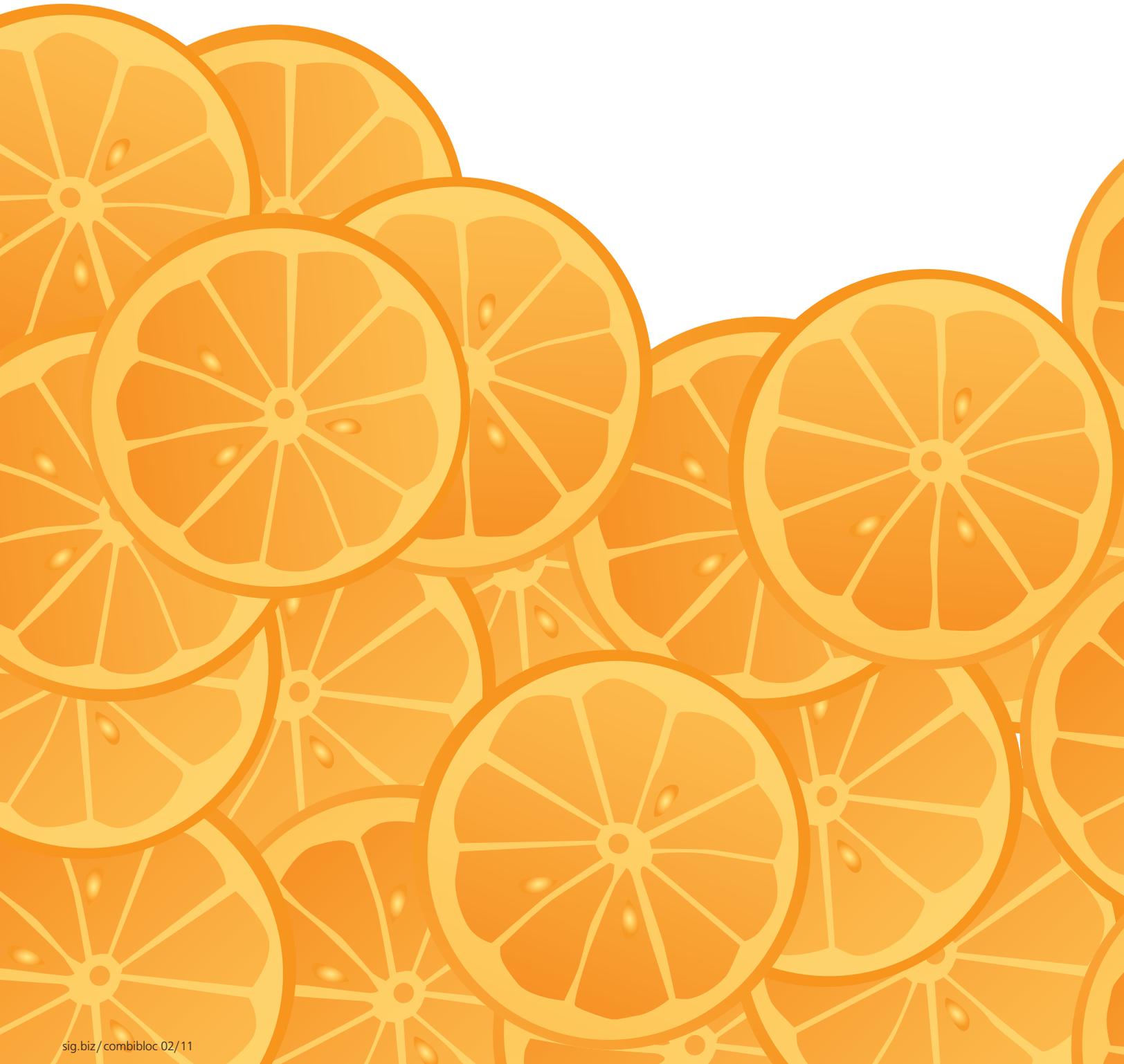


# Latest IFEU comparative analysis for PET, glass and carton packs

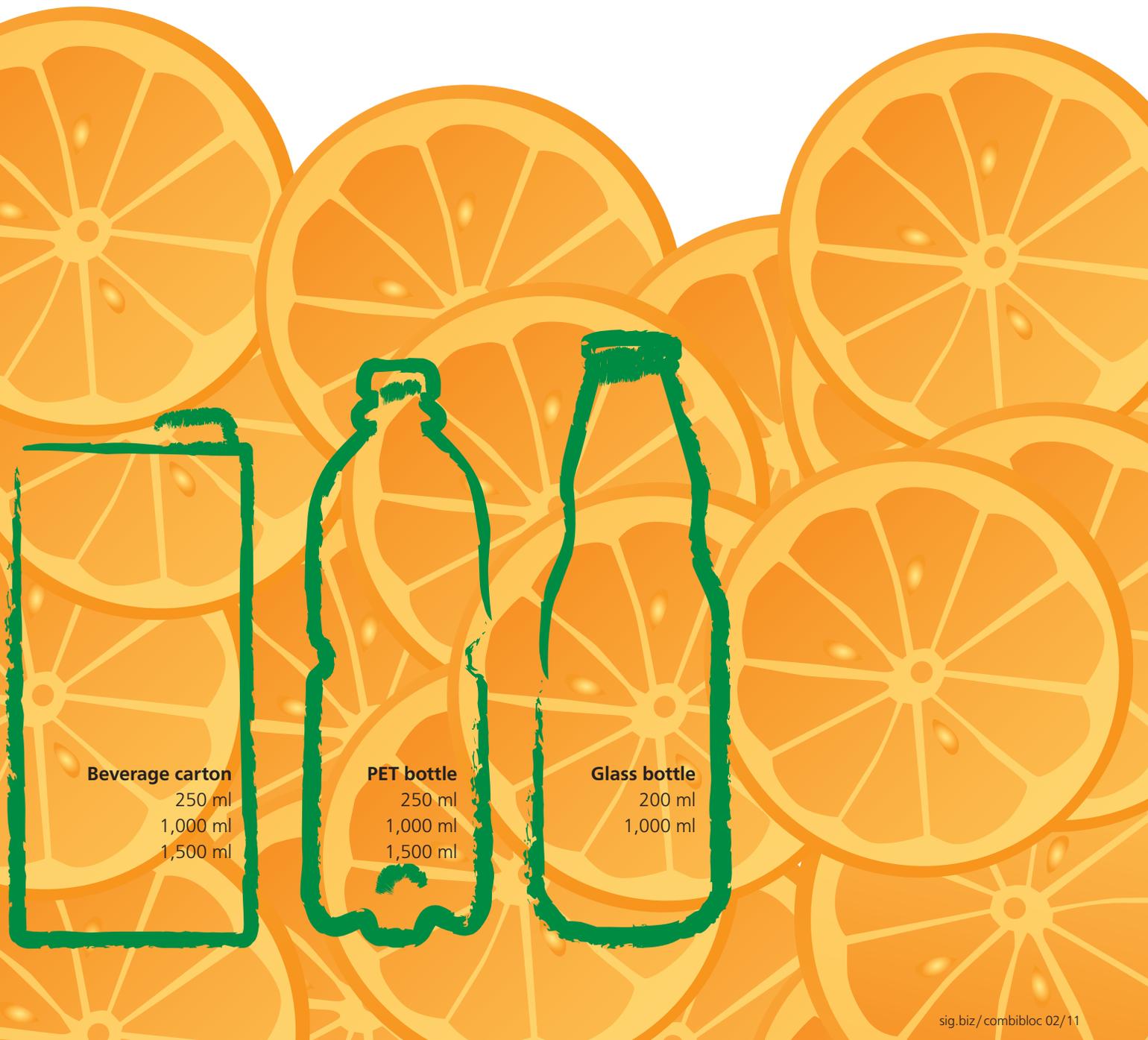
*Europe-wide life-cycle assessment for NCSD packaging: carton packs are top performers in the categories CO<sub>2</sub> emission and fossil resource consumption.*



An Europe-wide life-cycle assessment analysing disposable PET bottles, disposable glass bottles and carton packs as packaging for non-carbonated soft drinks has confirmed that in all format sizes, compared to the commercially available packaging alternatives, carton packs have an environmental profile that offers significant benefits particularly with respect to CO<sub>2</sub> emission, use of fossil resources and consumption of primary energy.

