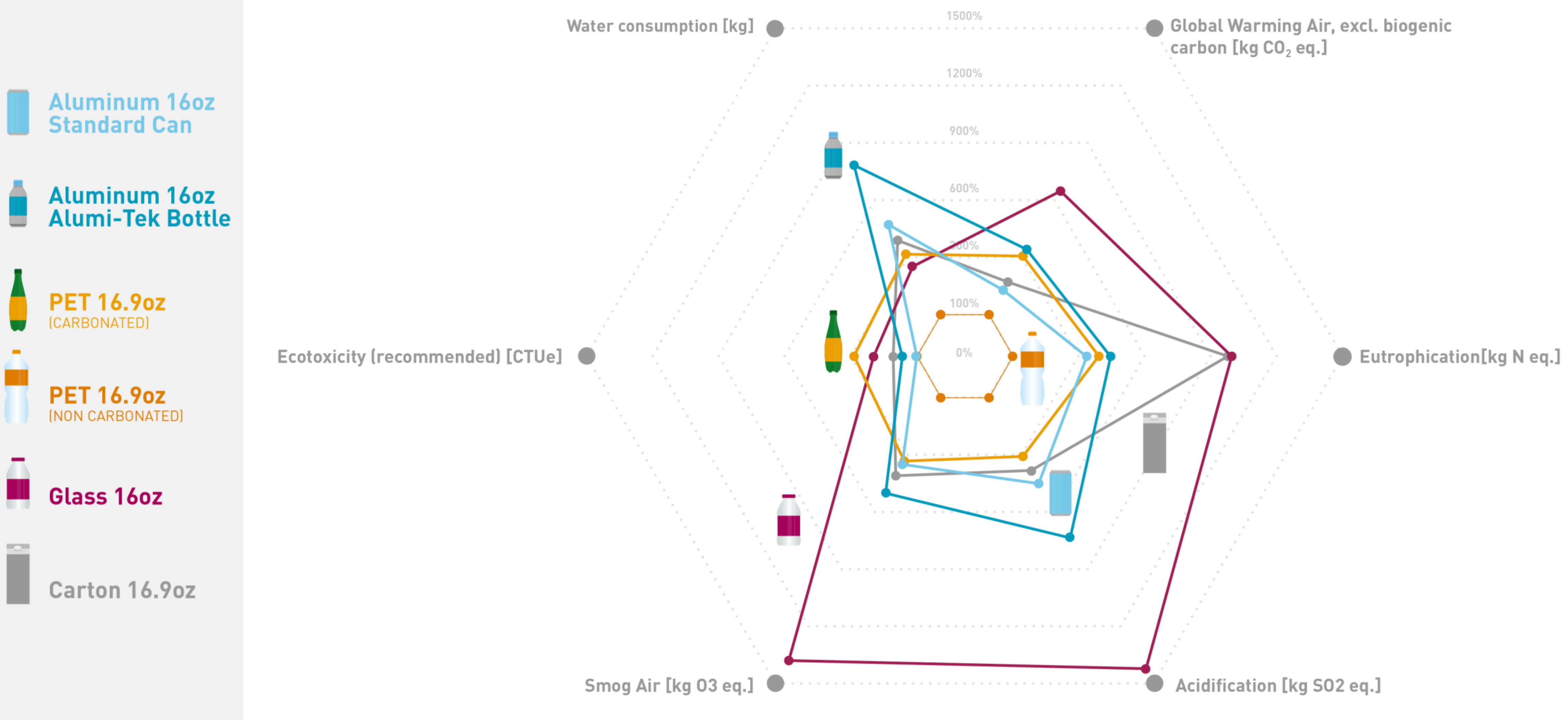
Environmental management consultant, LCA expert (focus modelling, packaging), reviewer for the International Journal of Life Cycle Assessment

GLOBAL WARMING POTENTIAL (CARBON FOOTPRINT) PER GALLON



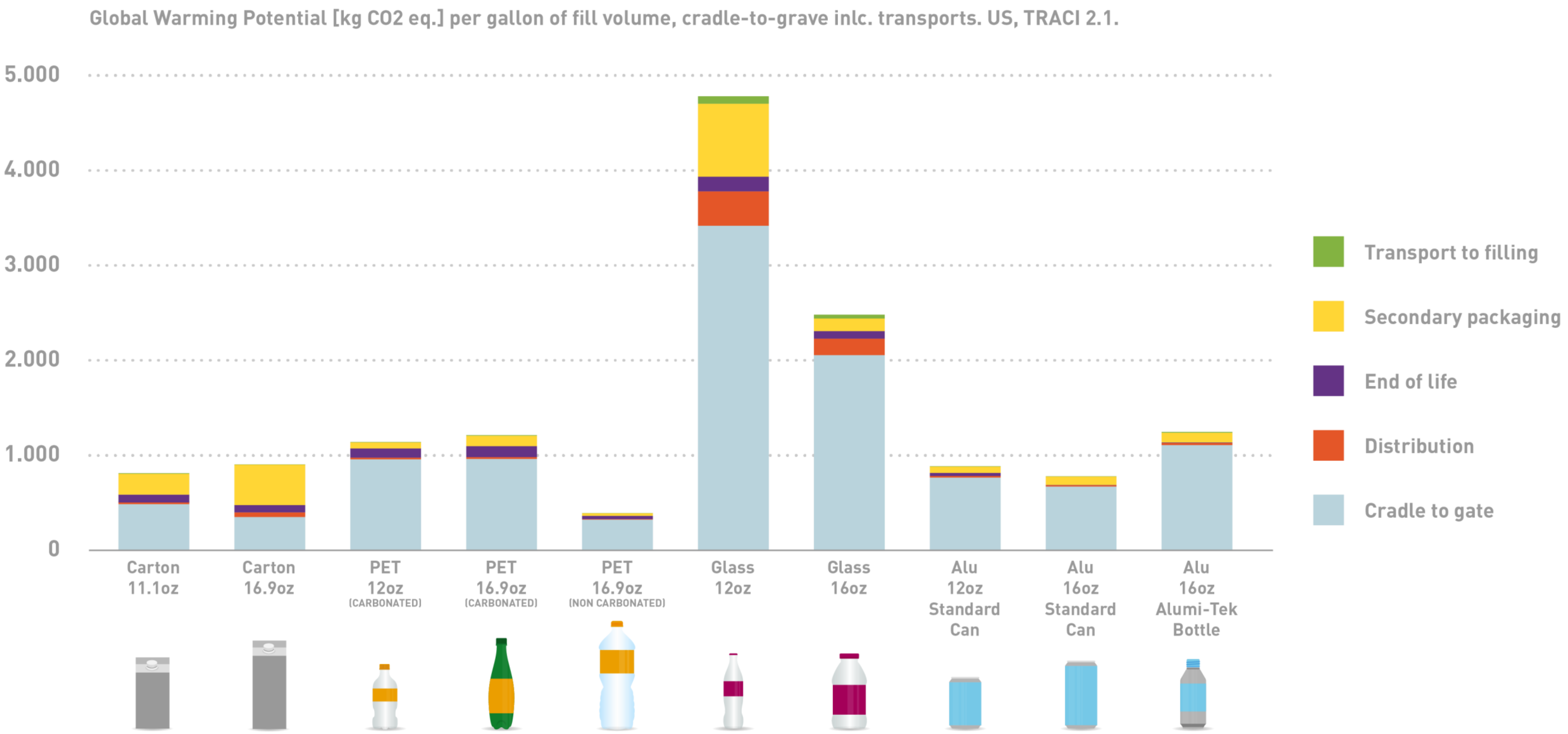
Source: Peer reviewed comparative beverage packaging LCA, Sphera, 2020

