



Another first from kp as they offer a new, fully recyclable packaging solution for food-to-go that will keep food hotter for longer.

# *Infinity*<sup>TM</sup>

## Packaging with a future

Sustainable packaging for food-to-go

# Introducing kp Infinity™

## Taking Expanded PolyPropylene (EPP) into the future

### Packaging with a future: a changing world

Since we began business over 55 years ago, kp has designed and manufactured sustainable products to address the most pressing global issues.

We want to use our knowledge and expertise to develop packaging solutions to help achieve:

- Food safety, quality and preservation.
- Food waste reduction.
- Consumer demand for more convenient products.
- Materials with a lower environmental footprint.

Plastic is a miraculous material, endlessly recyclable, versatile and an effective way to cut food waste. The features and benefits of plastic are unmatched today, providing the best barrier properties in food safety and quality, while being hygienic, lightweight, durable and resource efficient to produce.

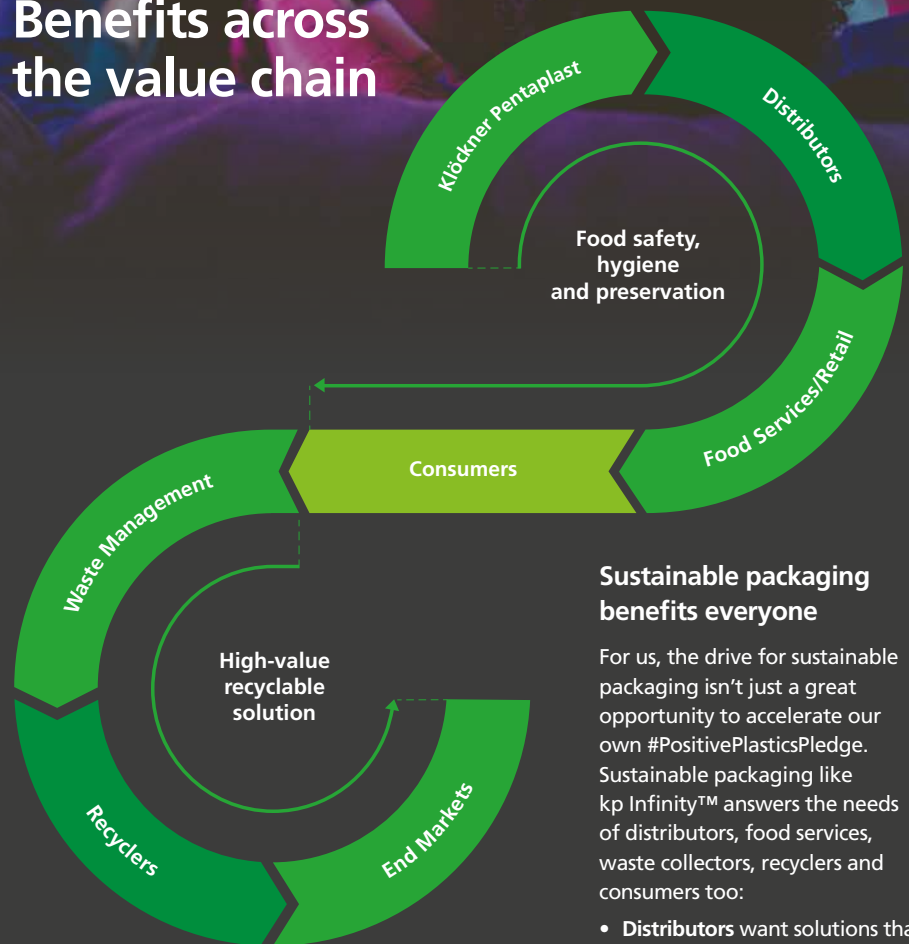
The world is looking for ways to be more sustainable. We are playing our part by innovating packaging solutions that protect our planet and protect our food, while meeting the needs of our modern society.

We want to stop plastic waste leaking into our land and marine environment and keep this valuable material in places where it will be recycled and reused.

There is a demand for packaging to be designed to use less resources, such as materials, water, energy and with a lower carbon footprint, while also working in harmony with today's collection, sorting and recycling systems. In addition, we need to stay true to our purpose in protecting food, keeping it safe and helping reduce food waste.

Embedded in the fabric of our company is our primary purpose – the sustainable protection of everyday needs – it's why we exist; it's why we do what we do.