In the 1-litre format, the packaging size with the greatest market relevance, carton packs generate 28 per cent less CO<sub>2</sub>, use 51 per cent less fossil resources, and consume 24 per cent less primary energy compared to monolayer PET bottles. The current, independently verified study carried out by the Institute for Energy and Environmental Research (IFEU) attributes the carton pack's positive environmental profile largely to the good environmental performance of the main raw material, including its renewability and the resource-efficient use of materials. Already today, carton packs are manufactured up to 75 per cent from wood fibre, a natural, completely renewable and bio-based resource.

In politics, economics and consumer interest circles, environmental issues play an important role. And increasingly, the focus is moving on to food packaging. Throughout their entire product life cycle, packaging forms have different environmental impacts. In order to produce valid, scientifically sound and reliable facts on the environmental impacts generated by carton packaging for non-carbonated soft drinks (NCSD) in comparison with packaging alternatives such as glass and PET bottles, SIG Combibloc commissioned the IFEU in Heidelberg (Germany)



with carrying out a comparative, Europe-wide life-cycle assessment. The objective of the study was to analyse the environmental impacts of a range of different packaging systems for non-carbonated soft drinks and evaluate them according to ISO 14040 et seqq., the ISO standard for life-cycle assessments. The independent IFEU institute is one of the most reputable environmental research institutes in Europe, also carrying out studies and analyses for, among others, government

ministries, international environmental and conservation organisations, Germany's Federal Environmental Agency, and various companies and corporations.

**Environmental profile throughout the product life-cycle**

Michael Hecker, Head of Group Environment, Health & Safety at SIG Combibloc: "The current comparative analysis focused on the market-relevant types of packaging for non-carbonated juices, nectars and juice drinks. In addition to our carton packs, this

includes first and foremost monolayer PET bottles. For the sake of completeness, in the 1-litre bracket multilayer PET bottles, which have comparable product protection and barrier characteristics to carton packs, and disposable glass bottles were also included in the life-cycle assessment, although both have considerably lower market significance in this product sector. The study made a thorough evaluation of all key factors and processes of environmental relevance that come into play

*Overview LCA results  
Beverage carton vs. PET bottle*

	Small size	Medium size	Large size	
Fossil resource consumption (in kg crude oil equivalent)*	 -75%	 -51%	 -47%	Resource-related impact categories
Non-renewable primary energy (in giga joule)*	 -70%	 -42%	 -35%	
Total primary energy consumption (in giga joule)*	 -61%	 -24%	 -14%	
Use of nature (in m <sup>2</sup> )*	 +65%	 +93%	 +85%	
Climate change (in kg CO <sub>2</sub> equivalent)*	 -64%	 -28%	 -18%	Emission-related impact categories
Acidification (in g SO <sub>2</sub> equivalent)*	 -54%	 -13%	 -1.3%	
Eutrophication (in g PO <sub>4</sub> equivalent)*	 -56%	 +/-0%	 +5%	
Human toxicity PM <sub>10</sub> (in g PM <sub>10</sub> equivalent)*	 -57%	 -15%	 -7%	

\* per packaging required for 1,000 L non-carbonated soft drinks

 significantly better'

 significantly "worse"'

