School Milk Packaging CO_2-Footprint Analysis

carried out by c7-consult e.U.

viscotec

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Product Carbon Footprint Packaging for 250 ml School Milk Yoghurt Drink

Version 2.0

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Aim of the Analysis

- The aim of the analysis is the calculation of the Product Carbon Footprint for 4 packaging solutions for 250 ml school milk yoghurt:
  - Cups made from 100 % **rPET**, after their use 55 % are mechanically recycled and 45 % are incinerated in a waste incineration plant
  - Cups made from **PP**, 100 % incineration in waste incineration plant
  - Cups made from **PS**, 100 % incineration in waste incineration plant
  - **Returnable Glass**, 100 % return rate, 30 refills
- System boundaries
  - The system boundary includes the production of the cups and closures, printing (where applicable) delivery for filling, filling, transport delivery and return, washing of the reusable glass containers, as well as End of Life treatment (material recycling or energy recovery).
  - Outside the system boundary are the production of the content, losses during transport and storage, or due to damaged packaging.

Method Carbon Footprint

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- The Product Carbon Footprint provides information about the total greenhouse gas emissions that are caused by a product over the entire life cycle.
  - It is calculated in kg CO_2-equivalent for a defined functional unit and includes:
    - Emissions in the life cycle phases production, use and recycling / disposal (End of Life)
    - Emissions from the production and supply of energy and raw materials
    - Substitution effects through recycling and recovery
- The carbon footprint is calculated based on the standards ISO 14044 Life Cycle Assessment and ISO 14067 - Greenhouse Gases - Carbon Footprint of Products - Requirements and Guidelines for Quantification.
  - According to PEF - Product Environmental Footprint, the 50:50 approach is chosen for the allocation at the End of Life. This means that 50 % of the burdens for recycling and recovery as well as 50 % of the benefits for substituted primary material production or electricity and heat production are credited to the product.

Input Data
250 ml School Milk Yoghurt Drink

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Cups / Glass	Unit	rPET	PP	PS	Glass retournable
Basic Material Cup / Glass	[-]	rPET, white	PP, white	PS, white	Glass brown
Mass Cup / Glass	[g]	7,70	5,87	6,80	207,00
Number of Refills	[-]	1	1	1	30
Closure	**Unit**	**rPET**	**PP**	**PS**	**Glass ret.**
Material Closure	[-]	Aluminium	Aluminium	Aluminium	HDPE
Mass Closure	[g]	0,49	0,49	0,49	3,13
Printing ink	**Unit**	**rPET**	**PP**	**PS**	**Glass ret.**
printed	[-]	not	printed	printed	not
Mass Printing ink	[g]	-	0,10	0,10	-
Delivery to Filling	**Unit**	**rPET**	**PP**	**PS**	**Glass ret.**
Delivery to Filling	[km]	150	150	150	150
Distribution	**Unit**	**rPET**	**PP**	**PS**	**Glass ret.**
Filler - School	[km]	40	40	40	40
Units per truck	[pcs.]	2.400	2.400	2.400	2.400
Mass per truck	[kg]	617	615	617	1.104