### Benefits across the value chain



### Sustainable packaging benefits everyone

For us, the drive for sustainable packaging isn't just a great opportunity to accelerate our own #PositivePlasticsPledge. Sustainable packaging like kp Infinity™ answers the needs of distributors, food services, waste collectors, recyclers and consumers too:

- **Distributors** want solutions that comply with regulations, and are versatile, durable, hygienic and lightweight.
- **Food services** need a stackable, premium product that is cost-effective and will maintain food quality.
- **Consumers** are looking for packaging that is recyclable, convenient, microwaveable and keeps food hotter for longer.
- **Recyclers and waste collectors** need recoverable materials that are easy-to-handle, high-value mono solutions.

We ensure, when we design any new product, that it meets the needs of every stakeholder along the chain. We believe that kp Infinity™ does just that.

**kp Infinity™ is the packaging of the future – perfectly designed to protect and supply food and now infinitely recyclable. We are exceptionally proud to be supplying the materials for this unique product and look forward to changing how we produce packaging not just in the UK but globally."**

Andreas Leitner, Head of New Business Development, Borealis Polyolefins

# Our trials and research

We worked closely with several experts, rigorously testing and trialling kp Infinity™ to ensure its safety, efficiency and quality.

- Comparative benchmarking conducted by the kp I-Center and CellMat involved testing samples of expanded polystyrene (EPS), bagasse, lined carton board materials and EPP using the HP6 packaging format.

- We also conducted a complete peer-reviewed lifecycle analysis (LCA) study in partnership with the LCA Centre in Holland, as well as independent qualitative consumer research with The Cog.
- In collaboration with MTM in Germany, we held an eight-tonne EPP recycling trial.



## Fully recyclable P4

Fully recyclable and easily identified by sorting technology, unlike other materials



## Water resistant P7

Natural water-repelling qualities hygienically protect food quality



## Resistant to acids and alkalis P7

Resistance to the acids and alkalis commonly found in foods helps protect package integrity and food quality



## Resistant to hot oil P8

Ability to withstand extreme temperatures without melting keeps the packaging sturdy and protects consumers



## Keeps food hotter for longer P8

Superior thermal properties that can keep food hotter for longer while still being microwaveable



## Cooler to the touch P9

Excellent conductivity resistance means that even as the food stays warm, the outside of the box stays cool



## Low carbon footprint P10

Lightweight and recyclable, kp Infinity™ has a lower carbon footprint, is made with less material and has lower water and energy use across its lifecycle



## Consumer tested and approved P14

Meeting the demand from consumers for food to arrive hot delivers a satisfying experience, with food arriving in recyclable packaging that can be microwaved

Properties	kp Infinity™	Bagasse	Carton board	EPS
Fully recyclable	Yes	No	Yes	No
Water resistant	Excellent	Poor	OK	Good
Resistant to acids and alkalis	Excellent	Poor	OK	Excellent
Lightweight	Good	Poor	OK	Excellent
Thermal protection	Excellent	Poor	Poor	Excellent
Resistant to hot oil	Excellent	Good	Good	Good
Microwaveable	Yes	No	No	No
Contains recycle	No	No	No	No
Virgin material	Yes	Yes	Yes	Yes





“With so much focus on plastics, packaging and recyclability, I congratulate kp on their innovation and leadership in this space. We are pleased to support the development of kp Infinity™, which I am sure will be a great success.”

Stuart Foster, CEO, RECOUP

# Fully recyclable



**kp Infinity™ is a high-quality material made from a single form of plastic. This means it is easily recycled and can be used to create a variety of new products: from packaging to furniture, flooring and textiles – which gives our food-to-go packaging a second life and more.**

To fully understand how recyclable kp Infinity™ is, we collaborated with several key partners across Europe leading comprehensive trials, as well as conducting our own trials in a series of key tests.

## Ensuring the basics

Our research began with an extensive trial, set up by Borealis, with recycling specialists Veolia and MTM. This first test required the recycling of 20 tonnes of EPP cups to check that it could be easily sorted and recycled using the technology and processes available in UK and European facilities.

## Testing the full cycle

After these successful trials, MTM took a further eight tonnes – in the form of pressed clamshell boxes commonly used for takeaway food – to determine whether recycled kp Infinity™ could be processed into pellets that meet regulation standards for being recycled and reprocessed into new products.