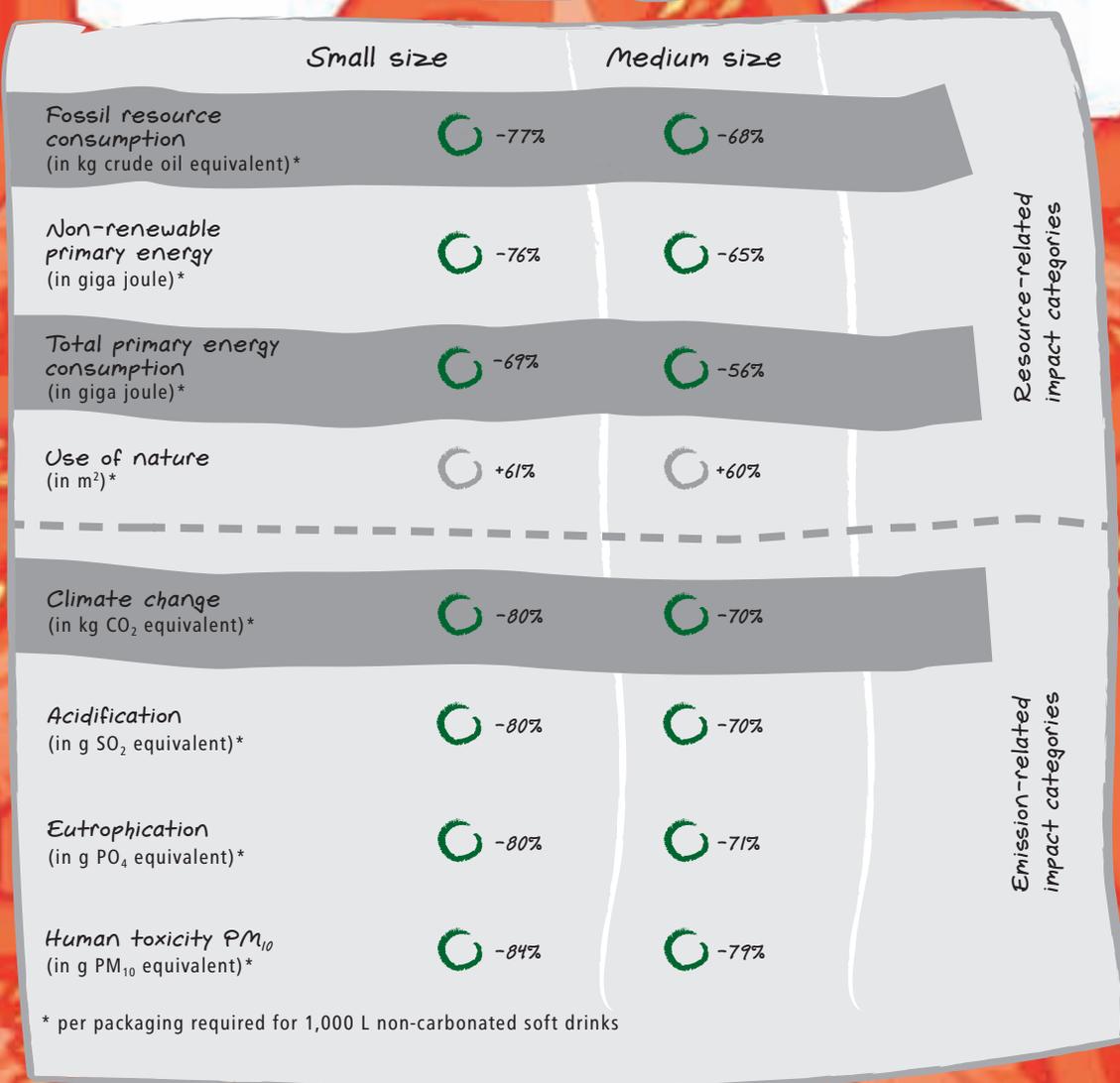
throughout the life cycles of the different types of packaging”. The extraction and refining of the raw materials used to make the packaging were taken into consideration, as were the process of manufacturing the packaging, transport, the process of packaging the beverage, distribution up to the retailing stage, and the recycling or disposal of the packaging after use. At each stage of the product life cycle, the key environmental impact categories relevant to the resource and emission-related categories were investigated and evaluated. In terms of resource consumption,

factors such as the consumption of fossil resources, the amount of primary energy used and the use of nature are looked at. With respect to emissions, it is the CO<sub>2</sub> output and the associated climate change, the particulate loading of the air and the eutrophication and acidification of soils and watercourses that are of interest. At present, the key environmental impact categories are emission of greenhouse gases, consumption of fossil resources and use of primary energy sources.