Results Product Carbon Footprint
250 ml School Milk Yoghurt Drink

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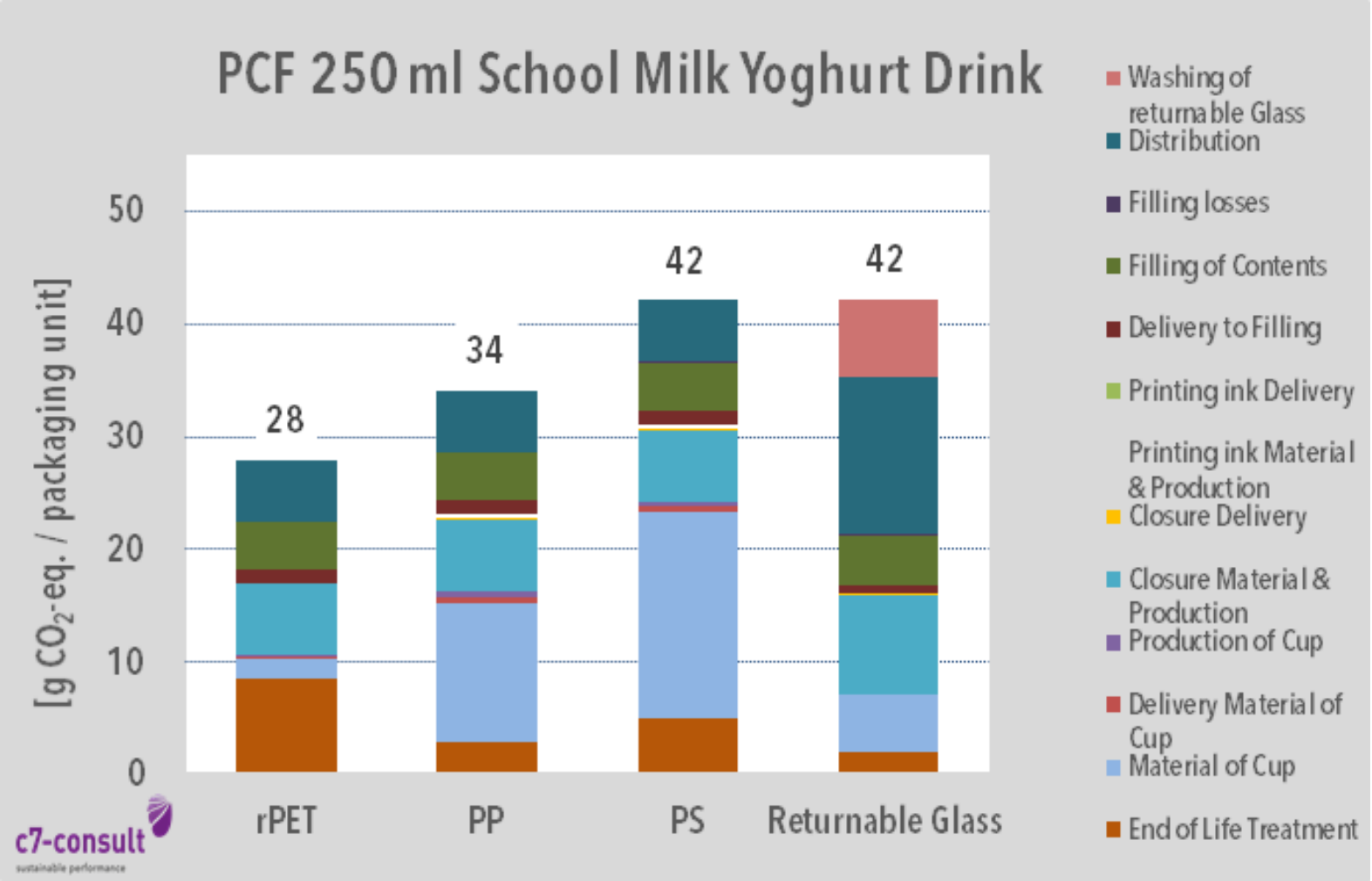

Results Product Carbon Footprint
250 ml School Milk Yoghurt Drink

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PCF 250 ml School Milk Yoghurt Drink				
Material	**rPET**	**PP**	**PS**	**Returnable Glass**
Material of Cup	1,86	12,31	18,34	5,11
Delivery Material of Cup	0,07	0,40	0,46	-
Production of Cup	0,27	0,60	0,38	-
Closure Material & Production	6,31	6,31	6,31	8,65
Closure Delivery	0,04	0,04	0,04	0,21
Printing ink Material & Production	-	0,57	0,57	-
Printing ink Delivery	-	0,005	0,005	-
Delivery to Filling	1,16	1,16	1,16	0,82
Filling of Contents	4,25	4,25	4,25	4,25
Filling losses	0,02	0,08	0,11	0,26
Distribution	5,49	5,44	5,47	13,86
Washing of returnable Glass	-	-	-	6,94
End of Life Treatment	8,52	2,98	5,02	2,10
	28	**34**	**42**	**42**

