



PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY



All India Glass Manufacturer's Federation



**All India Glass
Manufacturer's Federation
Mumbai India**

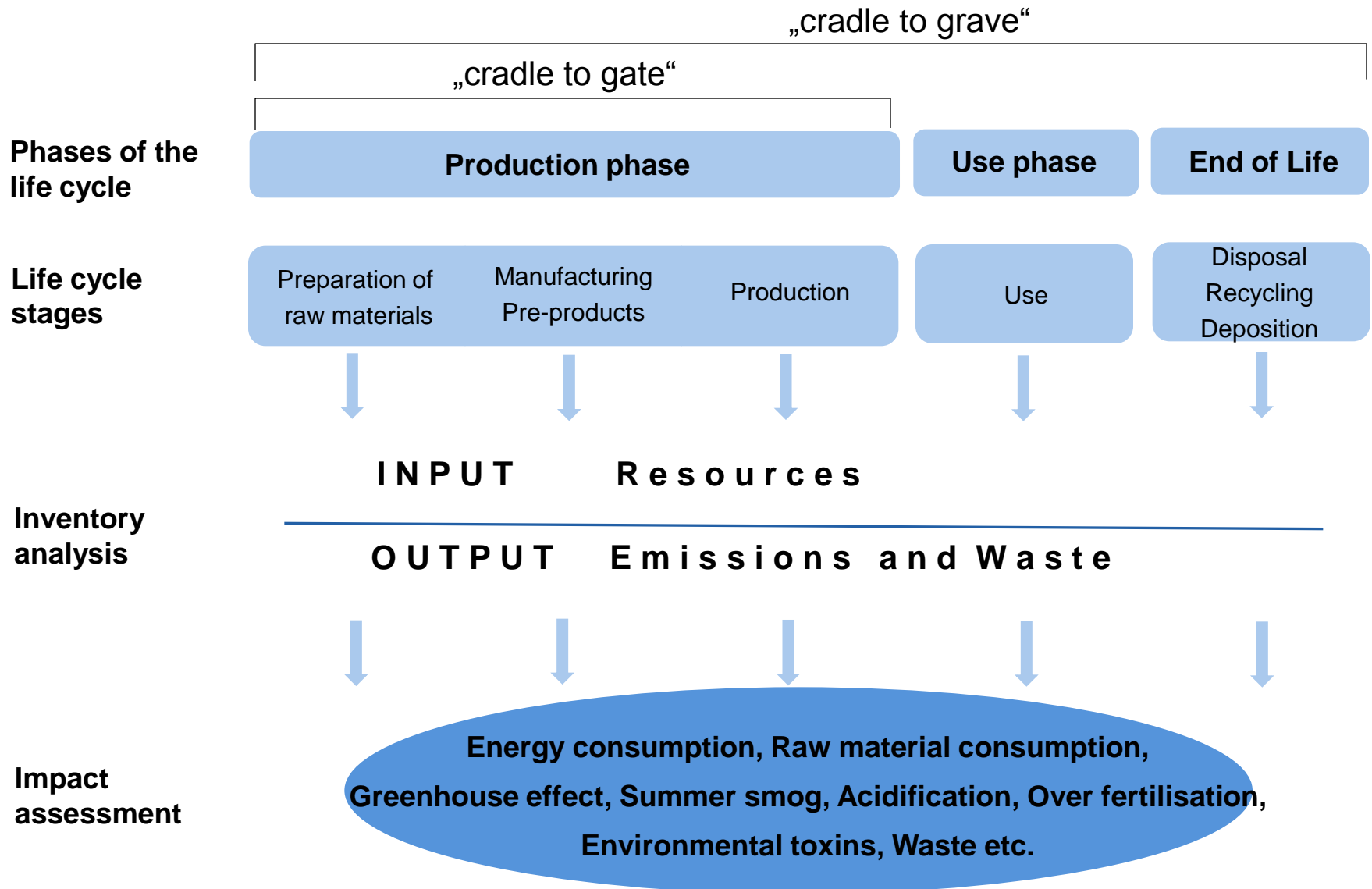
LCA of Container Glass and comparison with PET, Tetra and Pouch

Julia Pflieger, Rajesh Singh, Sudhir Chavan and
Ritesh Agrawal
PE Sustainability Solutions Pvt Ltd, India
A subsidiary of PE International AG, Germany

LCA

Definition of Life Cycle Assessment from DIN ISO 14044:

Life Cycle Assessment is the compiling and evaluation of the input and outputs and the potential environmental impacts of a product system during its lifetime.