During the trial, a mix of 20% kp Infinity™ and 80% standard post-consumer polypropylene (PP) was processed into plastic flakes. Despite the EPP component, higher than that usually processed by MTM, there were no impacts to the efficiency and the end product was of the same quality as a standard batch. The trial determined that kp Infinity™ was highly recyclable. We also conducted a test with UK waste management specialists Biffa. Using a one-tonne sheet of kp Infinity™ as input material, Biffa also confirmed that kp Infinity™ is fully recyclable within its infrastructure.

The final phase of the test was to blow-mould the resulting polymer resin into non-food grade bottles, such as those traditionally used for household bleach.

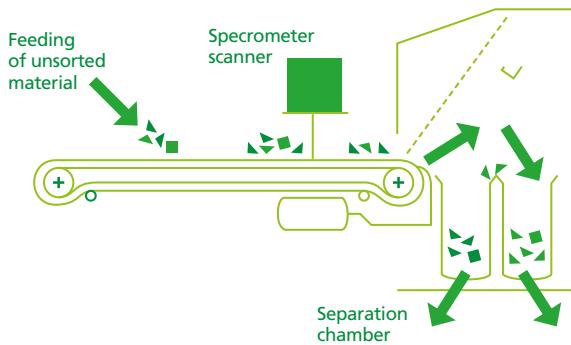
## Preventing contamination

At plastics recycling facilities (PRF), sink–float technology is commonly used to separate out the PP waste stream (70%) from the mixed waste stream (30%). Foamed or expanded PP has a density lower than one and floats in water. Other plastics, such as EPS and expanded polyethylene terephthalate (EPET), also have a density lower than one, meaning there is the potential for contamination of the profitable PP stream. It is for this reason that they are difficult to recycle within the current system. kp Infinity™, however, being a mono-material, will have the benefit of adding more high-quality PP into the reprocessing stream.

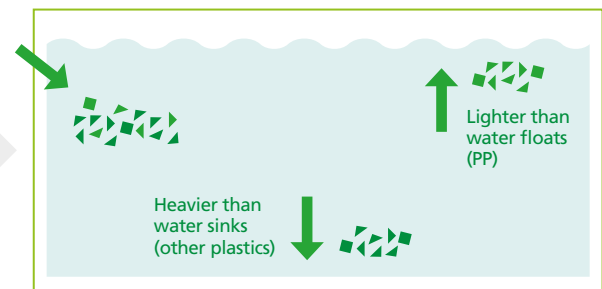
### Results

**The partner trials all concluded that kp Infinity™ performs as expected in all existing recycler processes and is therefore fully recyclable.**

### Materials recycling facility (MRF)



### Plastics recycling facility (PRF)








## Conclusive approval

Working closely with RECOUP, who are the UK's leading authority on plastics waste and resource management, samples were supplied for trial at a local materials recovery facility (MRF) to see if they would

be separated easily into the correct recycling stream. An MRF collects all different types of materials and sorts them into defined streams. The results were decisive and successful, with kp Infinity™ easily being diverted to the correct stream.

For further validation, samples were sent to TOMRA in Germany to determine whether kp Infinity™ could be scanned by near infra-red (NIR) AUTOSORT technology, which is designed to detect the exact chemical and material makeup of objects. All samples were fully recognised and sorted by AUTOSORT.

	Partners	Purpose	Inputs	Result
<b>Recycling trial 1</b>	Veolia, Borealis and MTM	To determine whether kp Infinity™ could be easily sorted by NIR	20 tonnes collectively of EPP in the form of cups	 Easily sorted – determined fully recyclable
<b>Recycling trial 2</b>	MTM	To determine whether kp Infinity™ could be taken through the full processing stream after sorting and converted into polymer	20% kp Infinity™ added to a standard MTM processing stream	 Easily processed – determined fully recyclable
<b>Recycling trial 3</b>	Borealis and MTM	To determine whether polymer from kp Infinity™ could be further processed into new packaging	Polymer from recycling trial 2	 Polymer successfully blow-moulded into non-food grade bottles
<b>Recycling trial 4</b>	Biffa at Redcar	To determine whether kp Infinity™ could be easily separated with belt technology by recycling facilities	One-tonne sheet of kp Infinity™	 Easily separated – determined fully recyclable
<b>Recycling trial 5</b>	RECOUP and TOMRA	To determine whether kp Infinity™ could be sorted through an MRF and easily scanned by NIR AUTOSORT technology facilities	Three different samples of kp Infinity™ products and pre-forms	 Easily scanned – determined fully recyclable



