# Taking a closer look at paper cups for coffee


## Key findings

Like all food packaging, the carbon footprint of a paper cup is small compared to the food itself.

In most every-day scenarios, a paper cup has the lowest carbon footprint and is always a hygienic choice.

Recycling drives lower greenhouse gas emissions. When recycled the carbon footprint of a paper cup falls by a significant 54%. If a traditional paper cup is swapped for Huhtamaki's FutureSmart paper cup and is also recycled, the footprint falls by 64%.

Paper cups are always the best choice for the climate if ceramic alternatives aren't washed efficiently.

This report presents the results of a life cycle analysis (LCA) study on paper cups, which was carried out by VTT Technical Research Centre of Finland Ltd in 2018-19.

Huhtamaki

# Climate impact of paper cups

## Learning more about the climate impact

We use paper cups because they are easy-to-use, hygienic and give us the freedom to buy take-away hot and cold drinks. They are also safe and functional, especially with a matching lid. They meet the needs of modern life in a cost-effective way.

"At Huhtamaki we are passionate about the sustainability of our products, and we constantly want to know and understand more about this important subject. That's why we set out to study the life cycle of a paper cup for coffee and its climate impact. We also wanted to find out what are the major critical aspects of paper cups and what could be improved."

*Richard Ali, Sustainability Director for Huhtamaki Foodservice Europe-Asia-Oceania*

## What are the paper cups worth and how do they compare to other cups?

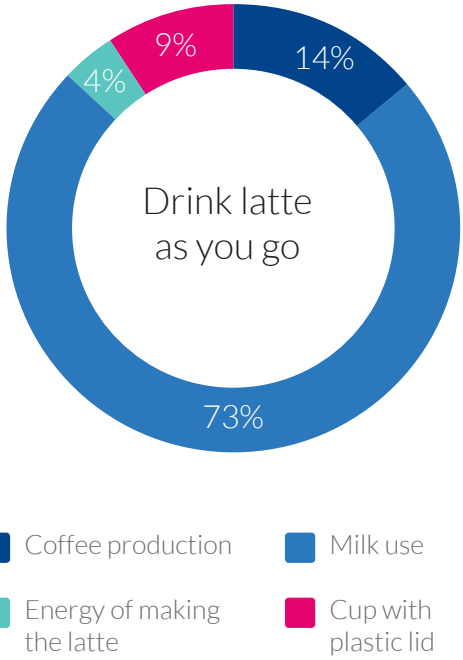
In 2018-2019, we participated in a life cycle analysis (LCA) study on paper cups. The study was carried out by VTT Technical Research Centre of Finland Ltd and was commissioned by Huhtamaki and the Finnish paperboard manufacturer Stora Enso. The study focused on two main scenarios; paper cups used either in a café or in a take-away coffee-to-go serving. Paper cups were compared to ceramic cups in the café scenario and to reusable plastic and steel cups in the coffee-to-go scenario.

# Painting the big picture

**Paper cups account for 4% of the climate impact of a take-away cafe latte**

Before looking into the findings, let's spend a moment to set the right perspective. Packaging generally represents some 5% of the total carbon footprint of the food product. 80% is caused by growing and preparing the food and 15% is caused by transport.

The findings were similar also in the case of paper cups used for coffee. For example, the carbon footprint of a latte, without any cup, is approximately 230 g $CO_2$-eq./one 8 oz latte. When the latte is served in a paper cup the carbon footprint increases to 239 g $CO_2$-eq. and when a plastic lid is used it increases to 251 g $CO_2$-eq. In other words, a paper cup accounts for just 4% of the climate impact of a take-away latte, while the remaining 96% is coffee and milk production and energy of making the actual drink. If a plastic lid is added this accounts for 5%.




*Carbon footprint of a cafe latte on-the-go*

One way to understand the climate impact of paper cups is to compare it to driving a car; one cup with a lid has the same impact as driving 160-190 meters in a car.

