



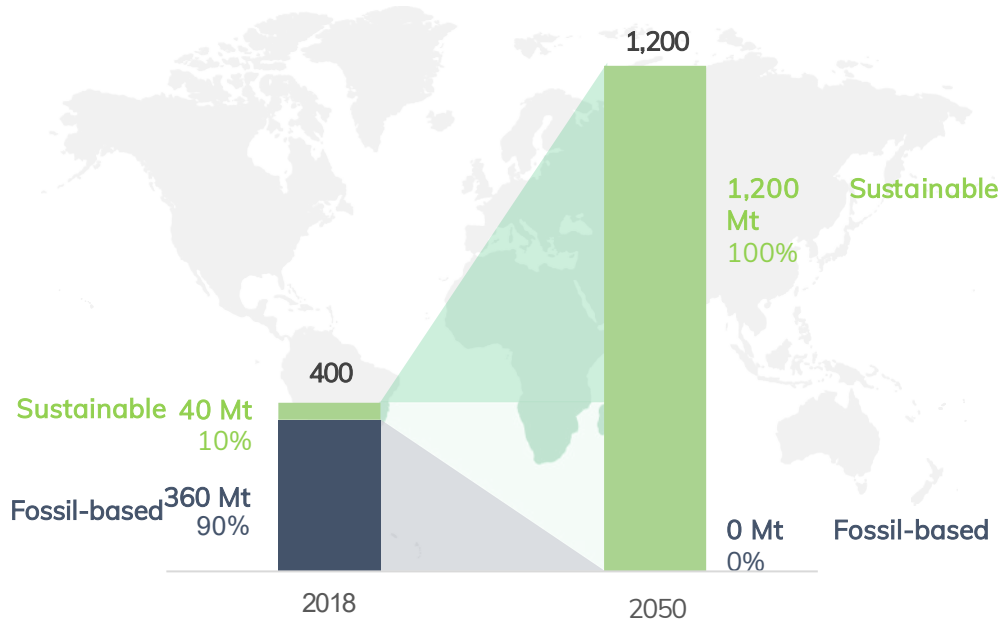
**avantium**

# Avantium Renewable Polymers Business Development

Retail Investor day – March 28<sup>th</sup>, 2022

# Fossil-based products are expected to phase out

## World plastic and chemicals production (in Mt)



Sources: Nova Institute

## Key market drivers



**Demographic growth** and increasing purchase power of a growing worldwide middle class



**Tougher regulations** geared towards recycling and/or bio-based feedstock, combined with neutral carbon footprint via CO2 taxation



**Increasing industry commitment** towards sustainable products



**Product performance** determines size of market, speeds of adoption and price level



## Renewable packaging is needed to complement current solutions



PET packaging sector is moving towards higher levels of circularity fast

- recycled content in plastic packaging
- recyclability of plastic packaging
- better collection
- reuse where viable

However, according to BCG 45% of the demand for recycled PET will be unmet by 2025

# The future of packaging is circular & plant-based



*Endlessly Refreshing:  
Coca-Cola North America rolls out  
bottles made from 100% recycled  
PET plastic*



Feb 9<sup>th</sup>, 2021

&

*Coca-Cola collaborates with Tech Partners  
to create bottle prototype made from 100%  
plant-based sources*