**Material and quantity are the decisive factors**

The current study, carried out in accordance with the internationally binding ISO standards for life-cycle assessments, verifies that the material and the quantity of material used are the key factors determining the environmental impact of a packaging system for NCSD products during the life cycle of the packaging. In all three sizes evaluated (small size: PET/carton pack 250 ml, glass 200 ml; medium size: all three packaging sys-

*Overview LCA results  
Beverage carton vs. glass bottle*



\* per packaging required for 1,000 L non-carbonated soft drinks

No significant difference<sup>1</sup>      <sup>1</sup> at a 10% significance level

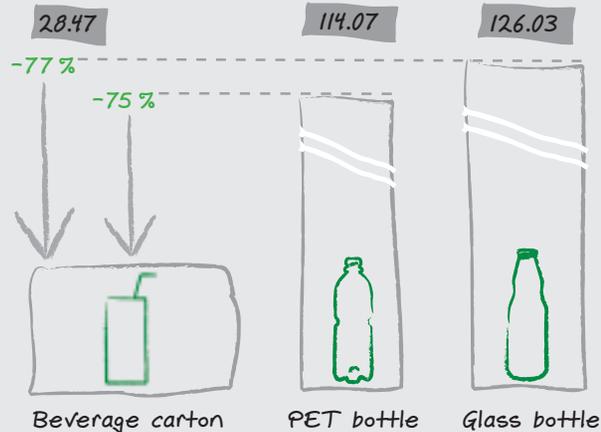
tems 1,000 ml; large size: PET/carton pack 1,500 ml), the comparative analysis showed that the carton pack offers significant advantages – with respect to CO<sub>2</sub> emissions and to use of fossil resources. The properties of the carton packs have a beneficial effect in the environmental impact categories ‘Consumption of fossil resources’, ‘Use of primary energy sources’, and ‘CO<sub>2</sub> output/climate change’. In the medium format, which has the greatest market relevance in the juices,

nectars & juice drinks sector, compared with monolayer PET bottles, carton packs generate 28 per cent less CO<sub>2</sub> emissions, use 51 per cent less fossil resources and consume 24 per cent less primary energy (Reduction compared to glass: CO<sub>2</sub>: -70 per cent; fossil resources: -68 per cent; primary energy: -56 per cent. Reduction compared to multilayer PET bottles: CO<sub>2</sub>: -39 per cent; fossil resources: -58 per cent; primary energy: -34 per cent). In the small format, compared to PET monolayer bottles the carton pack generates 64 per

## Small size

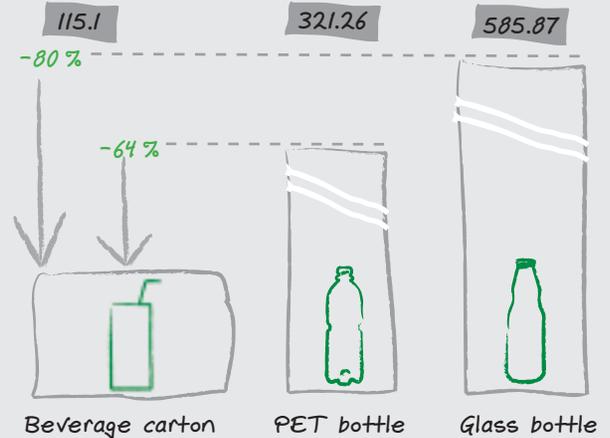
### Fossil resource consumption

(in kg crude oil equivalent; per packaging required for packaging 1,000 L non-carbonated soft drinks)