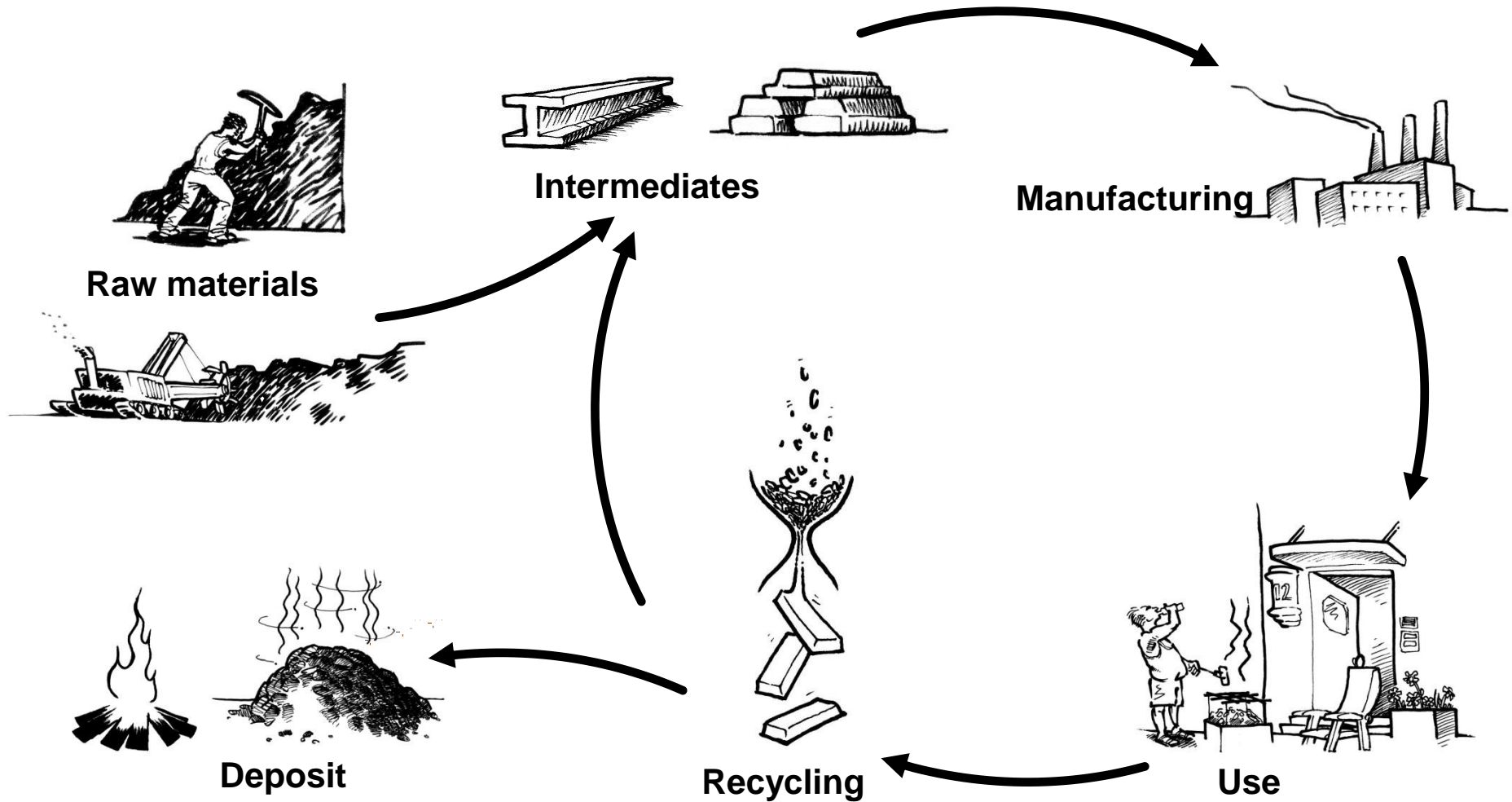


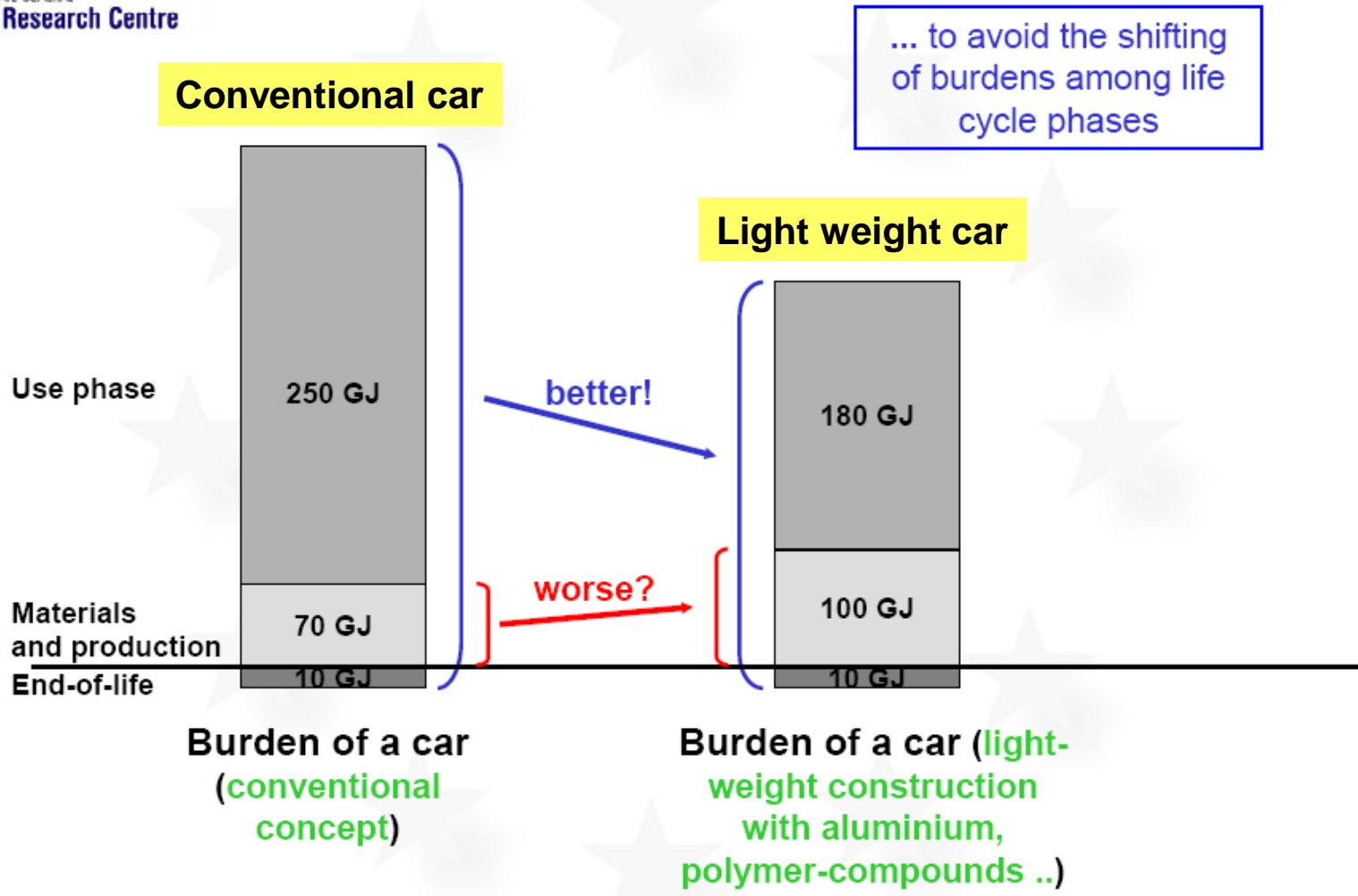
Principles of Life Cycle Assessment

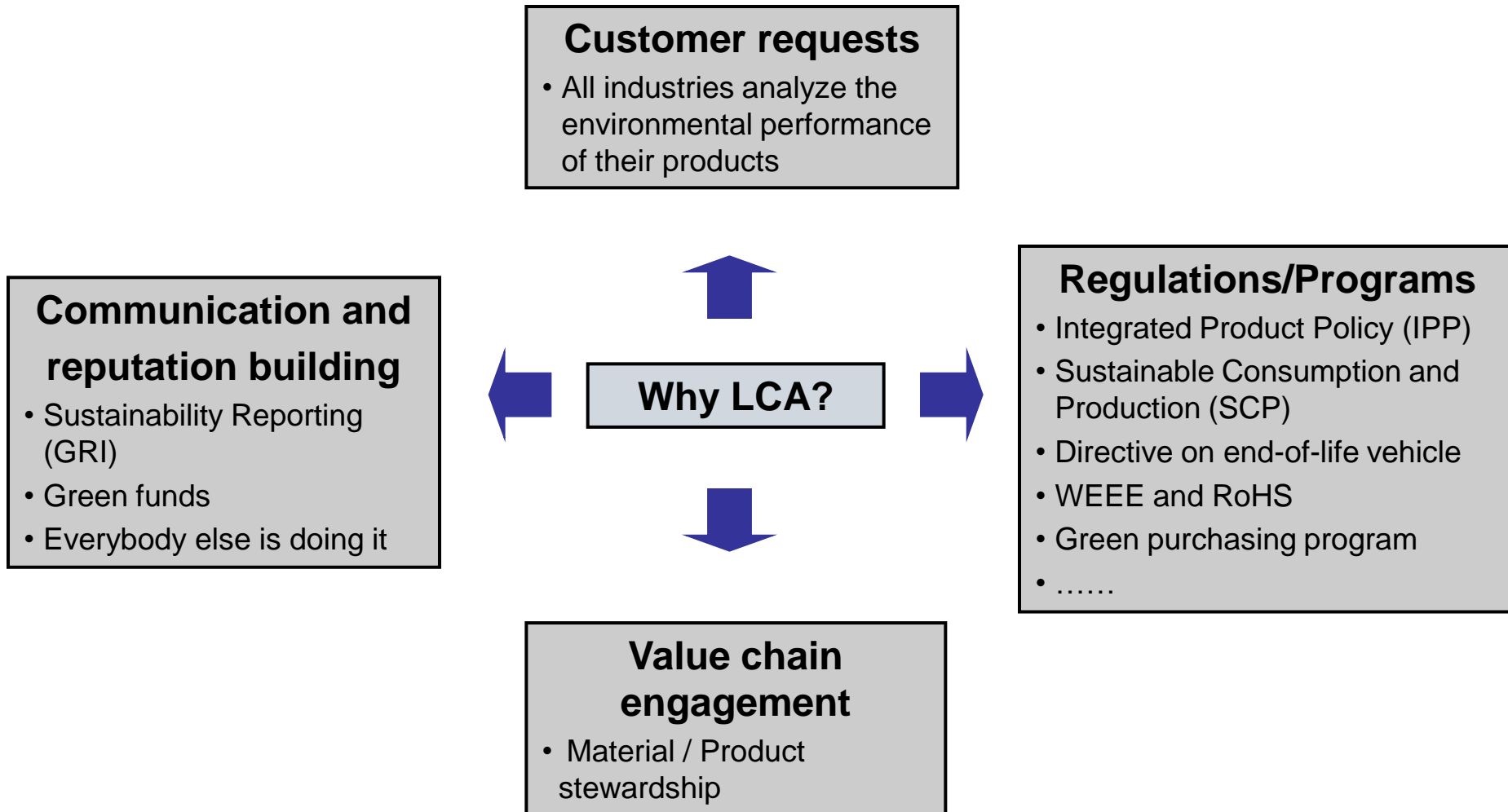
The concept of Life Cycle Thinking



PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY







Objective

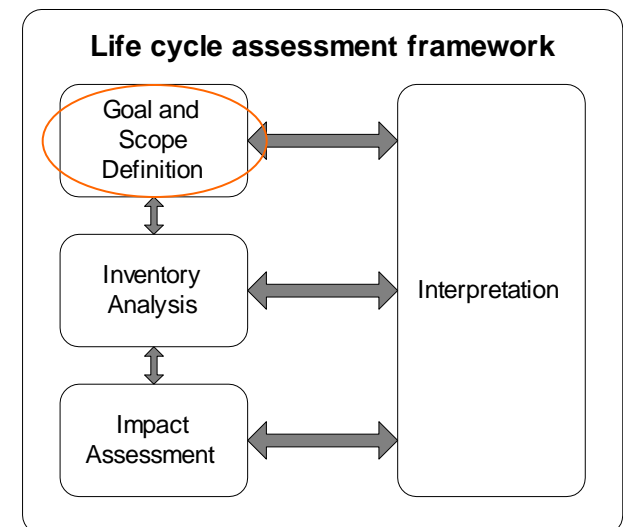
- To evaluate the environmental profile of glass, determine improvement opportunities
- Comparison with alternative packaging materials such as PET, Tetra , pouch
- External communication of product environmental attributes for enhancing the green brand of glass product, provide foundation for meaningful use of LCA results to project the green image of the product amongst consumers and other stakeholders.
- Critical Review by Panel of International Experts

Coverage of study

Scope, functional unit, reference flow, time frame, geographical boundary, data requirements

Who will be audience

Internal, external



Functional unit

- AIGMF: Comparable size of container glass (amber, flint, green) and alternative packaging products (Tetra, PET and Pouch)
- GPI: 1 kg of container glass

Time coverage

- AIGMF: 2010-11
- GPI: 2007

Geographical coverage

- AIGMF: 70-80% of Indian production mix (48 furnaces; 7596 tpd)
- GPI: 75 % of North American production mix (105 furnaces; 8.17 million metric tons)