Oct 21<sup>st</sup>, 2021



# Superior properties PEF compared to PET

**10°C**

higher glass transition  
temperature

**30-40°C**

lower melting point

**60%**

higher modulus and strength

**10x**

better oxygen barrier

**15x**

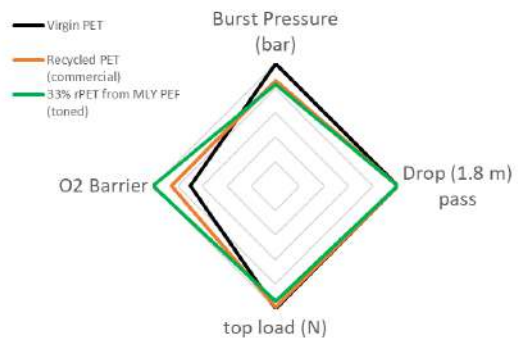
better CO<sub>2</sub> barrier

**2-3x**

better water barrier



# Recycling multilayer PET/PEF pre-assessment

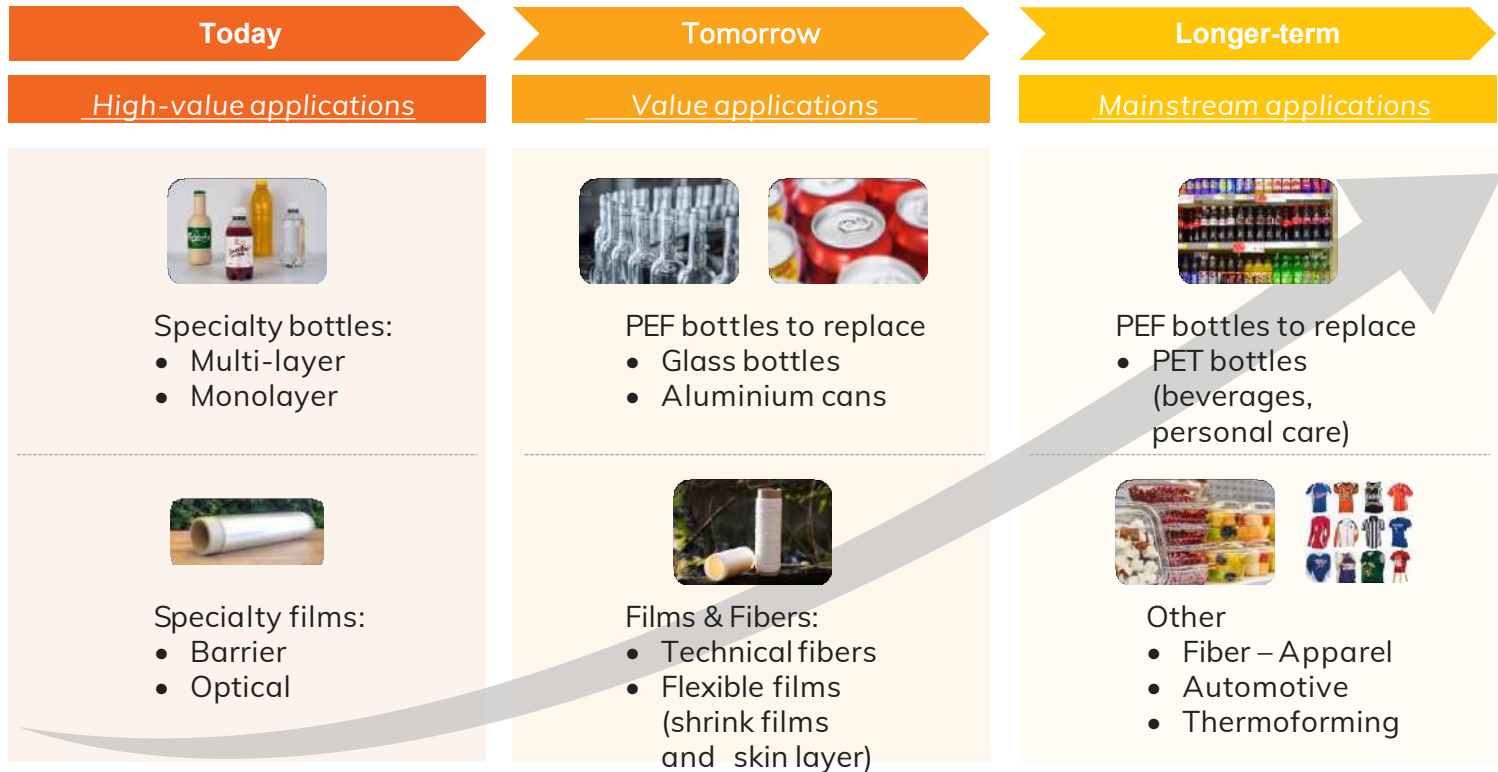


- Mechanical properties comparable with commercial recycled PET (from deposit scheme)
- Color, haze and general appearance comparable if not better



	Virgin PET	Recycled PET (commercial)	33% rPET from Multilayer PET/PEF
L*	95	95	95
a*	0	-0.4	-0.2
b*	0.6	1.1	0.8
Haze % D65/10	2	2.9	1.8

# Addressing an extensive number of end-markets over time



Refresco continuously looks for new, innovative and more sustainable solutions to meet its customers' changing needs.