# What do the numbers tell us?

## Cups used in the study

The study included six different coffee cups.
Three of them were paper cups
- Paper cup, standard polyethylene (PE) coating
- Paper cup, plant-based polyethylene (PE) coating
- Compostable paper cup (according to EN13432)

In addition to these, there were three alternatives
- Ceramic cups used in a café
- Reusable cups for take-away made from plastic
- Reusable cups for take-away made from steel

In the breakeven point analysis, the study included both non-recycled and 80% recycled cups. The study included cup recycling up to 80%, which exceeds the European Union's 2030 recycling target for packaging of 70%.

## Comparison to ceramic cups used in a café

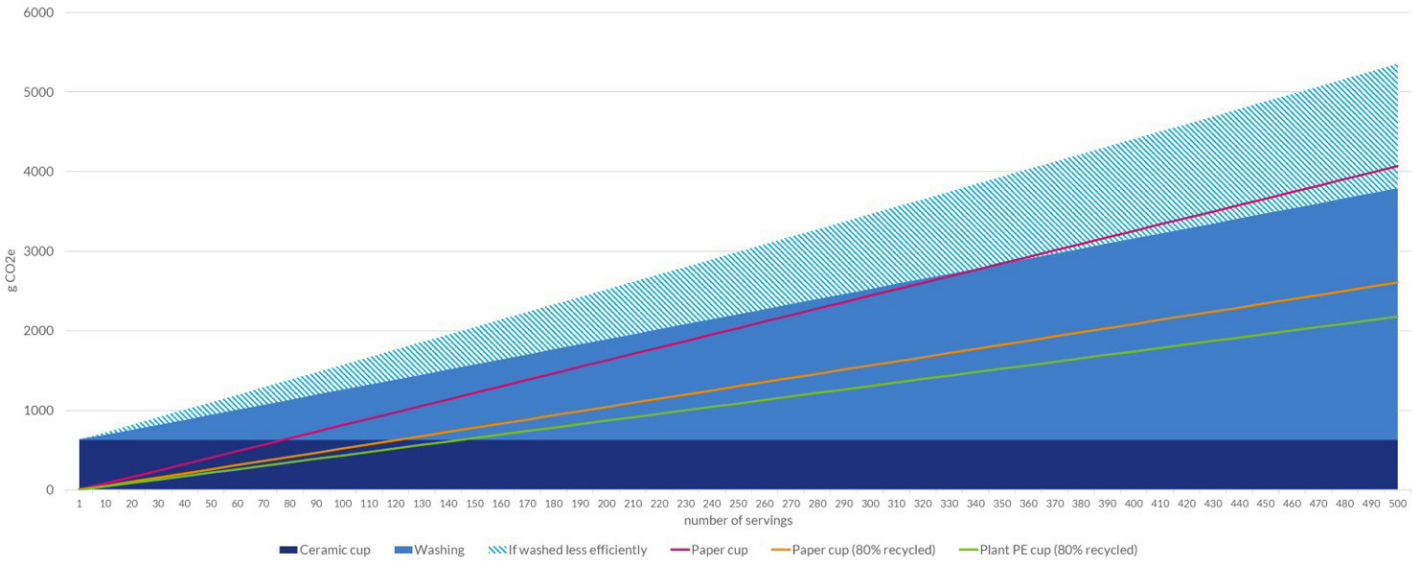
There is no data currently available on how many times the ceramic cups are used in real life, and how long they last in a hygienic and presentable form in cafés or restaurants. For the study, a relatively high reference number of 1,000 uses was chosen.

The major factor affecting the climate impact of ceramic cups was the efficiency of washing. This includes the use of clean water, detergent, energy and the waste water treatment. The study found that dishwashing causes more than 90% of the life cycle emissions of a reusable cup.

The study suggests that even when washed efficiently, ceramic cups need to be used at least 350 times before having a smaller carbon footprint than that of a paper cup. The data also shows that if the paper cup is recycled after use, or if more than 80% of paper cups are recycled, then paper cups are always the better option from a climate change point of view. That's also the case when ceramic cups aren't washed efficiently.