Critical Review

- AIGMF: of container glass LCA study and comparative assessment
- GPI: of container glass LCA study

Life Cycle Analysis of Glass Packaging

AIGMF LCA Study: Action Plan - Completed so far



PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

SI No	Activity	Nov 2011				Dec 2011		
		W1	W2	W3	W4	W5	W6	W7
1	Communication to Member Companies (MC) of AIGMF from President about initiating the LCA study of glass	■						
3	Finalisation of list of participating companies	■						
4	Finalisation of glass and comparative products	■						
5	Nomination of coordinator from all the participating member companies	■						
6	Kick-off meeting with AIGMF , member companies and PE International (goal, scope, boundary setting, data requirements, approach, methodology etc)		■					
7	Web-based awareness training for coordinators			■				
8	Release of questionnaire for data collection			■				
9	Site Visit of PE expert to Firozabad Cluster			■				
10	Site Visit of PE Expert to Surat Cluster				■			
11	Site Visit of PE Expert to HNG Units				■			
12	Site Visit of PE Expert to other major glass companies				■			
13	Site Visit to Supplier location				■			
14	Completion of Data collection				■	■	■	
15	Data consistency and Quality check							■

Life Cycle Analysis of Glass Packaging

AIGMF LCA Study: Action Plan - Way forward



PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

		Jan 2012			Feb 2012			Mar 2012		
16	Preparation of GaBi LCA model for glass	■								
17	Data collection for other materials PET, Tetra and pouch									
18	Preparation of GaBi LCA model for PET, Tetra and pouch	■								
19	Compilation of End of Life (EoL) scenario for all the packaging systems with sources/references									
20	Submission of first LCA results with other three alternative scenarios		■							
21	Meeting, discussion on first LCA results and related queries		■							
22	Incorporation of clarifications, queries, comments in the final LCA report			■						
23	Final presentation of LCA results to AIGMF			■						
24	Initiation of critical review activities			■						
25	Submission of requisite document to critical review team				■					
26	First kick-off meeting with critical review					■				
27	Receipt of comments/queries from Critical Review Panel					■	■	■		
28	Communication of final comments from Critical Review Panel to AIGMF								■	
29	Dissemination workshop and meeting of critical review panle with AIGMF/MC/PE									■
30	Submission of final report with critical review comments									■

	Flint	Amber	Green	Others
Production (tpd)	5108	2170	150	168
% Share	67.2	28.6	2.0	2.2

Collection Status:

63.7%

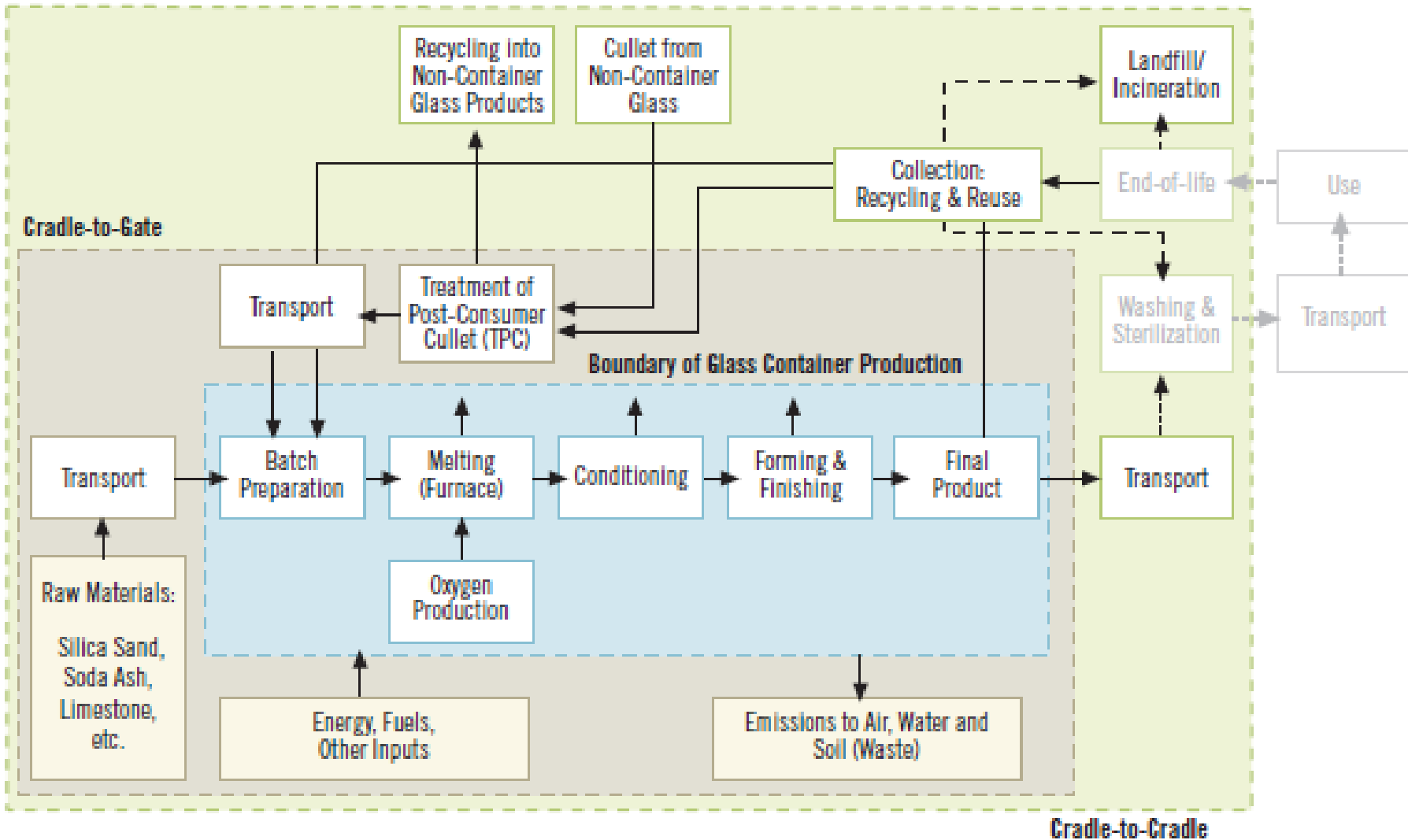
Post Consumer Cullet Variation (big furnaces):

38.9% maximum

17.5% minimum

Life Cycle Analysis of Glass Packaging

Scope / System Boundaries



[Source: [www.gpi.org/...](http://www.gpi.org/)]

Selected LCA results (cradle-to-gate) per kg formed and finished glass [GPI, 2007]:

- Primary Energy Demand: 15,49 MJ
- Global Warming Potential: 1,18 kg CO₂ equivalents

[Source: [www.gpi.org/...](http://www.gpi.org/)]

Discussion of container glass LCA results – in general:

- Melting/Furnace
 - Emissions from fuel combustion (natural gas, heavy fuel oil, ...)
 - Emissions from batch decomposition (soda ash, dolomite, limestone, ...)
- Synthetic soda ash
 - Energy consumption in production
 - Emissions of carbon dioxide, nitrogen oxides and sulphur dioxide
- On-site electricity consumption
- Cullet Input Rate

End-of-life management scenarios:

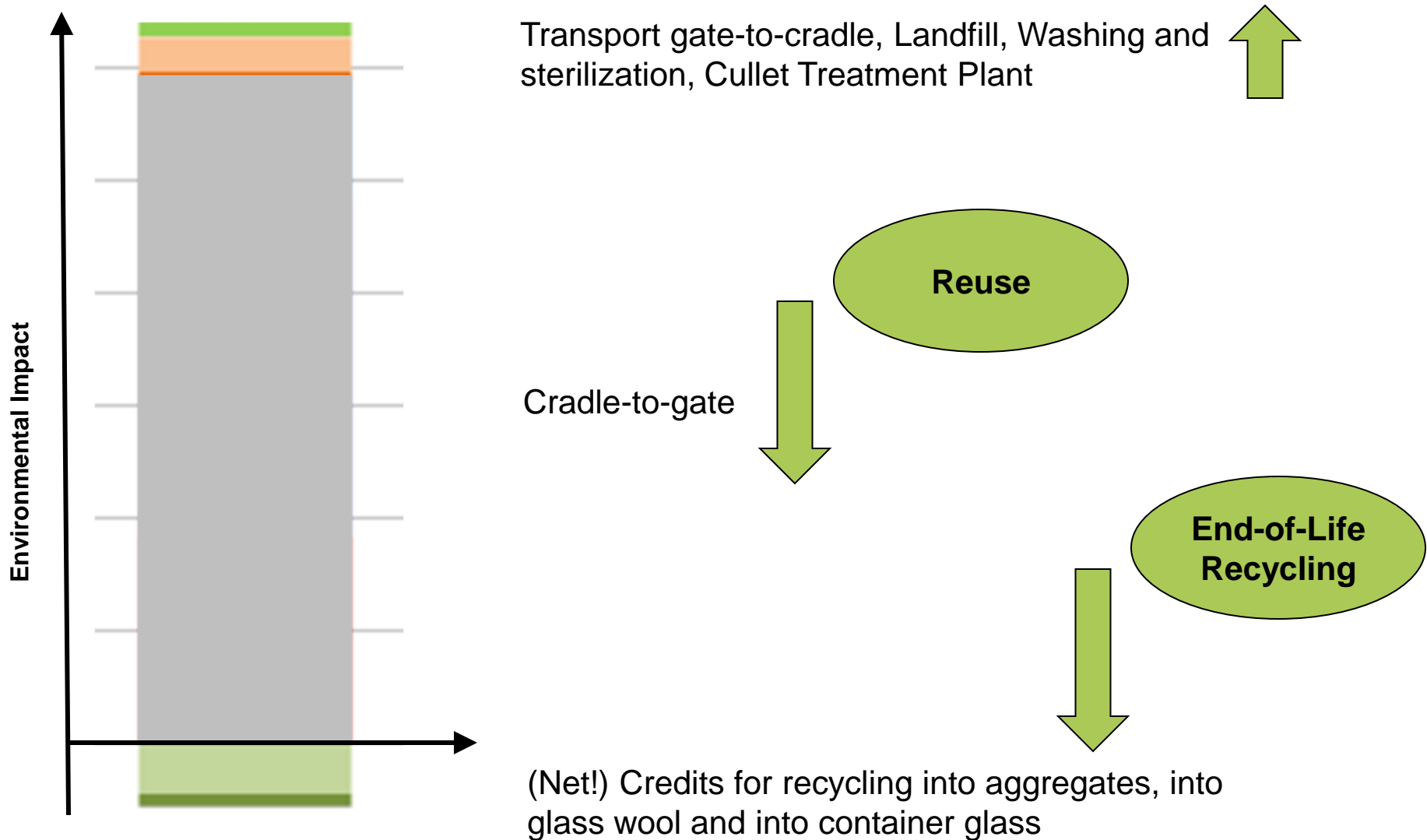
- (1) Closed-loop of glass packaging back to new packaging
- (2) Recycling of glass packaging into non-packaging products or fiberglass
- (3) Losses via aggressive landfill cover, incineration