SUMMARY OF ALL ENVIRONMENTAL IMPACT CATEGORIES (16 AND 16.9 OZ)

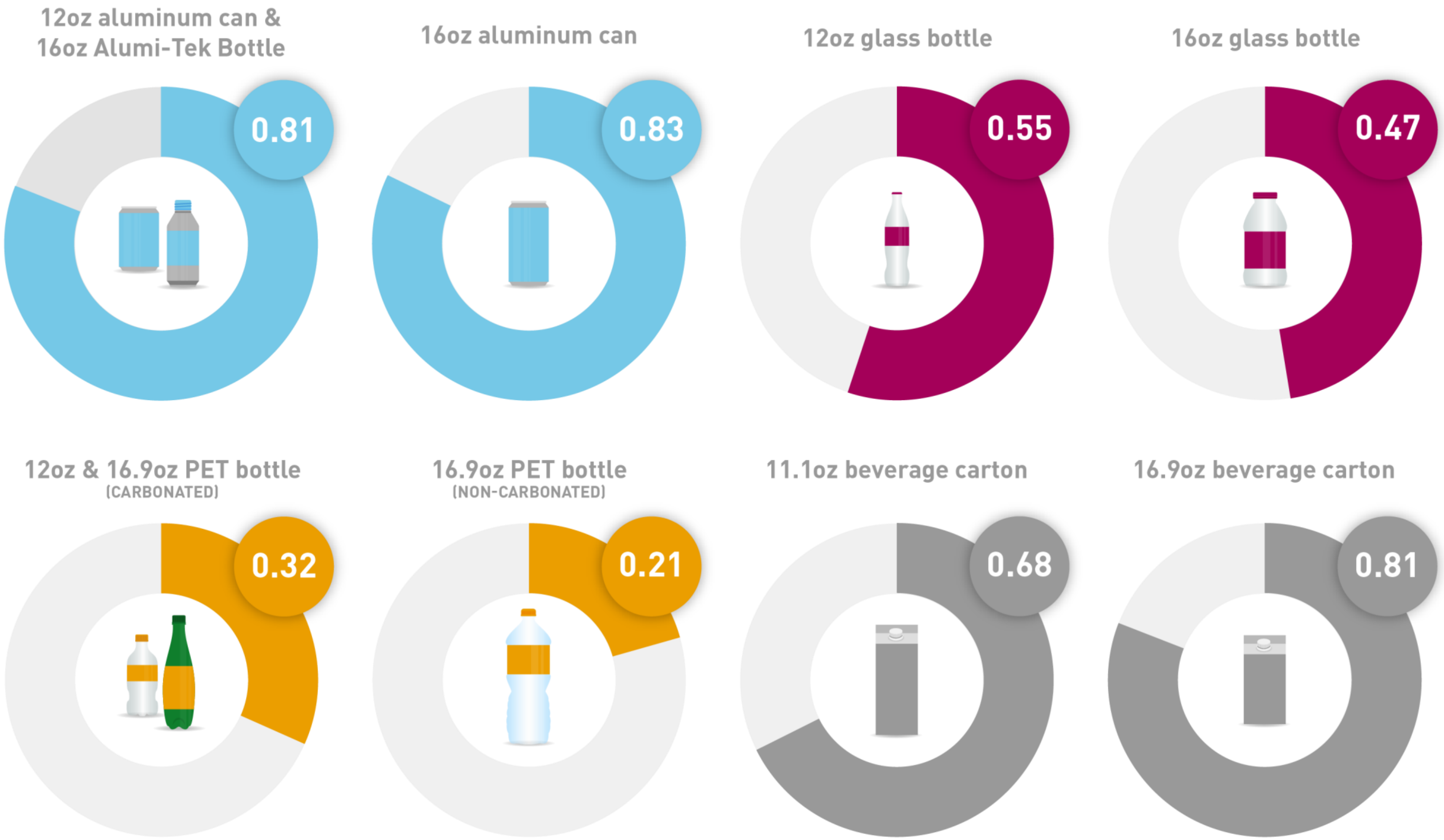


Source: Peer reviewed comparative beverage packaging LCA, Sphera, 2020

GLOBAL WARMING POTENTIAL PER CONTAINER SHOWING GATE TO END OF LIFE IMPACTS



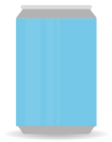
MATERIAL CIRCULARITY INDICATOR (MCI): 0.1 = LINEAR, 1 = FULLY CIRCULAR



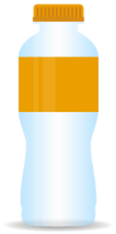
Note: MCI methodology includes non-recycled renewables fibres as circular. Other methodologies do not.

