KEIRYO PACKAGING SA

Maximizing materials efficiency for a better environment

The KP Mission

February 2019

About this document

This document has been created by Keiryo Packaging SA for the purpose of providing the reader with further detailed perspectives on the selected topic.

Although carefully established, the document does not seek to be complete or exhaustive on the selected topic.

The representatives of Keiryo Packaging are always available to provide further context and to enter into continued dialogue should this be desired. Please refer to the ‘About Us’ page on the website to find the appropriate contact details.

Meanwhile, enjoy the read and we are looking forward to be hearing from you.

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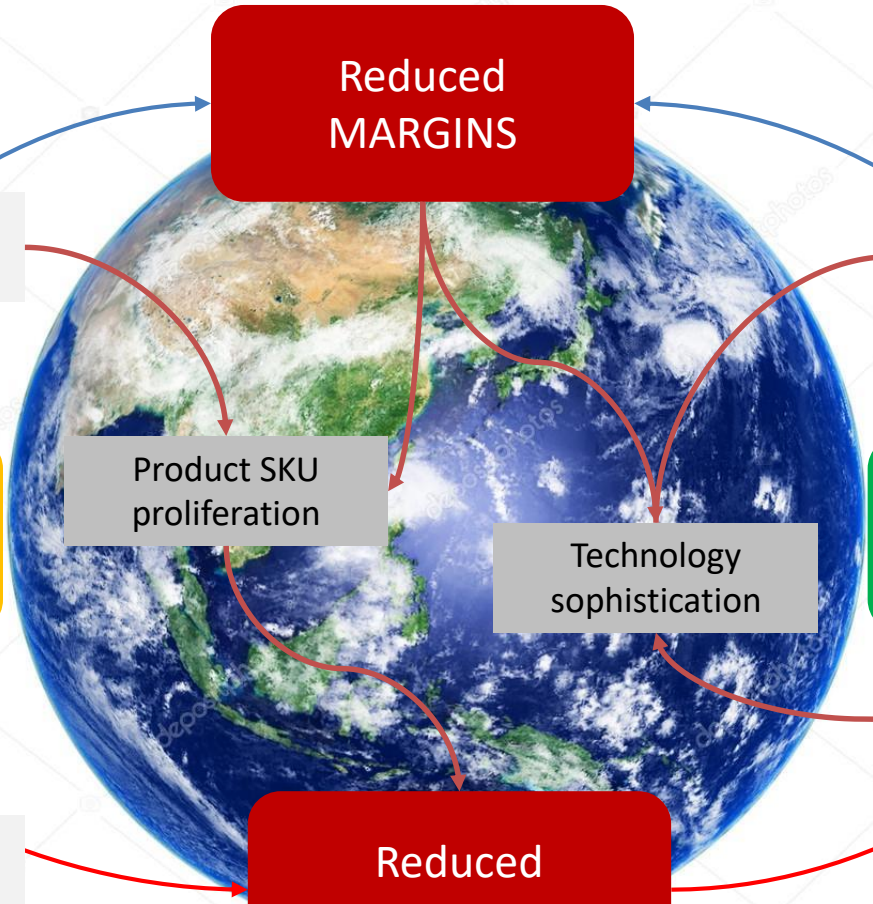
Redesigning plastic processing technology for improved environmental and economic sustainability

Starting reflection : the plastic supply chain is threatened in both its ecological and economic existence



Reduced MARGINS

Increased product commoditization

Systemically increased operating costs

Opex and/or Capex

Increased CONSUMPTION

Product SKU proliferation

Technology sophistication

Increased INNOVATION

PET :
15 MT (1964) -> 311 MT (2014)

Systemic innovation ?