The efficiency or inefficiency of washing a cup is not only a matter of climate impact but an overall food safety and hygiene concern. In many settings safe washing is not guaranteed, which creates a risk of bacteria building up in the cup, especially if milk has been used in the coffee. Additionally, ceramic cups cannot be used for take-away.

Breakeven point with the impact of washing calculated, number of servings in different cups (CFF method)




*In the case of inefficient washing of ceramic cups, paper cups are always a better option from the climate impact point of view.*

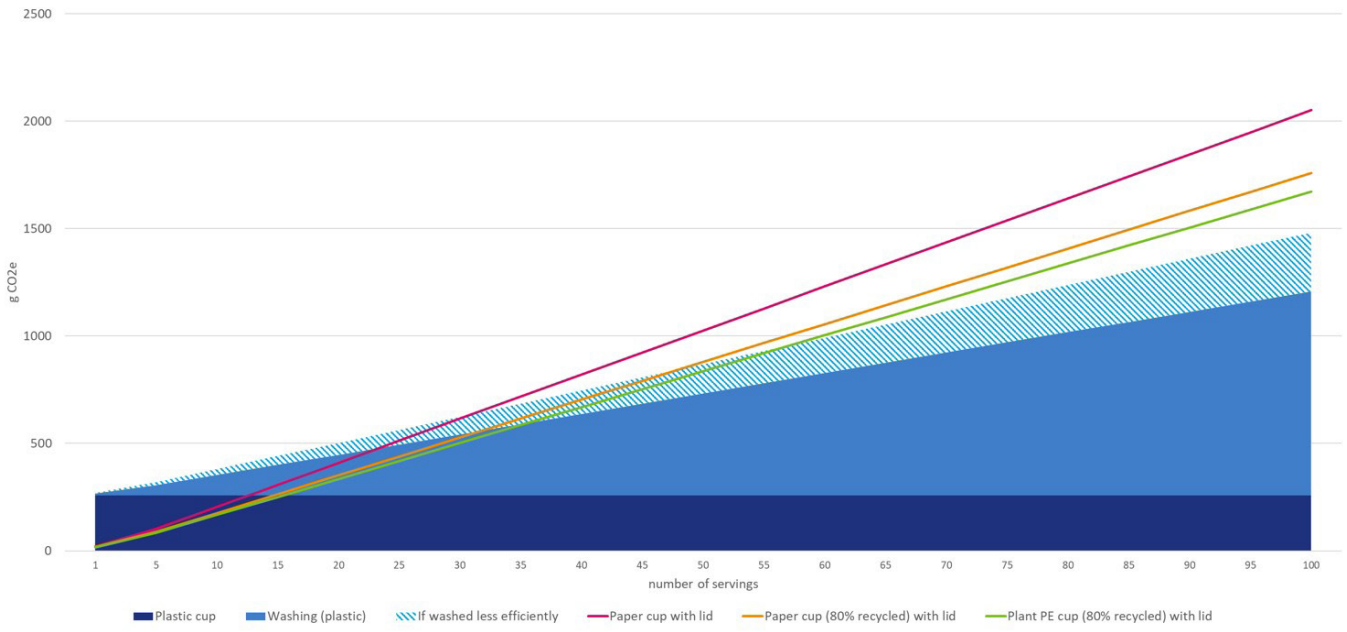
## Take-away paper cups compared to reusable take-away cups made of plastic

The study also compared reusable plastic cups with paper cups used in a take-away setting where plastic lids secure the drink and prevent accidents. Here, the study suggests that the reusable cups should be used at least 20 times to minimize climate impacts. If the paper cup is recycled afterwards and/or is made with a Plant PE coating, the breakeven point increases to between 32 and 36 times.

In the case of reusable cups made of steel, these need to be used minimum 130 times to cause less $CO_2$ emissions than a take-away paper cup and plastic lid.

In the single-use take-away scenario, polystyrene lids make up the majority of the total climate impact of packaging. This is due to the energy intensity of plastic production and the fact that polystyrene lids are rarely recycled. The impact of a take-away paper cup with lid would be substantially lower if a fiber lid was used instead of a polystyrene one.