# Performance properties

There are multiple factors to consider when it comes to food packaging, including safety, durability and convenience for food-to-go outlets and consumers. Being able to remain sturdy while containing wet or steaming food is crucial, but so is the ability to resist the corrosive damage of alkaline or acidic foods, sauces and hot oils. Tests have shown that

kp Infinity™ delivers best-in-class performance against all these criteria. In addition, the kp Infinity™ HP6 tray was tested at our own facilities alongside equivalent trays in EPS, bagasse and carton board materials to benchmark their weights.



kp Infinity™ is an example of excellence in product innovation, designed to be recyclable in existing waste management infrastructure. The bold on-pack 'Recycle me' provides a clear and simple message; dispose of this product correctly and it can have a second life."

Katie Bradbury, Sustainability and Packaging Innovation Manager, Bunzl Catering Supplies



# Water resistant



kp Infinity™ represents an incredible evolution in packaging technology when it comes to dealing with moisture. kp Infinity™ is naturally water repellent, removing the need for extra barrier coatings or layers that would make the packaging more complex and harder to recycle. Being waterproof also means that it is the perfect, hygienic choice for packaging and protecting hot and cold food while adding a new level of durability.

To determine water resistance, kp Infinity™ was rigorously tested against the following comparable packaging types:

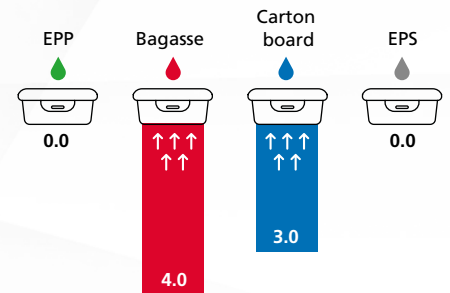
- Bagasse
- Carton board
- EPS

kp Infinity™ and EPS proved to be better than both bagasse and carton board in terms of water resistance. kp Infinity™ only absorbed 0.1/g of water in comparison to 4.0/g absorbed by bagasse.

Its resistance to moisture not only allowed it to retain its pack stability over time – which is critical for transportation and delivery times – it also makes kp Infinity™ the more hygienic option. The material proved to be best-in-class for water resistance and demonstrated that both hot and wet food products benefit from this packaging.

## Water resistance

Mass water absorption/g



### Results

kp Infinity™ proved to be better than both bagasse and carton board in terms of water resistance.

# Resistant to acids and alkalis

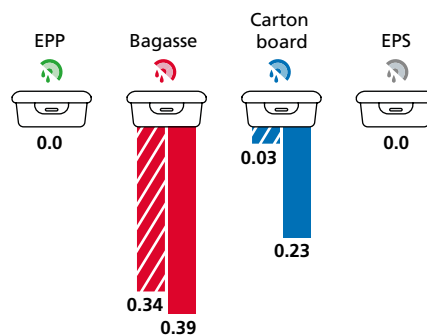


Resistance to acids and alkalis in food packaging is a cornerstone of delivering a quality consumer experience. Almost every widely enjoyed food type can create a potential compromise in the integrity of packaging. kp Infinity™ is best-in-class for resistance to acids and alkalis.

## Acid/alkali resistance

Weight absorption (g)

▨ Acid (Lemon)  
 ■ Alkali (Soy)



### Results

kp Infinity™ is best-in-class for resistance to acids and alkalis.

# Resistant to hot oil



Hot oil is a feature of many packaged food items but can, in some cases, damage the structural integrity of the packaging material used to transport it.

This, in turn, can cause leakage and odour transfer, making the product less hygienic. On top of this, as hot oil is transferred to the packaging, the food inside cools down, resulting in a less enjoyable consumer experience.

When tested against alternative materials, kp Infinity™ clearly led in hot oil resistance. Trials were performed with fish and chips cooked in oil at 195°C, which had a contact temperature with packaging of between 145–160°C. The results showed almost no impact from food contact – a significant achievement when compared with alternative packaging.



## Results

kp Infinity™ showed almost no impact from hot food contact, unlike alternative packaging.