Source: Peer reviewed comparative beverage packaging LCA, Sphera, 2020

SUMMARY AND CONCLUSIONS FOR EACH MATERIAL

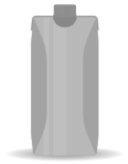


- Excellent performance on **climate change** and eutrophication, benefiting from light weight and high recycled content
- Shifting the electricity mix of can manufacturing from grid to **renewables** (as announced by Ball for 2021 across North America) reduces the carbon footprint of aluminum cans by 12-18%
- Excellent **material circularity** scores (~0.8)



- **Higher impacts** than cans and cartons across most categories, primarily due to oil and gas-related impacts and low recycled content
- Low recycling rates and recycled content as well as high recycling yield losses result in the **worst material circularity scores** of all substrates (~0.2-0.3)

- Highest environmental impacts in most categories, driven by **heavy weight**, very resource and **energy intensive glass production**, and lack of refillable systems in the U.S.
- Medium circularity scores (~0.5)



- Good results in most impact categories, driven by relatively **small manufacturing impacts** and the fact that integrated pulp and paper mills generate most of their energy from biomass intake such as wood offcuts
- Assuming sustainably sourced fibers, they achieve decent circularity scores (~0.7-0.8), despite lack of real recycling at scale

Source: Ball summary analysis based on Peer reviewed comparative beverage packaging LCA, Sphera, 2020

	Alu 16oz AlumiTek	Alu 16oz Standard	Alu 12oz Standard	PET 16.9oz (non-carbonated)	PET 16.9oz (carbonated)	PET 12oz (carbonated)	Glass 16oz	Glass 12oz	Carton 16.9oz	Carton 11.1oz
Total Container Weight *(g)*	24.53	14.61	12.68	10.1 (bottle, cap, label)	29.9 (bottle, cap, label)	21.4 (bottle, cap, label)	229 (bottle, cap, label)	290 (bottle, cap)	21.3 (carton, cap)	17.0 (carton, cap)
Secondary Packaging	9 pack, corrug. board (119g)	4 pack, corrug. board (50g)	8 pack, corrug. board, (66g)	12 pack, LDPE (14g)	6 pack, LDPE (13g)	8 pack, LDPE (5g)	6 pack, corrug. board (69g)	12 pack, corrug. board (439g)	24 pack, corrug. board (1055g)	12 pack, corrug. board (231g)
Recycled Content	78.6%			6%			35%		0%	
Recycling rate	50.4%			29.9%			41.9%		26.4%	
Main Datasets	Primary & secondary aluminum, sheet rolling: AA 2016			PET granulate, blow molding: GaBi 2016			Virgin & recycled glass: GaBi 2016		Liquid packaging board: FEFCO 2014	

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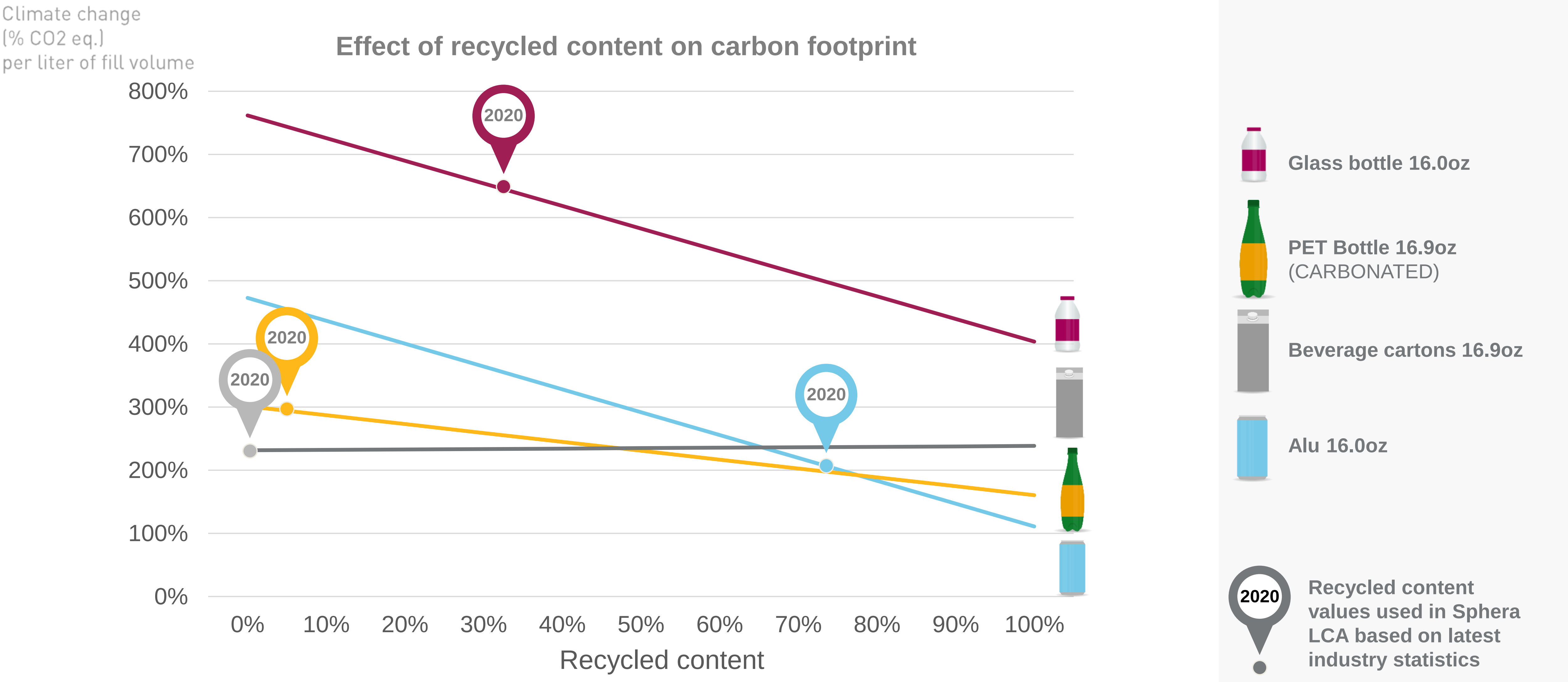
Sensitivity Analysis