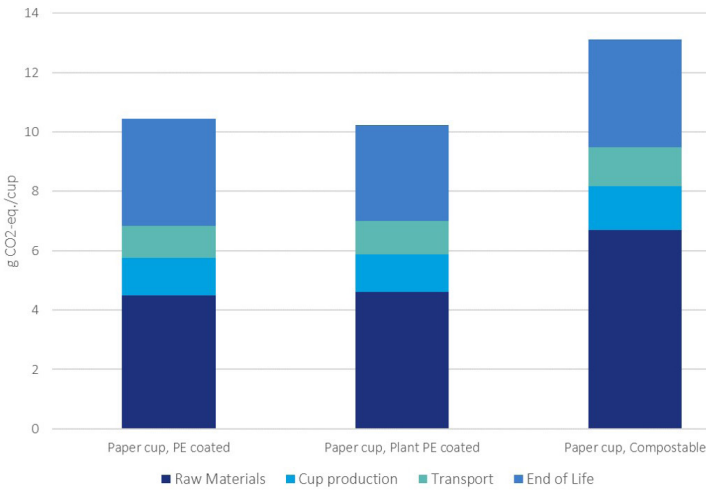
Breakeven point calculated with plastic reusable cups and paper cups with lids (CFF method)




## Comparison of different types of paper cups

The study compared three types of paper cups. Plant PE coated cup was the best performing paper cup, having the lowest climate impact at 10.2 g $CO_2$-eq./cup. Compostable cups typically require a thicker lining to achieve leak-proofing, and some fossil-content, which increases their carbon footprint.

The end of life scenarios are defined based on average European statistics: 30% to landfilling, 34% to incineration and 36% to recycling.