### Climate change

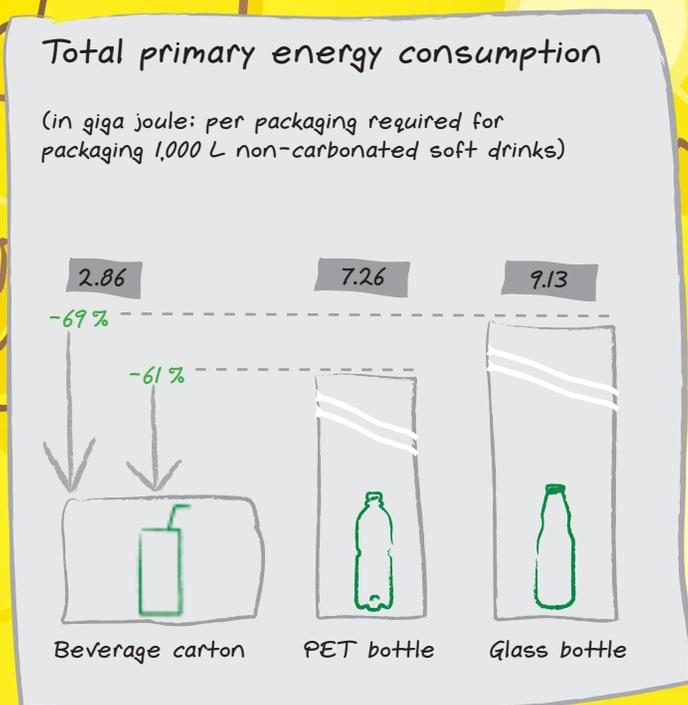
(in kg CO<sub>2</sub> equivalent; per packaging required for packaging 1,000 L non-carbonated soft drinks)



cent less CO<sub>2</sub>, uses 75 per cent less fossil resources, and consumes 61 per cent less primary energy (Reduction compared to glass: CO<sub>2</sub>: -80 per cent; fossil resources: -77 per cent; primary energy: -69 per cent). And in the large format too, compared to PET mono-layer bottles, the carton pack saves 18 per cent on CO<sub>2</sub> emissions, 47 per cent on fossil resources and 14 per cent on primary energy. Due to a lack of market relevance, glass bottles were not considered in this format size.

The resource-efficient use of renewable raw material – which moreover is manufactured using a high fraction of renewable energy – and the low weight contribute significantly to the positive environmental performance of the carton pack. Carton packs use significantly fewer fossil resources than PET and glass bottles, because they are manufactured up to 75 per cent from pulp fibres obtained from wood, a renewable resource.

Consequently, in the impact category 'Use of nature' the carton pack lags behind the packaging forms manufactured from fossil resource-based raw materials; but in contrast to finite resources, with responsible forest management there can be a constant supply of this renewable raw material. Added to this is the fact that wood is carbon-neutral and therefore does not alter the CO<sub>2</sub> balance of the atmosphere. The reason for this CO<sub>2</sub> neutrality is that while they are growing, trees



extract carbon dioxide from the atmosphere and store it. When they later burn or decay, they release only the same quantity of CO<sub>2</sub> that they absorbed during their lifespan.

The results of the life-cycle assessment conducted by the IFEU have been monitored, critically reviewed and confirmed by independent LCA and packaging experts Prof. Dr. Walter Klöpffer, Hans-Jürgen Garvens and Dr. Fredy Dinkel.

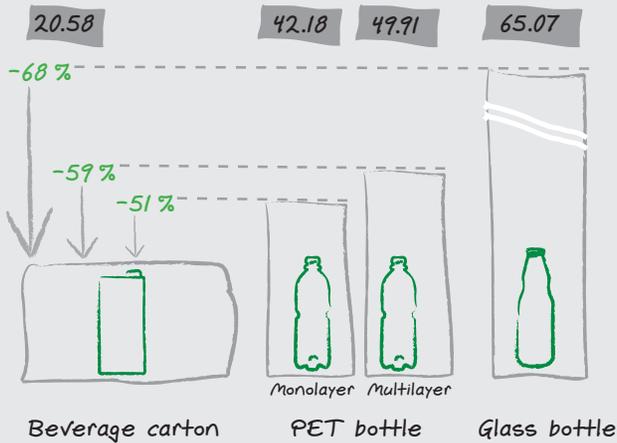
Michael Hecker: “The packaging industry is very dynamic. The results of the most recent, critically reviewed life-cycle assessment for soft drinks packaging solutions show very clearly that even with planned enhancements to the packaging alternatives – such as the use of PET recyclates – the carton pack in its current composite structure will continue to show clear advantages when it comes to environmental life-cycle assessments. But in terms of

development, we’re not resting on our laurels either – we’re hard at work on innovations to further minimise the environmental footprint of our carton packs for NCSD products, so that they continue to be one of the most environmentally friendly packaging solutions around. For instance, in the juices, nectars and juice drinks sector, we’re looking into a new type of paperboard composite that will potentially generate around 20 per cent less CO<sub>2</sub>”.