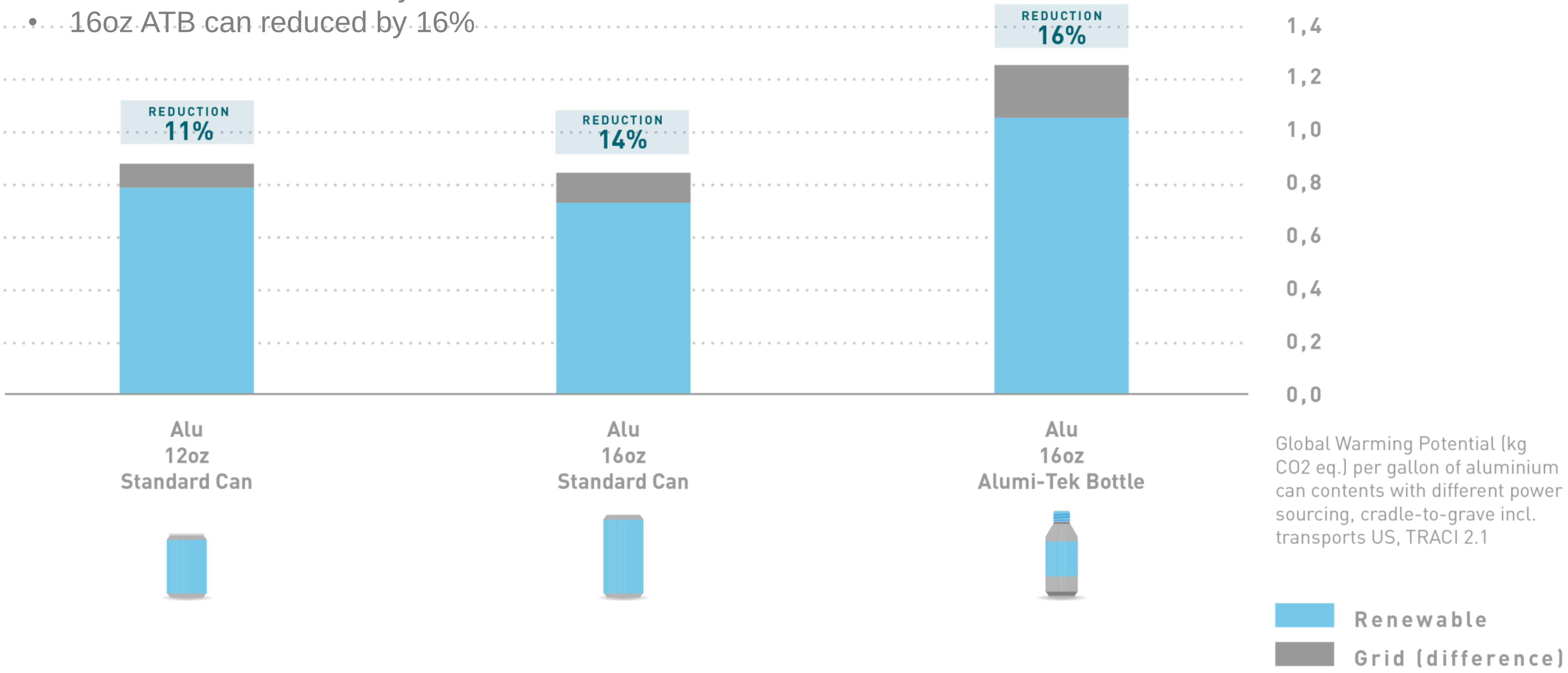


Source: Ball's graph based on sensitivity data from the peer reviewed comparative beverage packaging LCA, Sphera, 2020