Results Product Carbon Footprint
250 ml School Milk Yoghurt Drink

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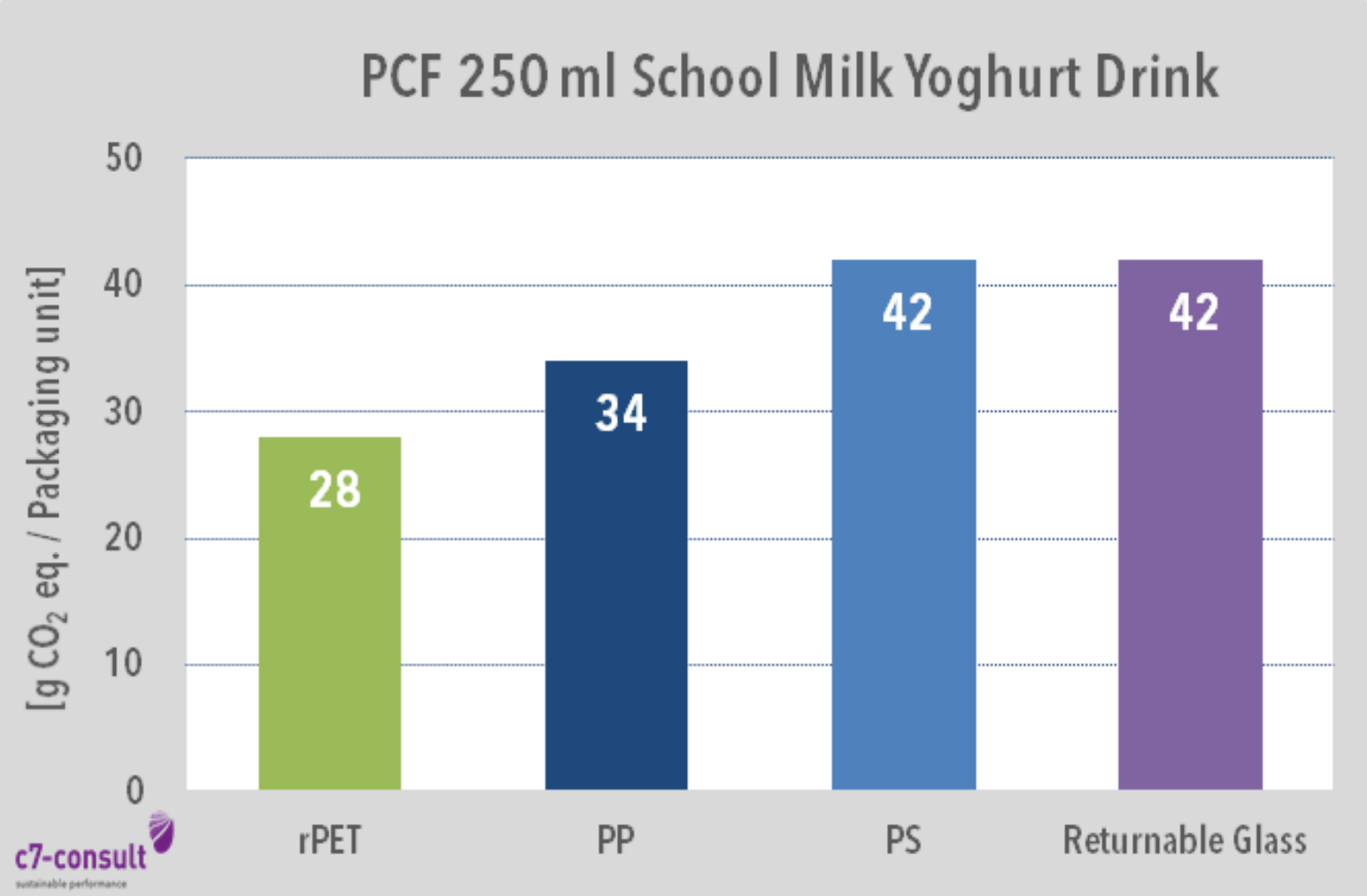

Schlussfolgerungen
250 ml School Milk Yoghurt Drink

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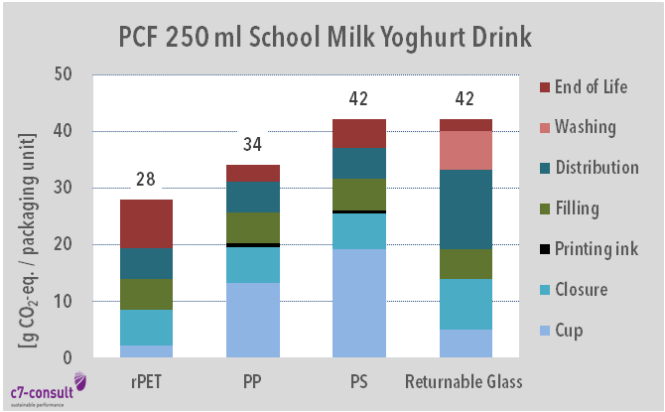
- The analysis shows, that the rPET cup has the lowest Product Carbon Footprint of all analysed materials.
  - The rPET cup, that is 55% recycled mechanically in the semi-closed loop, causes 28 g CO_2-eq. per cup.
  - The PP cup, which is used for energy production in a waste incineration plant after use, causes 34 g CO_2-eq. per cup, the PS cup causes 42 g CO_2-eq. je Becher.
  - The returnable glass, which is refilled 30 times, causes 42 g CO_2-eq.
    - The glass container with 207 g is heavier by 200 g or 3.000 %, than the cups made from plastics.
    - The closure made from plastics with a weight of 3.1 g is almost as heavy as the plastic cups, whose aluminium lids are just 0,5 g.
    - The enormous difference in weight cause higher greenhouse gas emissions during delivery to school and during return transport.
    - In addition, there is the cost of washing the reusable glasses.

Summary
250 ml Schulmilch Trinkjoghurt

- rPET cups for 250 ml school milk yoghurt cause the least greenhouse gas emissions of all the analysed packaging systems.
  - Although the PP cups are significantly lighter at 5.9 g than the rPET cups at 7.7 g, they cause higher greenhouse gas emissions.
  - The PS cup with 6.8 g causes with 42 g CO_2-eq. the highest greenhouse gas emissions of all plastic cups.
  - The reusable glass has 42 g CO_2-eq. This is due to the high weight, the heavy closure and the resulting high transport emissions.
- The use of rPET in combination with high rates of mechanical material recycling is best for our climate.



Thank you
for your attention!

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