Credit calculation for closed-loop recycling:

- a) Substitution of ~1.18 kg of raw materials by 1 kg of post-consumer cullet
- b) Reduction of energy consumption in melting process is 3% for each 10% of cullet replacing raw materials [Source: Beerkens & Van Limpt]
- c) Reduction of emissions in melting process:
 - i. Reduction of CO₂ emissions in relation to the (reduced) consumption of raw materials and energy (calculated via standard emission factors)
 - ii. Reduction of NO_x, Dust and SO_x emissions in proportional relation to the (reduced) energy input

Life Cycle Analysis of Glass Packaging

Exemplary LCA Results (cradle-to-grave/cradle)



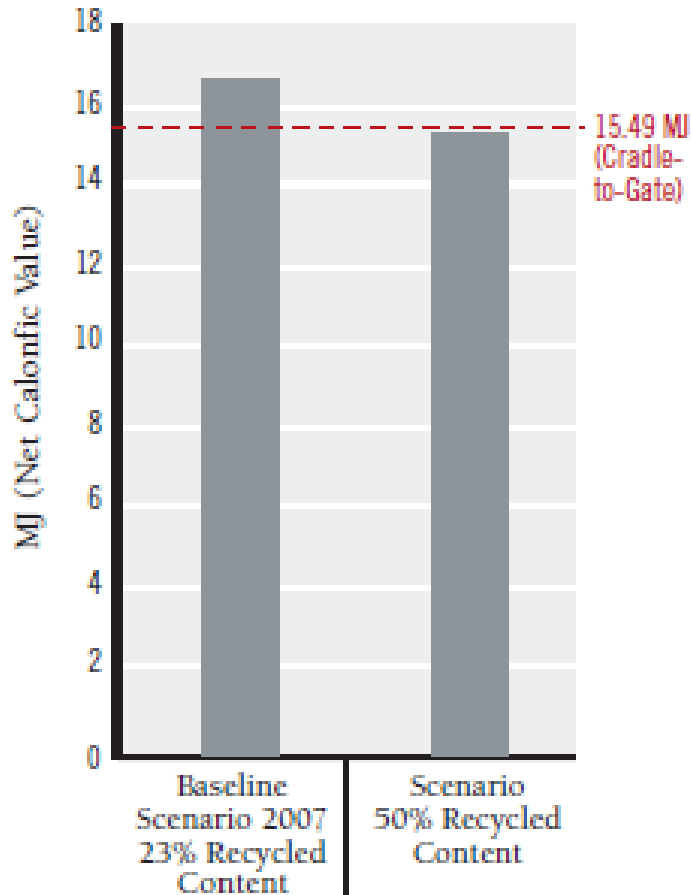
Life Cycle Analysis of Glass Packaging

Selected LCA Results (cradle-to-grave/cradle) – per kg container glass

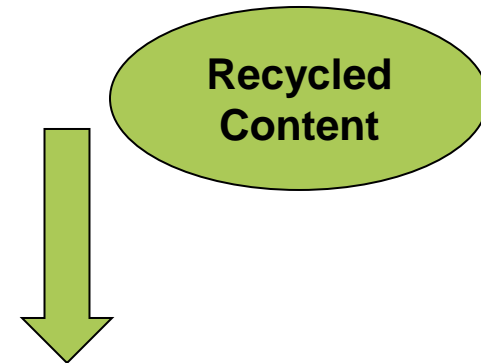
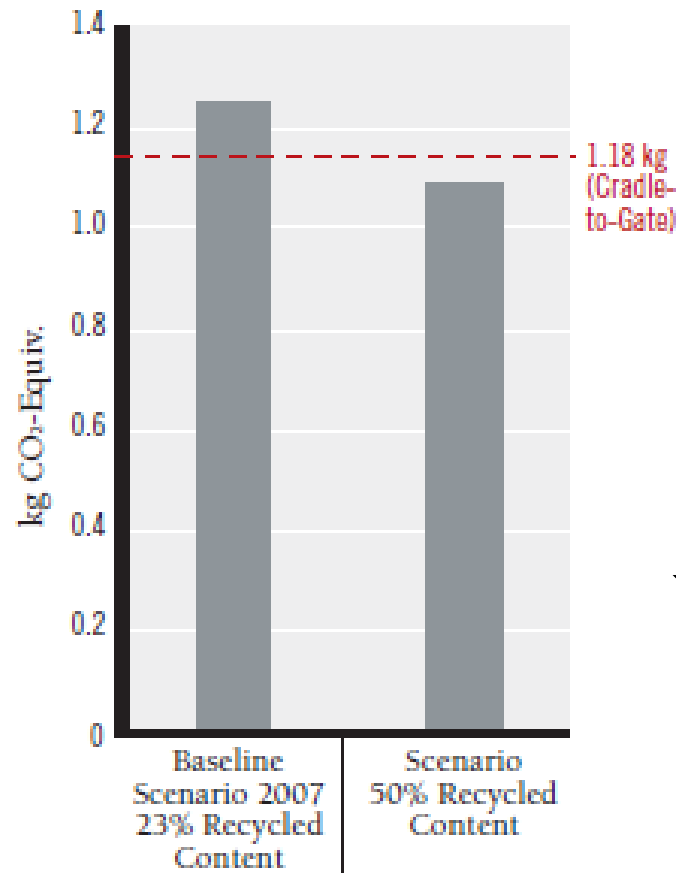


PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

Primary Energy Demand



Global Warming Potential



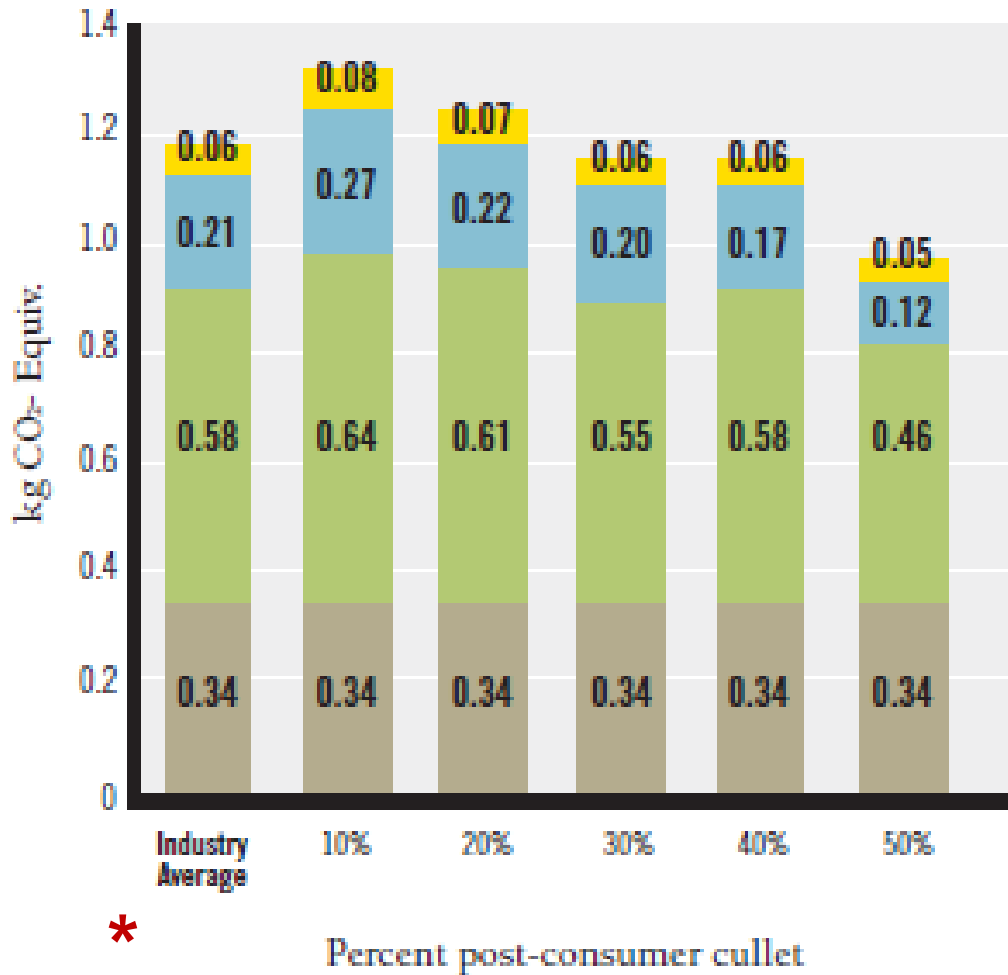
[Source: [www.gpi.org/...](http://www.gpi.org/)]

Life Cycle Analysis of Glass Packaging

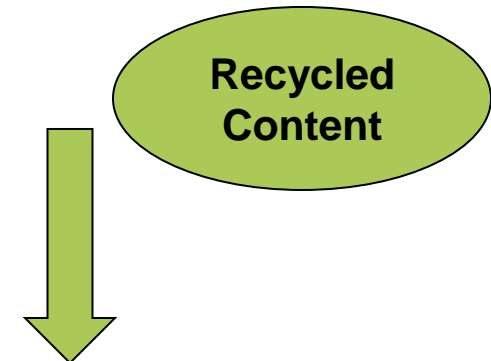
Selected LCA Results (cradle-to-grave/cradle) – per kg container glass



PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY



***Industry average post-consumer recycle input rate of 23%**



- Transport of Batch and Post-Consumer Cullet
- Batch and Post-Consumer Cullet Treatment
- Furnace
- Non-Furnace Activities

[Source: [www.gpi.org/...](http://www.gpi.org/)]



Environmental Overview
Complete Life Cycle Assessment of
North American Container Glass



carbon calculator

Use our Carbon Calculator to find out how much energy you can save by recycling your glass containers.