# Keeps food hotter for longer

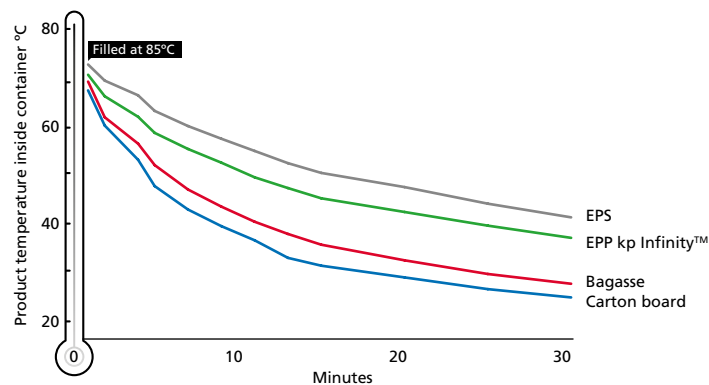


When it comes to convenience foods – whether via delivery or takeaway – keeping the food hot while transporting it is crucial to customer satisfaction and therefore for food service. Thanks to unique thermal conduction abilities, kp Infinity™ clearly outperforms its competitors.

kp Infinity™ was tested alongside EPS, bagasse and carton board to determine the precise levels of heat retention for each. Each packaging type was filled with water that was heated to 85°C. The temperature of the water, as well as that of the outside of the packaging, was monitored to determine how much heat was lost over 30 minutes.

After half an hour, the water in the kp Infinity™ packaging was 10°C warmer than either the bagasse or the carton board, and was comparable to EPS. At the same time, surface temperature recordings showed kp Infinity™ had the lowest thermal conductivity value, retaining heat within the packaging instead. Other packaging in the test had lost over 50°C of heat over the same time period.

Product temperature evolution inside container with product filled at 85°C



## Thermal conductivity value

In a further test between kp Infinity™, cellulose trays, white foam trays and paperboard trays, kp Infinity™'s thermal conductivity properties allowed far less heat to escape from the product and kept food hotter for longer than the alternatives.

## Results

Surface temperature recordings showed kp Infinity™ had the lowest thermal conductivity value, retaining heat within the packaging instead.



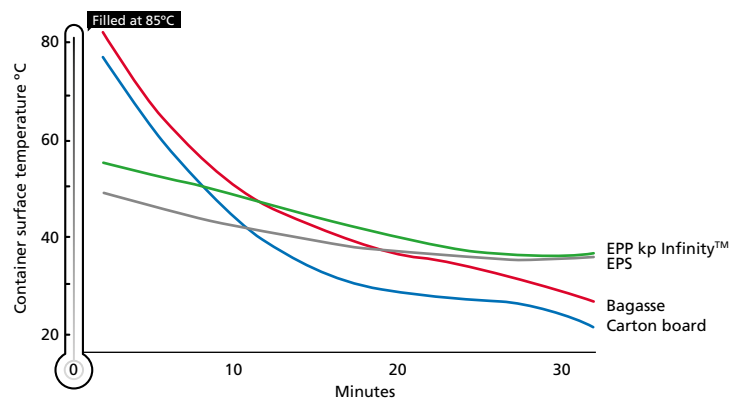


# Cooler to the touch



Besides the value to consumers of keeping food hotter for longer, kp Infinity™'s thermal conductivity means it remains cool to the touch even when the food contents are hot, another benefit for consumers and food service outlets. It means that packaging with hot food will always be easier and safer to handle.

Container surface-level temperature evolution after filling at 85°C



## Results

kp Infinity™ packaging remains cool to the touch due to its thermal conductivity properties.



# Low carbon footprint



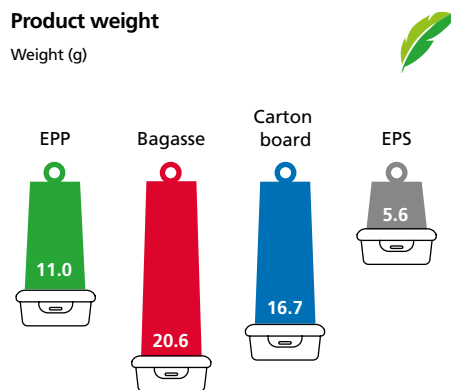
One feature that makes kp Infinity™ a better choice over other materials is its reduced environmental footprint. Not only is it fully recyclable, the specific production processes needed to make kp Infinity™ mean it has a lower carbon footprint too.