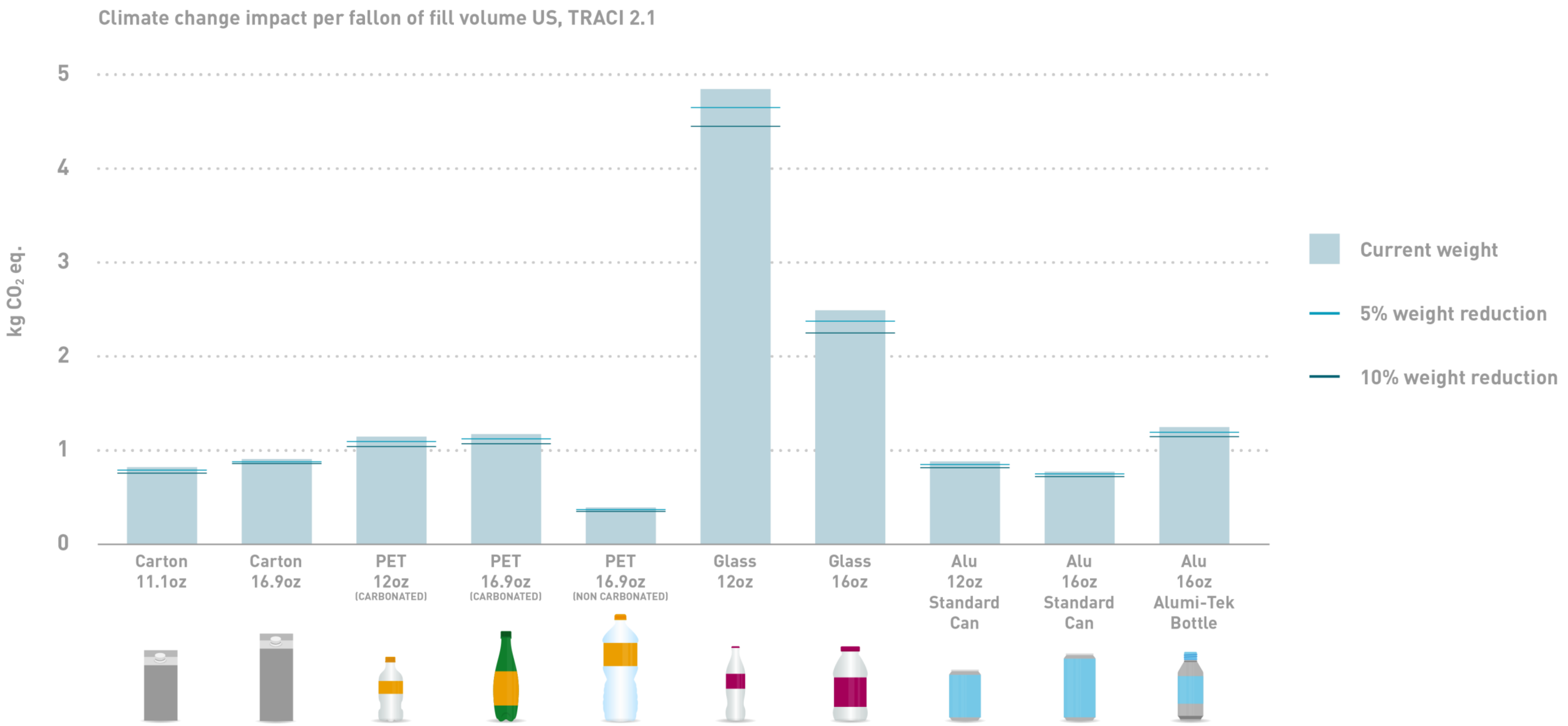
EFFECT OF SWITCHING TO RENEWABLE ENERGY

When switching to a renewable energy grid mix the GWP of the:

- 12oz can reduced by 11%
- 16oz STD can reduced by 14%
- 16oz ATB can reduced by 16%