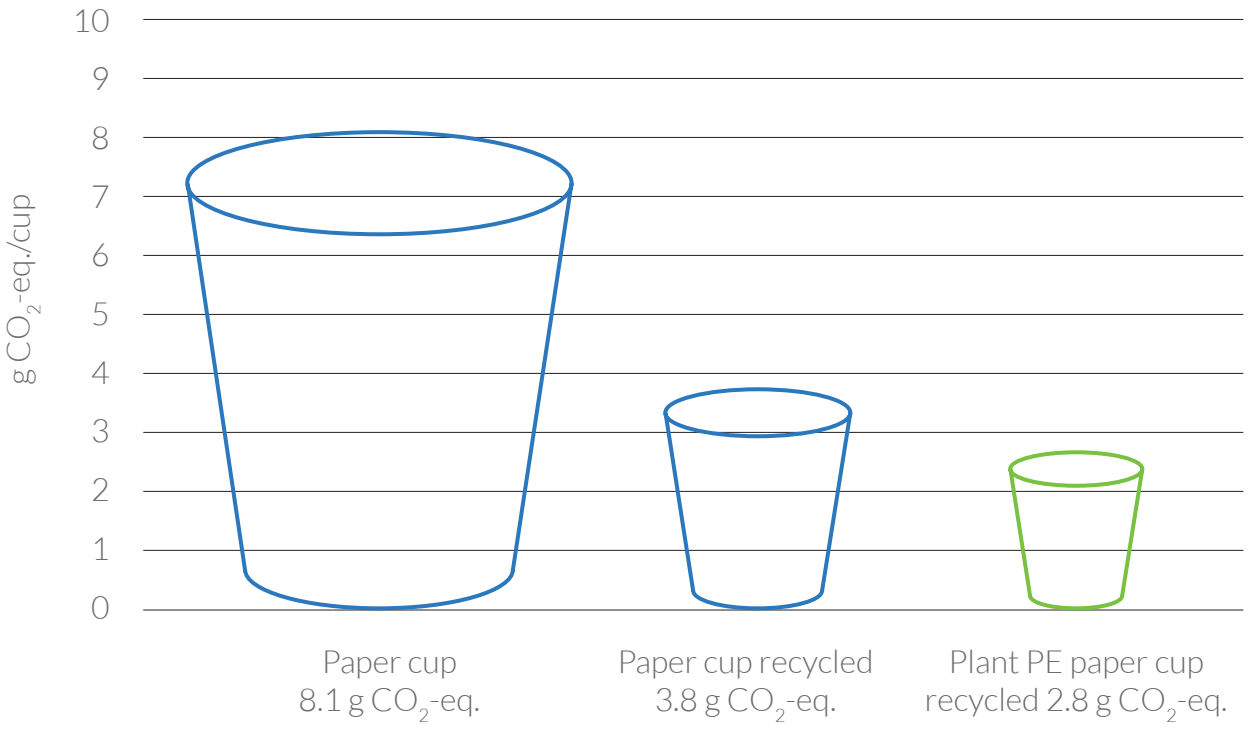
# Recycling makes a major difference

The study showed that the end-of-life solution has a major impact on the $CO_2$ emissions of paper cups: The carbon footprint of regular PE coated cups is 8.1 g $CO_2$-eq. when disposed of according to European averages, but can be reduced by 54% to 3.8 g $CO_2$-eq. when 100% recycled. If plant-based PE is used, and 100% of the cups are recycled, the carbon footprint falls by 64% to 2.8 g $CO_2$-eq./cup. These figures are calculated using the Circular Footprint Formula (CFF) method.

"This LCA has confirmed the positive impact recycling can have on our planet. The fiber in our paper cups can be recycled up to seven times, so by recycling we really are doing the right thing."

*Richard Ali, Sustainability Director for Huhtamaki Foodservice Europe-Asia-Oceania*

Greenhouse gas emissions per cup when recycled




*The carbon footprint per cup is measured according to the CFF method.*


## Future Smart

### The plant-based paper cup

Future Smart is a sustainable paper cup by Huhtamaki. Future Smart is made from fully plant-based materials and is 100% renewable. The paperboard is sourced from PEFC certified, sustainably managed forests. The inside lining of the cup is made of plant-based PE and can be recycled.

According to the study, this type of a plant PE coated paper cup is the best performing paper cup option in terms of climate change impact. By recycling the cup after use, the climate impact of the cup can be further reduced.

The Future Smart material is suitable for hot and cold drinks as well as for ice cream and take-away foods.

# Conclusions

- Like all food packaging, the carbon footprint of a paper cup is small compared to the food itself.
- In most every-day scenarios, a paper cup has the lowest carbon footprint and is always a hygienic choice.
- Recycling drives lower greenhouse gas emissions. When recycled the carbon footprint of a paper cup falls by a significant 54%. If a traditional paper cup is swapped for Huhtamaki's FutureSmart paper cup and is also recycled, the footprint falls by 64%. The high quality wood fiber in Huhtamaki's paper cups, which is sourced from sustainably managed forests, can be recycled up to 7 times before it loses its strength.
- Compostable cups are a good option when the cups are composted in the correct facilities.
- Paper cups are always the best choice for the climate if ceramic alternatives aren't washed efficiently.
- Re-usable cups would need to be light-weight, used multiple times and be washed efficiently for them to result in lower greenhouse gas emissions than paper cups.

# What is a life cycle analysis?

## Key facts about this study

Life Cycle Assessment (LCA) is a method to assess the environmental impacts of a product over its entire life cycle, taking into account raw materials, manufacturing, use, transport and end-of-life options.

For this research, VTT Technical Research Centre of Finland Ltd carried out the comparative LCA study, which was jointly commissioned by Huhtamaki and Stora Enso. Catharina Hohenthal, Marjukka Kujanpää, Ivan Deviatkin, Marja Myllysilta and Matias Alarotu from VTT formed the research team.

A critical review panel reviewed the study in order to allow for public comparative assertions based on the results of the study. The study is fully compliant with ISO 14040 and ISO 14044 standards.

The results are not comparable with earlier studies. This study follows European Commission's product environmental footprint (PEF) category rules for intermediate paper products. Cut off was the chosen allocation method but circular footprint formula (CFF) used to assess the impact of recycling rate.

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