It is much lighter than many other packaging alternatives and requires far fewer resources, such as energy, water and materials, to make. Our kp Infinity™ packaging is part of how we are doing more with less, helping us to progress on our #PositivePlasticsPledge. To determine just how much better kp Infinity™ is for the environment, we commissioned a full lifecycle analysis (LCA). The LCA was used to evaluate the environmental impact of kp Infinity™ from the point where materials are extracted to the moment the packaging is disposed of.

## Lightweight

How heavy a product is has a significant impact on its overall carbon footprint. Heavier packaging uses more resources to make and more energy to transport. The kp Infinity™ HP6 tray was tested by kp's laboratories alongside alternative trays to benchmark their weights.

Product weight  
Weight (g)



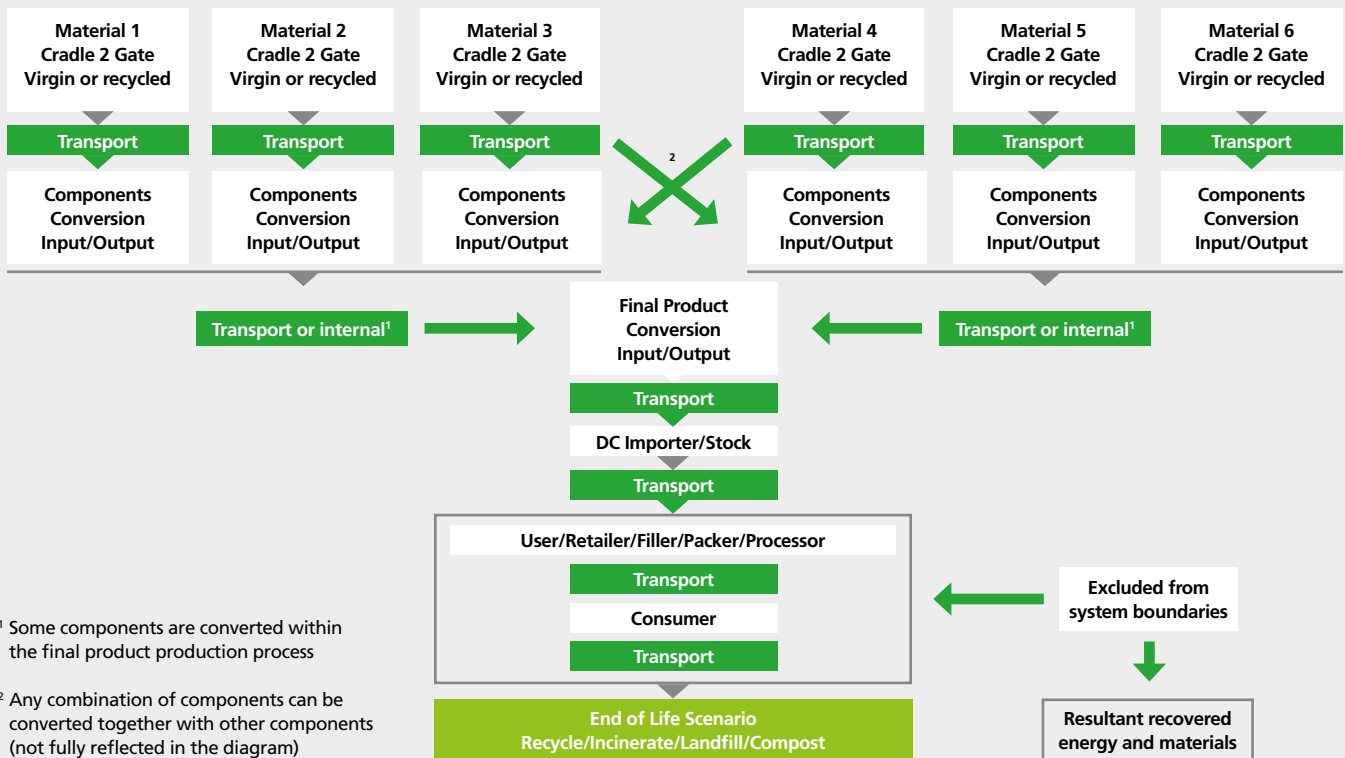
# Independent peer-reviewed lifecycle assessment study

The study was carried out by the LCA Centre in the Netherlands, using kp Infinity™ hinged takeaway packs and comparing the results to those of mineral-filled PP and carton boards with PE, varnish and simulated polylactic acid coatings. The impacts that were analysed were:

- **GWP – Global Warming Potential (kg CO<sub>2</sub> eq):** the carbon footprint of packaging across its lifecycle.
- **CED – Cumulative Energy Demand (MJ eq):** how much energy is required to produce and transport the packaging.
- **Resource – Water (m<sup>3</sup>):** how much water is needed to create each type of packaging.