EFFECT OF WEIGHT REDUCTIONS ON CARBON FOOTPRINT



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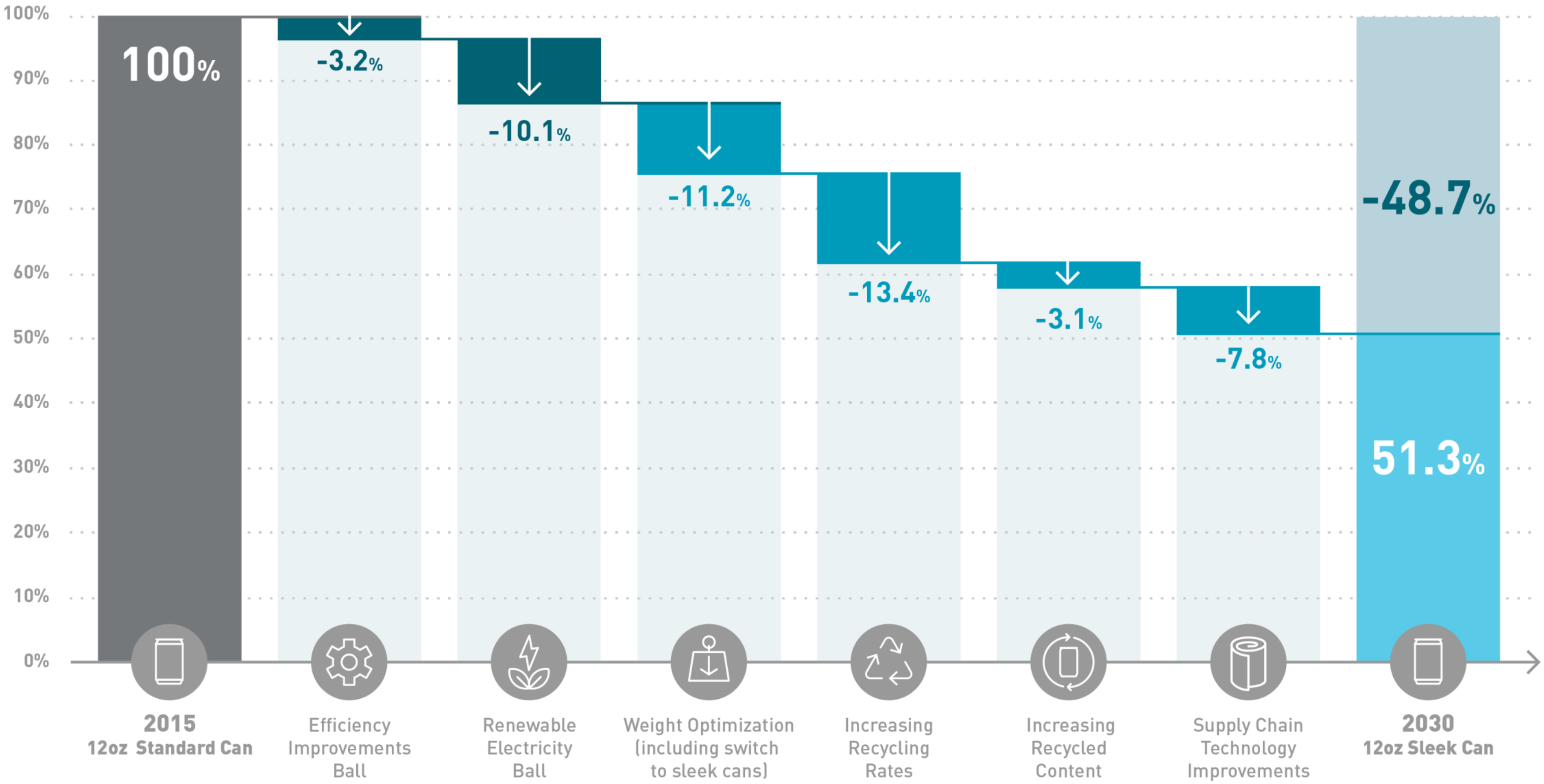
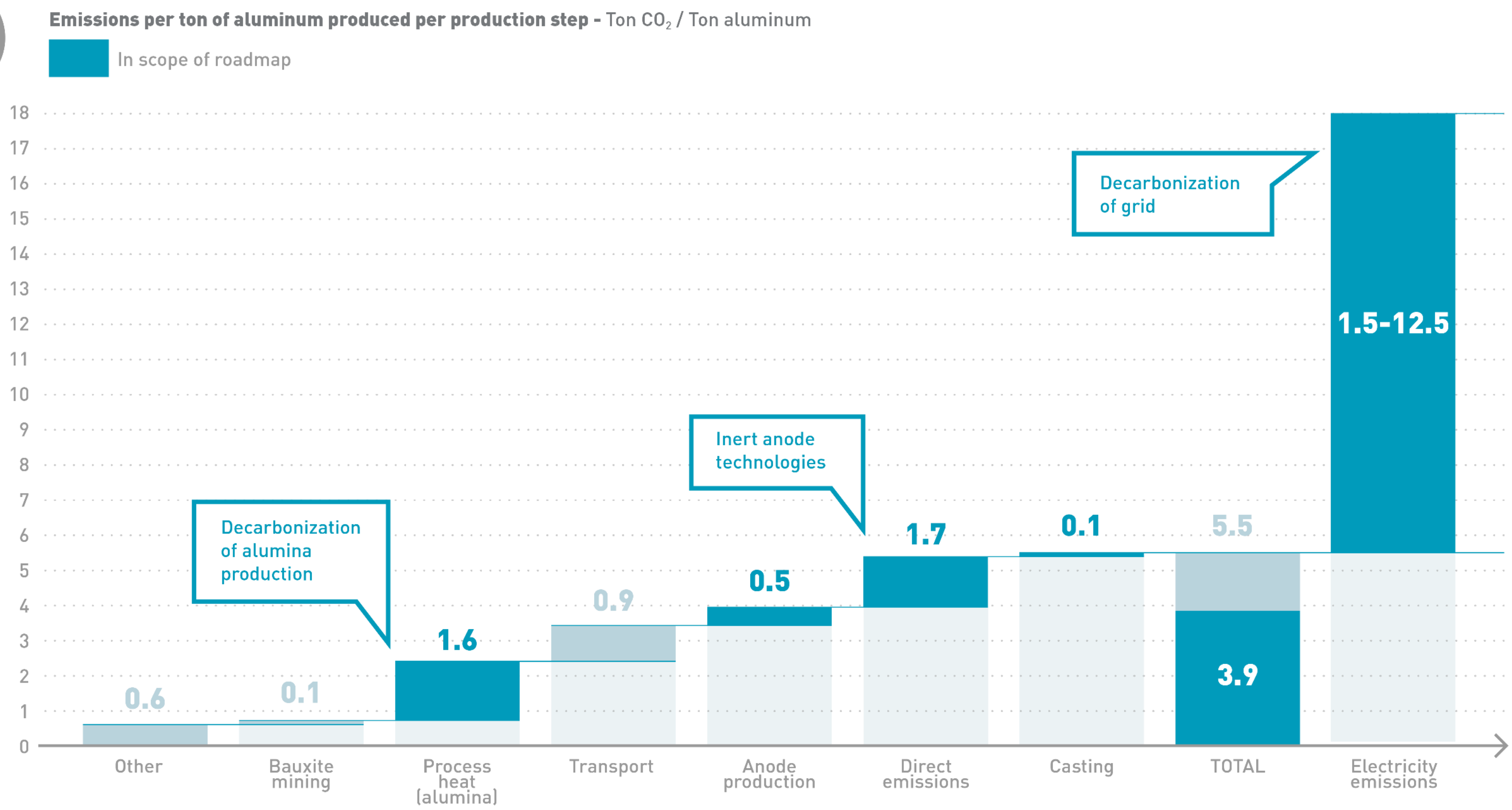
Plans to further improve the beverage can

2015-2030 PRODUCT CARBON FOOTPRINT (BPNCA 12OZ EXAMPLE)



Source: Ball's own calculation based on Instant LCA software using a 50/50 allocation rule and build on own as well as industry data/estimates

FURTHER OPPORTUNITIES TO DECREASE CARBON FOOTPRINT OF VIRGIN ALUMINIUM



Source: Material Economic analysis via data from International Aluminium Institute, 2019 (http://www.world-aluminium.org/statistics/)

We are working to increase real recycling.

PRODUCT DESIGN

CONSUMER EDUCATION

POLICIES TO DRIVE REAL RECYCLING (DRS/EPR)

INVEST IN RECYCLING INFRASTRUCTURE

TRANSPARENT LCAS + STANDARDS

"To make a real and positive impact on the **packaging waste crisis**, we need to focus on all the things we can do to promote **real recycling** so we can bend the dangerous curve of packaging pollution toward more **sustainable outcomes**.

Our **environment** and the **future** of our planet depend on it."