Number of glass containers recycled each week:

Calculate

"... In other words, the 50 percent recycle rate would remove 2.2 million metric tons of CO₂ from the environment, the equivalent of removing the CO₂ emissions of nearly 400,000 cars every year. ..."

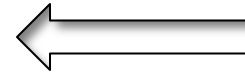
[Source: [www.gpi.org/...](http://www.gpi.org/)]

Reactive Communication:

- Benchmark claims against context of packaging LCA studies with the idea of evaluating their limitations and applicability
- Develop reactive statements to misleading claims as informed statements to stakeholders and clients

Proactive Communication:

- LCI data provision via public platforms (e.g. ELCD database) or expert tools (e.g. GaBi LCA software & databases)
- Press release, flyers, brochures, publication of studies, ...
- Sustainability Reporting, ...
- Stakeholder conferences and webinars, ...
- Interactive tools such as GPI carbon calculator



In addition to internal benefits, e.g. hot spot analysis, identification of improvement potential, benchmarking,

...

- ...safest packaging material on the market in terms of potential migration into food and drinks.
- ...only common packaging material where no plastic lining is placed between it and the contents.
- ...longer shelf life



Why choose Glass?

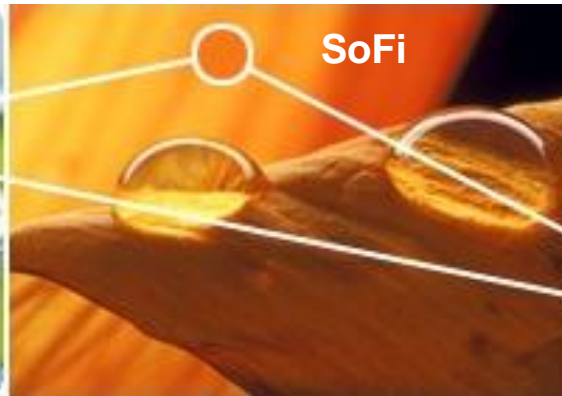
The benefits of glass packaging are clear: it's sustainable, it's virtually inert, it's 100% recyclable, reusable and refillable; it's safe to store food and drinks in; and it's beautiful.

Sustainability is a long-term issue – and has been a business model for PE INTERNATIONAL for 20 years.



Consulting

- Life Cycle Assessment (LCA)
- Energy efficiency studies
- Monitoring and Reporting Systems
- Carbon Footprints / Offset
- Compliance and risk management
- Management Systems
- Communication



Solutions for Corporate Sustainability

- Sustainability information management and reporting (e.g., GRI, ISO 14001, OHSAS 18000)
- Key Performance Indicator (KPI) systems
- Corporate Carbon Footprint
- Supply Chain Management



Solutions for Product Sustainability

- Life Cycle Assessment
- Design for Environment, Recycling, Disassembly
- Product Carbon Footprint

Consulting: +500 Customers, +1,000 projects in all sectors

PE is the clear market leader in the field of LCA, EPD's and Product Carbon Footprints worldwide. The client base consisting mainly of leading multinationals and world sector organizations will allow for expansion of the market through their suppliers or membership companies.

Corporate Sustainability: 51 Customers in 25 different sectors

“With its large ECA customer base and global organization, PE INTERNATIONAL is ideally positioned for success in the market.”

Paul Baier, VP of Consulting, Groom Energy, Jan 2010

Product Sustainability: +1,000 Customers in all industries

With more than 3.000 licenses sold world-wide GaBi software and databases are the leading solution for product sustainability.

Partnerships, Memberships and Accreditations

--	--	--	--	--	--	--	--	--	--	--	--

- In business since more than 20 years
- Wide variety of industries
- Satisfied user community in over 70 countries
- Over 500 Multinational companies (DJSI) use our solutions
- Setting standards through projects with international clients and standardization bodies worldwide
- Today, PE INTERNATIONAL employ approx. 220+ people worldwide representing 20 different nationalities in 10 companies, operating offices in 14 countries. Headquarters are in Stuttgart, Germany





World Business Council for Sustainable Development

We participate in the development of the new Product Life Cycle Accounting and Reporting Standard and the Scope 3 (Corporate Value Chain) Accounting and Reporting Standard. We provide our **GaBi** and **SoFi** software to 60 global corporations for road testing of the new GHG Protocol standards .



The Greenhouse Gas Protocol Initiative
The foundation for sound and sustainable climate strategies

CARBON DISCLOSURE PROJECT

ACCREDITED PROVIDER

“CDP is delighted to be working with PE INTERNATIONAL as a Carbon calculation Partner. SoFi has undergone testing by a third party to ensure it meets our criteria for performance and we are pleased to recommend this tool in the calculation of carbon emissions.”

Paul Dickinson, CEO of the Carbon Disclosure Project



We are a GRI Organisational Stakeholder since 2005 and were co-organizer of the launch conferences . We are involved in the OS feedback processes and applied for certification of our **SoFi** software.



We participated in the standardization group that developed the **PAS 2050** - Assessing the life cycle greenhouse gas emissions of goods and services.



International Organization for Standardization

Water Footprint NETWORK



ecop
partners for ecological performance >>>