The study analysed the impacts of the packaging from cradle to gate and then at the end of its life. The diverse ways packaging is distributed, bought and used means that it is impossible to accurately track and assess the impacts at the filling and use stages.

## System boundaries





# Carbon emissions

Carbon dioxide makes up approximately 76% of all greenhouse gas emissions, meaning the need to develop products with a lower carbon footprint is greater than ever before.

When recycling is factored into all the packaging lifecycles, kp Infinity™ and EPS had the lowest carbon footprint. While EPS is a superb material, it is not recycled enough, whereas kp Infinity™ is fully recyclable and has the next lowest footprint.

kp Infinity™ also outperforms all board-based solutions in terms of carbon emissions.

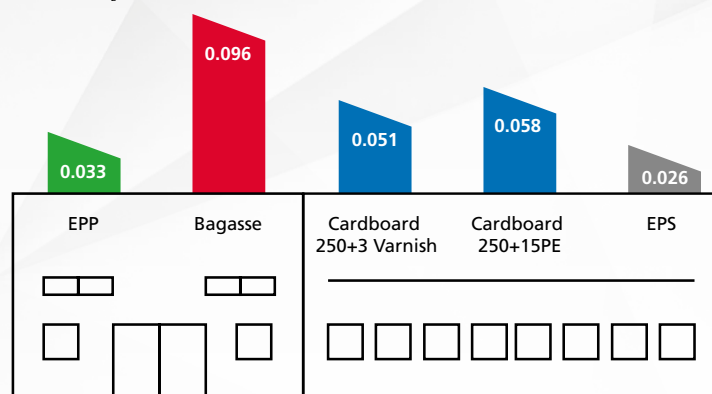


It's great to see innovation from kp in the development of EPP trays, but also their rigorous material selection process to ensure they're doing the right thing. If collected for recycling, these trays are effectively sorted and processed into new products."

Helen Bird, Strategic Engagement Manager, WRAP

## Climate Change – GWP 100a

GWP in kg CO<sub>2</sub>-Eq



### Results

kp Infinity™ outperforms alternative packaging when it comes to recyclability and carbon emissions and EPS outperforms alternatives when it comes to carbon emissions.



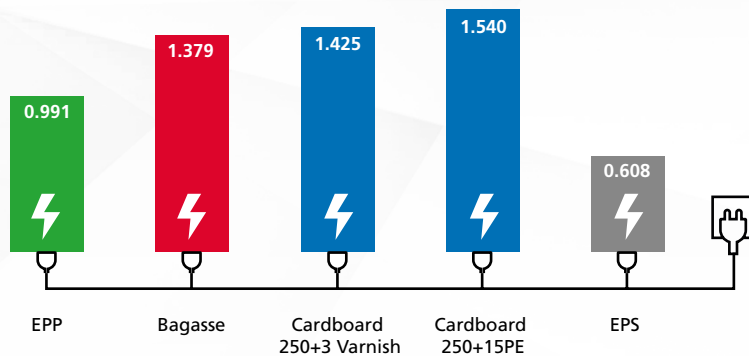


# Energy use

During packaging development, energy is used at every stage of production: from the extraction of raw materials, to processing raw materials into a final product, to the transport of the final product to consumers.

As with the carbon footprint profile, once recycling is factored into all the packaging lifecycles, kp Infinity™ and EPS had the lowest cumulative energy demand.

**Energy demand**  
CED in MJ-Eq



**Results**

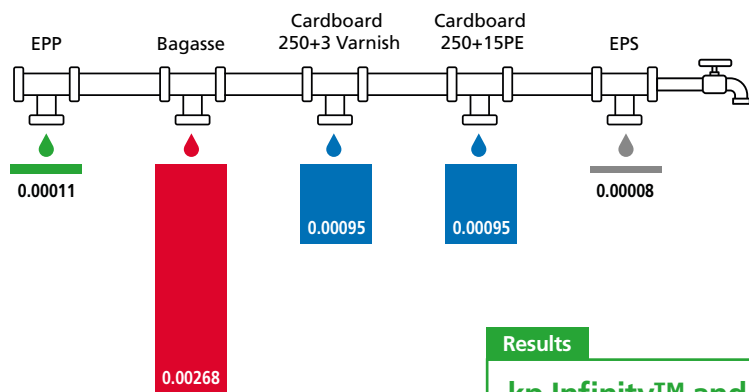
kp Infinity™ has a low energy demand across its lifecycle.