## PEF as part of circular packaging solution for juice





# The leading global independent beverage solutions provider

- Founded 20 years ago and grown into the global leader in beverage solutions
- Unique production footprint with over 70 manufacturing sites across North America and Europe
- Offering a complete product portfolio of beverages across key markets
- Customer offering based on three competitive strengths: scale, innovation and strong customer relationships
- Employing over 11,000 staff

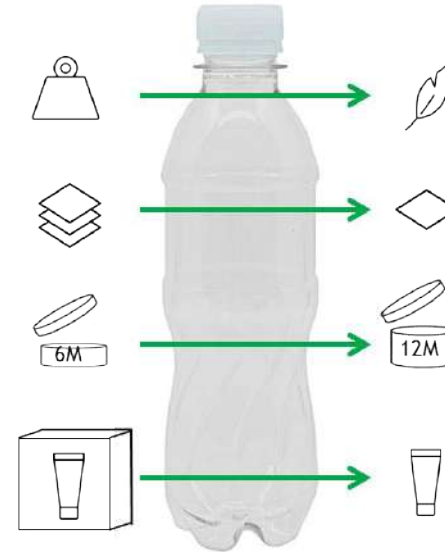
# The natural performance of PEF

*Proof of Product achieved with factor 6-7 shelf life and 20% less material*

**“PEF blows very easy and predictable; it likes to be stretched. A small preform gives a very wide processing window.”  
(Refresco’s converter)**

- 20% Light-weighting of 1 liter juice bottles, mechanical properties met
- Barrier properties exceeded with factor 6-7
- Flawless production in existing infrastructure of injection molding, blowing and filling
- PEF recyclable on same equipment as PET

## PEF Bottle



# The natural performance of PEF

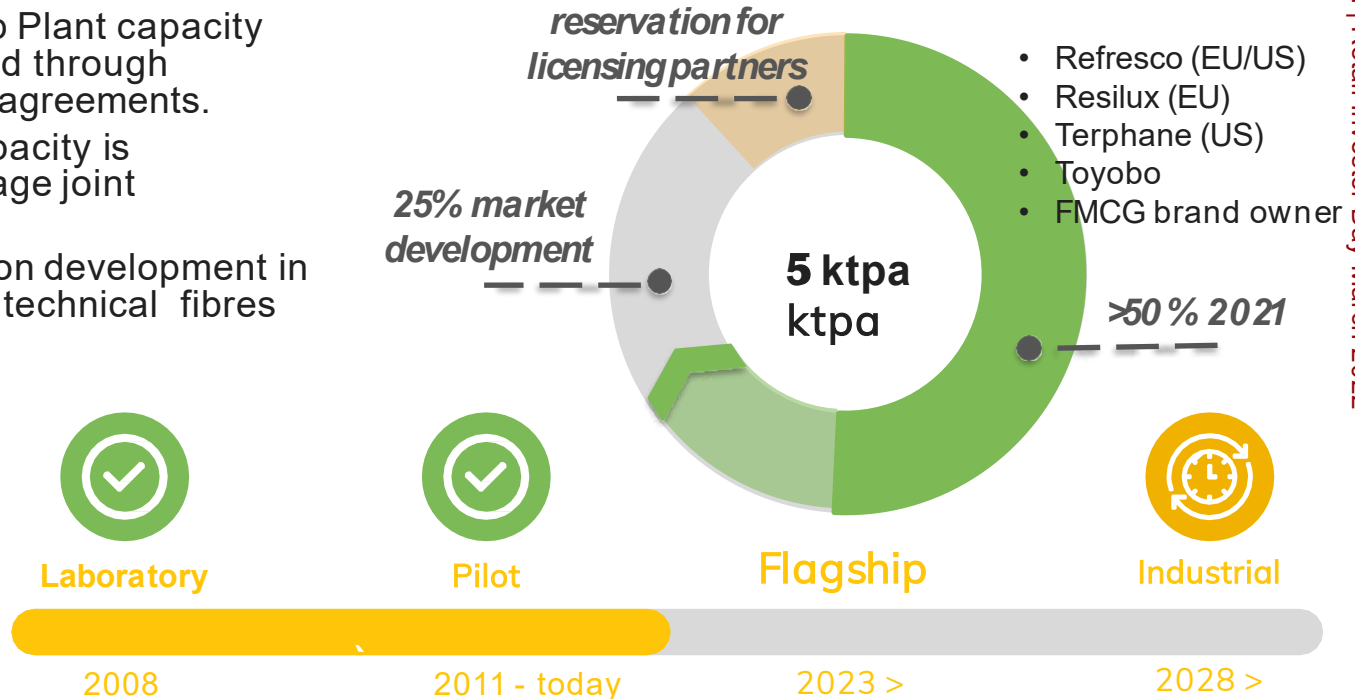
*Preserving Vitamin C and juice's natural color*