Ball Corporation CEO, John Hayes, CNBC Feb 2020

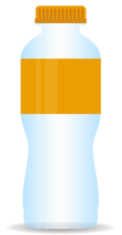
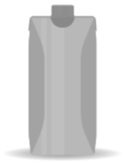
100% COLLECTION

100% RECYCLED CONTENT BACK INTO SAME VALUE PRODUCTS

100% OF THE MATERIALS ARE SORTED

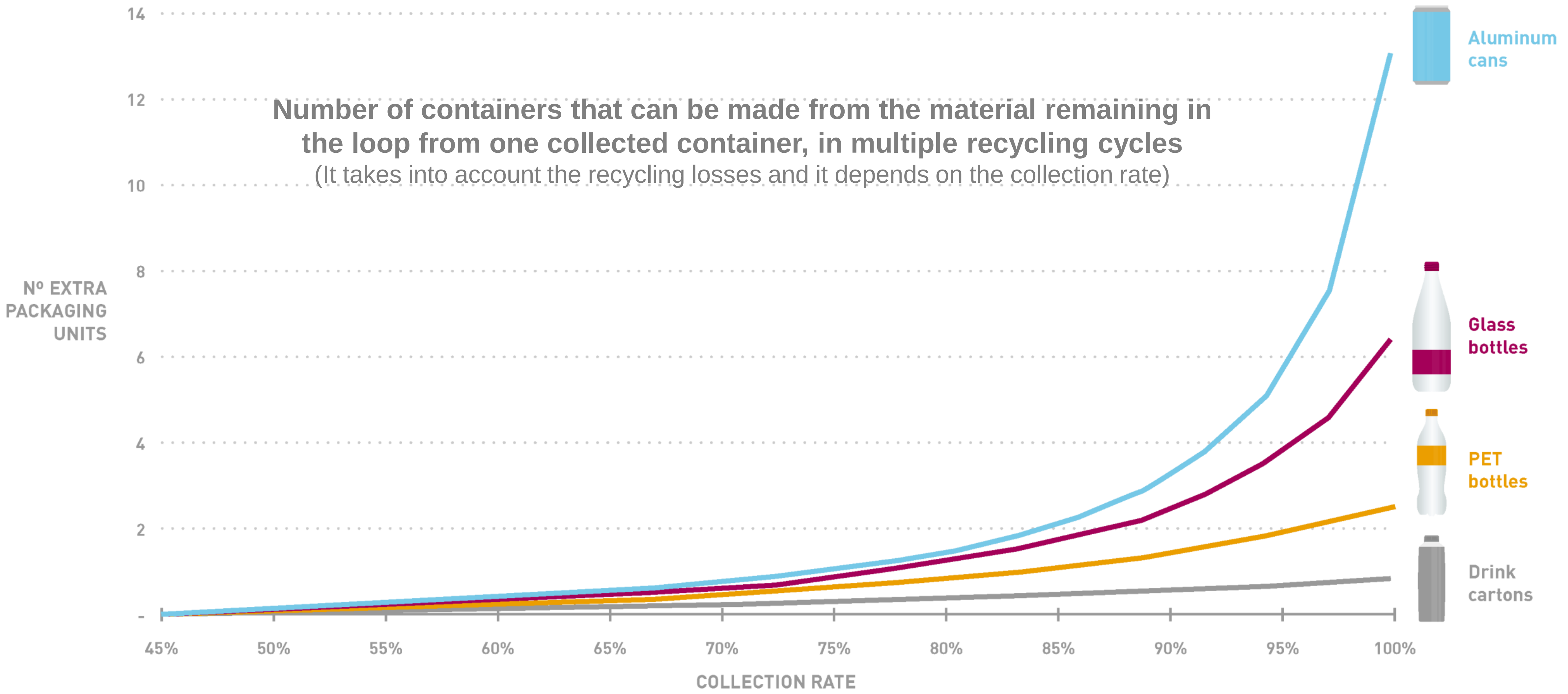
100% YIELD RECYCLING

ISSUES ACROSS ALL RECYCLING VALUE CHAIN FOR VARIOUS BEVERAGE CONTAINERS

	Collection	Sorting	Extra Sorting	Treatment	Re-incorporation
	• Weight • Breaks	• Color • Breaks	• Fine particles		• Low value
	• Minimum collection rate	• Black plastics • Coloured PET • Export market	• Cap, silicone valve, glue, label	• Opaque / TiO_2 • High Yield loss • Degradation • High cost	• Nurdles / pellet • Minimum rPET content • EFSA
	• Contamination to paper and cardboard • Low value	• Lack of Infrastructure	• Cap, straw, straw packaging	• Multi-material • High yield loss • PolyAl • Fibre shortening	• End markets
				• Non aluminium labels and ends	

Source: Ball's own analysis based on experience and interview with various consultants and recycling experts

MATERIAL KEPT IN THE LOOP AS COLLECTION INCREASES: EFFECT OF RECYCLING YIELDS IS WHAT MATTERS



Source: Eunomia's original idea. Ball's own analysis based on recycling yields assumptions for each packaging container. Real recycling yields are calculated as the ratio between the R2 factor of the PEF discussions (output recycling plant [R2], that can be download here) and the ´collection for recycling´ rate for the aluminium can, PET bottle and glass bottle.

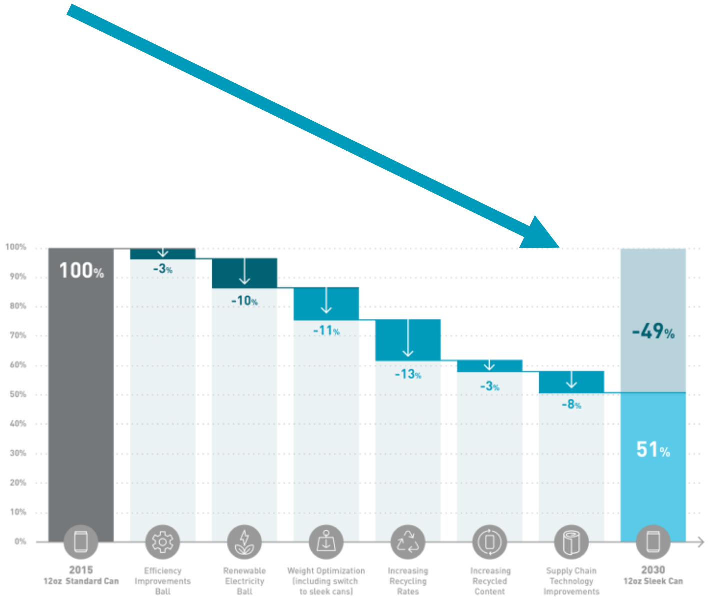

THANK YOU
Discussion

INCREASING RECYCLING OF ALUMINUM PROVIDES ECONOMIC OPPORTUNITY

Today, an average of 50% of the aluminum cans in the United States are recycled.