# Water use

Resource scarcity such as water use is one of the biggest discussion points in global conversations about sustainability. The need to focus on materials that use fewer inputs across their lifecycle has become greater. Water is diverted into making packaging products at a time when 11% of the world's population still don't have access to clean water.

Once again, tests from the LCA showed that kp Infinity™ and EPS used by far the lowest amount of water, when recycling was accounted for.

**Water impact**  
Water in m³



**Results**

kp Infinity™ and EPS use the lowest amount of water when recycling is accounted for.



# Consumer tested and approved



**We designed kp Infinity™ with consumer satisfaction in mind and to ensure that all core consumer needs were met to the highest of standards. The result is a packaging solution that is hygienic and keeps its contents hot while remaining cool to the touch. It is also uniquely microwaveable and easily recyclable, preventing waste.**

## Independent consumer research conducted

Online delivery platforms have created a growing take-away market and, more than ever, consumers are looking for businesses to provide packaging that ensures food quality and safety while being better for the environment.

kp worked with The Cog, a consumer research agency, to understand what consumers are looking for in food packaging.

For the majority of those interviewed, all of whom frequently purchase take-aways, the key priorities for packaging were:

- Protection of food integrity.
- Temperature control, particularly in retaining heat so food can be delivered hot.
- Secure closing and easy opening.
- Breathable materials to avoid 'sweating food'.
- Leak-proof and damage-proof.
- Widely recyclable.

## Perceptions of kp Infinity™ packaging

The change in colour to a more natural brown, matte finish and improved texture, with clear recycling messaging, combined to engage the test audience and prompted considerable excitement.

It served to highlight that it is important that kp Infinity™ packaging is:

- Not white
- Nicer to touch
- Has a matte (not shiny) finish
- Clearly communicated 'Recycle me' messaging





## Consumer priority 1: Recyclability and clear on-pack messaging

*"We want the ability to  
recycle packaging."*

*"Messaging must be clear,  
concise and understandable."*

While consumers want packaging that does its job well, such as keeping food hotter for longer, recyclability is also an important factor, especially among younger audiences who are actively seeking 'greener' options.

Not only was it important to the test group that kp Infinity™ is recyclable, but also that the recycling message must be clear. kp tested several icon options during the research to understand how best to communicate the message. Thanks to the analysis, all kp Infinity™ packaging will carry an eye-catching embossed 'Recycle me' icon.

## Consumer priority 2: Protection of the food

*"The pack needs to be  
robust and strong enough  
to deliver products safely  
on the journey home."*

Consumers expressed frustration with current packaging that leaks or doesn't hold its structure while being transported. Strong packaging is key to a quality food experience and consumer food satisfaction should be a fundamental consideration when it comes to packaging design.

## Consumer priority 3: Keeping food hotter for longer

*"Food must be delivered hot."*

*"Quality of the food and  
subsequent satisfaction of  
eating is fundamental."*

The temperature of food is a crucial element that can impact food quality and the consumer experience. Consumers also do not like packaging that makes food look 'sweaty'. The thermal properties of kp Infinity™, which mean food stays hot while the packaging and its contents remain drier, were a key improvement to the overall food-to-go experience for our test group.



We are excited by this innovative solution. It's an answer to the current recycling challenge in the food-to-go sector – creating a sustainable, recyclable solution for packaging, previously viewed only as waste. We are delighted to be part of this forward-thinking solution."

Guenter Stephan, Head of Mechanical Recycling, Borealis Circular Economy Solutions







## We care about the people who use our food packaging and we have listened to what they want.

Thanks to an independently run consumer survey and lifecycle analysis, as well as many consultations across the value chain, kp Infinity™ offers a food-to-go packaging solution everyone can feel good about, endorsing a clear and eye-catching message to let people know that the package can be recycled.

### Contact details

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### Corporate information

- Food packaging
- 14 countries worldwide
- 22 manufacturing sites
- Producing plastics in rigid films, rigid trays and flexible films