- Aseptic filling of PEF bottle
- Superior properties of PEF preserve Vitamin C level in juices
- Extended shelf life




# Availability of off-take capacity to extend PEF to other segments

- 50% of the Flagship Plant capacity has been contracted through conditional offtake agreements.
- Additional 15% capacity is reserved for late stage joint developments
- Increased application development in flexible packaging, technical fibres and apparel



# Avantium's cutting-edge PEF led to numerous strategic collaborations & recent offtake agreements



  
**avantium**

High performance

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Fully sustainable

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Cost competitive



**R&D collaborations**



**Long-term offtake agreements**

Development of PEF for beverage applications



“We highly value the many performance and sustainability features of PEF”



PEference aims to establish an innovative supply chain for FDCA & PEF



“We strongly believe that PEF improves the barrier properties of packaging materials and extends shelf life”

“PEF will allow us to offer sustainable solutions in special, high-end applications”



“With PEF, we will be able to offer another sustainable and renewable packaging solution”

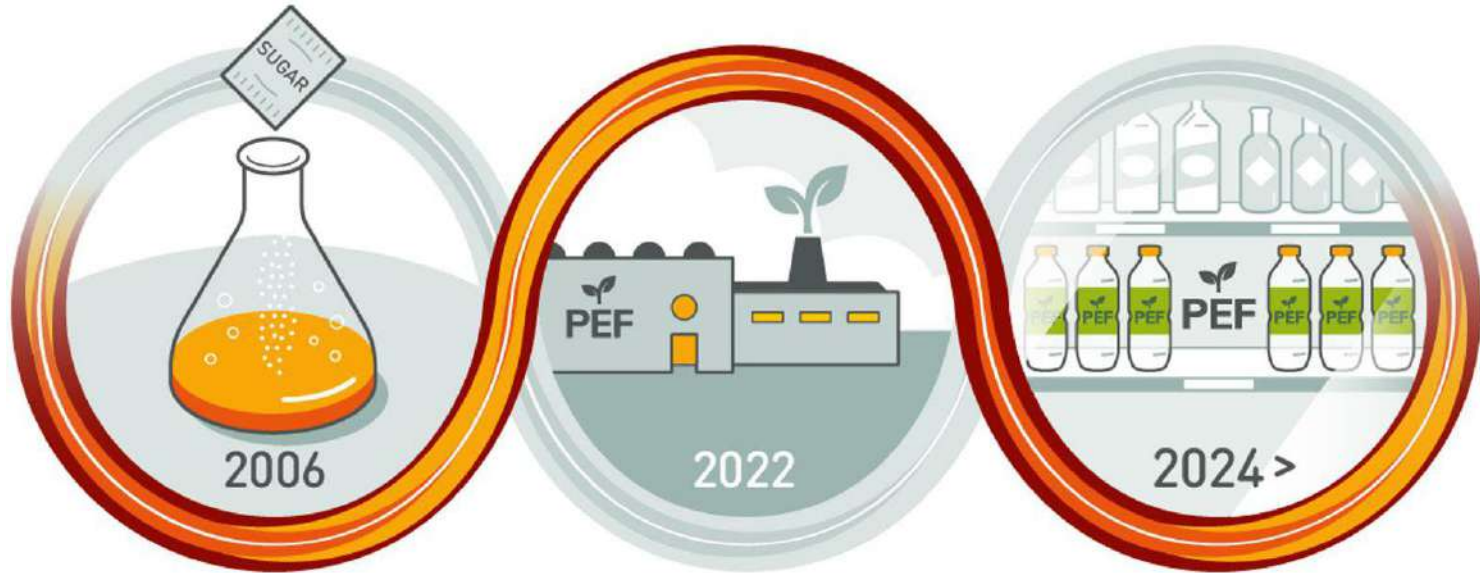
“Toyobo believes PEF is the only bio-based polymer which has superior properties compared to its closest fossil-based equivalent”



Major food & beverage brand owner



# Q&A





Thank you

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Refresco BV

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