## Medium size

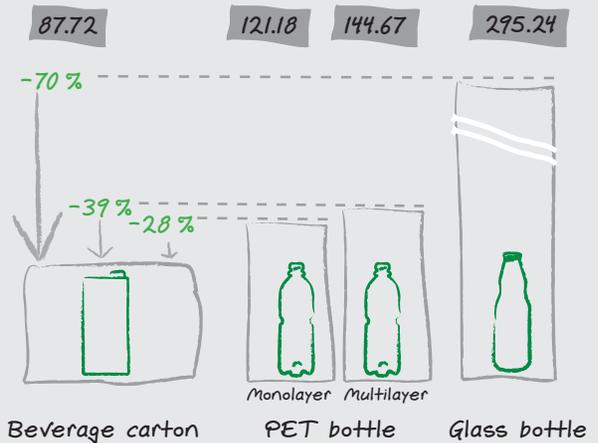
### Fossil resource consumption

(in kg crude oil equivalent; per packaging required for packaging 1,000 L non-carbonated soft drinks)



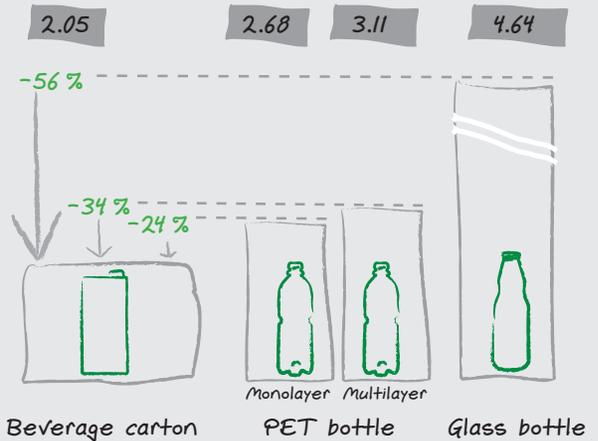
### Climate change

(in kg CO<sub>2</sub> equivalent; per packaging required for packaging 1,000 L non-carbonated soft drinks)



### Total primary energy consumption

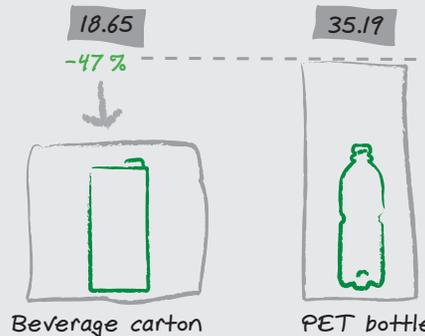
(in giga joule; per packaging required for packaging 1,000 L non-carbonated soft drinks)



## Large size

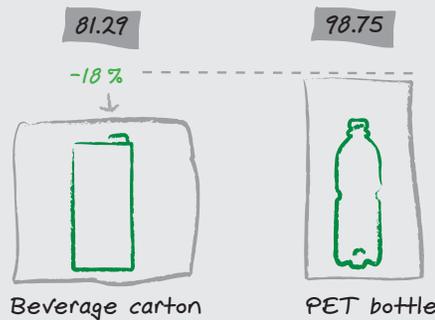
### Fossil resource consumption

(in kg crude oil equivalent; per packaging required for packaging 1,000 L non-carbonated soft drinks)



### Climate change

(in kg CO<sub>2</sub> equivalent; per packaging required for packaging 1,000 L non-carbonated soft drinks)



### Total primary energy consumption

(in giga joule; per packaging required for packaging 1,000 L non-carbonated soft drinks)