Increasing real recycling of aluminum means:

DECREASE ENVIRONMENTAL IMPACT

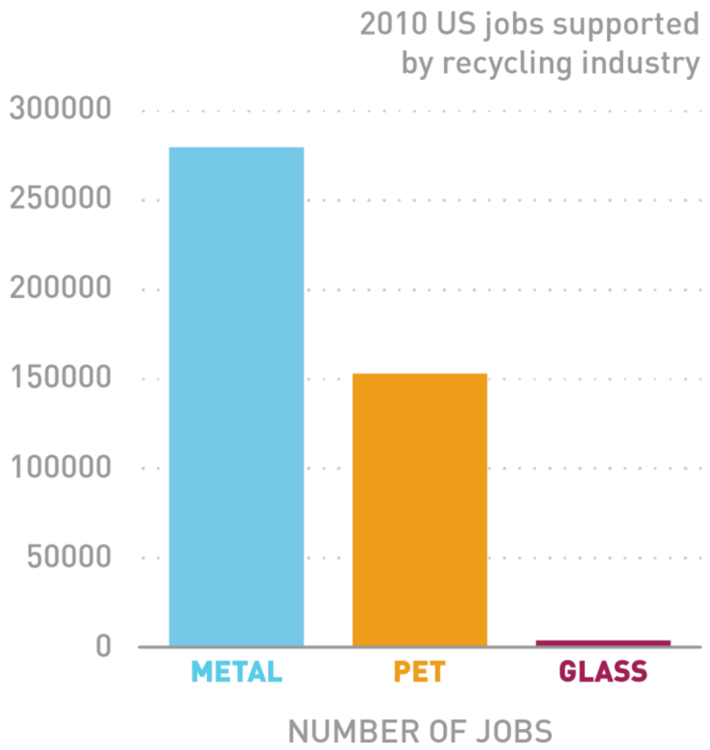


INCREASED ECONOMIC IMPACT

45 billion cans were recycled in 2019 and generated **$800M.**

That is **only half** of the available aluminum cans.

INCREASED SOCIAL IMPACT

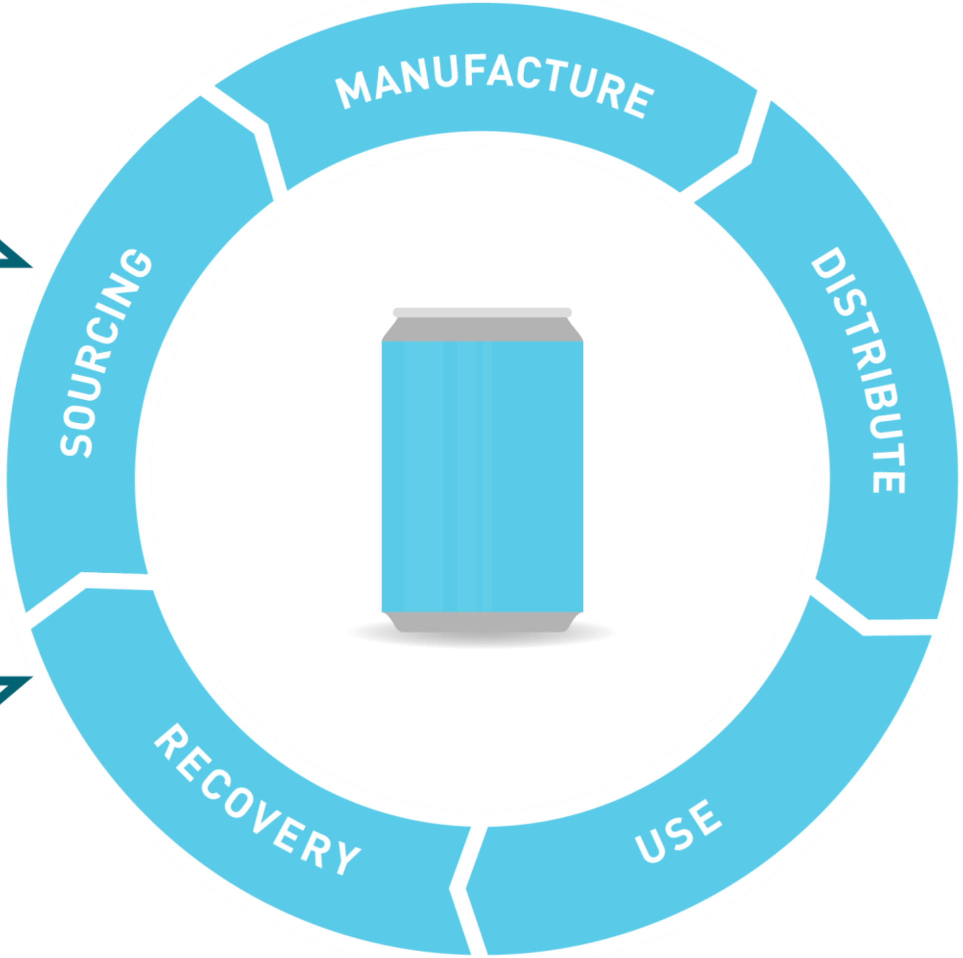


Source: CMI

ALUMINIUM ENABLES THE CIRCULAR ECONOMY

Today aluminum cans include **73%** recycled content

Recycled metal can be made into new cans an **infinite** number of times



Metal provides more **economic value** to recyling systems than all other substrates combined

Aluminum is nearly **50%** of the revenue of recycled materials

Source: CMI

THANK YOU

Questions?