Insufficient after-life value creation

Reduced SUSTAINABILITY

Various sustainability initiatives

Perception issues
Quality concerns
Lack of stable regulations
…

14% is collected for recycling
< 2% closed loop recycling

Reduce
Reuse
Transform

40 yrs of innovation has not made the plastic supply chain simpler, nor systemically longer lasting

All plastic supply chain constituents have engaged into various (competitive) sustainability improvement initiatives

1	Reduced material consumption	Plastic industry already has strong track record in raw material optimization. Opportunities for substantial further lightweighing are limited with conventional processing technology.
2	Increased use of food grade recyclates	Expansive utilization of food grade recyclates is impeded by (local) collection schemes, supply/demand competition, collapse of rude oil pricing and national regulatory restrictions.
3	Use of partially renewable source plastics	Offers higher cost opportunity for partial replacement of oil-derived components. Substantial investments required in building up supply capacity across the globe.
4	Use of fully renewable source plastics	Subject of ongoing R&D activities by several companies. Overall functional & recycling performance to be proven. High transition costs involved before stable supply will be reached.

Which systemic innovation will arise ?

REDUCE and **REUSE** should remain key focus area

How to extract more value from the conventional polymers

How to lower the adoption threshold for bio-polymers

Opportunity for transformational polymer processing technology boosting materials use efficiency

A transformational polymer processing technology needs to simultaneously accommodate both the ecological and economical challenges of the plastic industry

MOONSHOT INNOVATION

Mobilizing innovations that can scale across the system to redefine what is possible and create conditions for a new economy

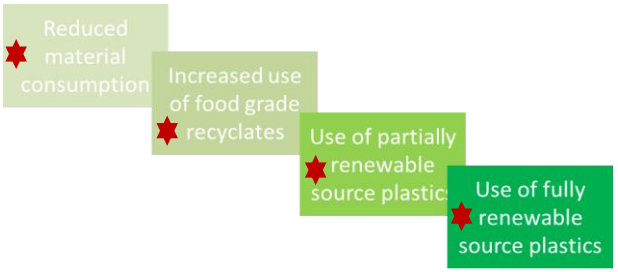
Key requirements for disruptive processing technology :

A. Create new industry margins and/or reallocate existing industry margins

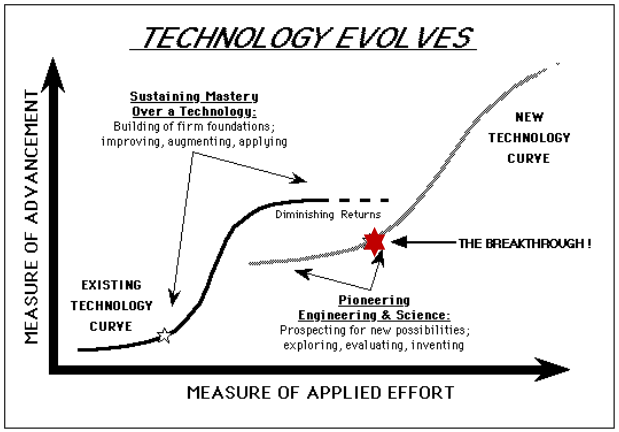
B. Enable global roll-out based on low capital requirements for technology conversion

C. Ensure non-competitive access to patent protected and proprietary know-how for all stakeholders

D. Rooted in cutting-edge, yet well-founded scientific frameworks of polymer rheology



Installing molecular polymer melt ordering



by application of the KP Technology

Redesigning plastic processing technology for improved environmental and economic sustainability

Opportunities

- **REDUCE** : substantial optimization in polymer consumption
  - *'the same with less'* or *'more with the same'*
  - *Reduce transition costs for partial or full bio-based polymers*
- **REUSE** : facilitate increased utilization of recyclates
- **CONVERGENCE** : polymer SKU reduction, creation of super-polymer
  - *Shift performance differentiation towards downstream process*

Scaling

- KP engaged into various **Technology Evaluation Agreements**
- Evaluating commercial opportunities for **Brand Owners** & **Resin Man.**
- Engagement of other plastic supply chain constituents

Pilot

- **Proof-of-Concept** established for **ISBM PET bottle** applications
- Potential for **strong systemic shift** has been demonstrated
- Strong **coherence** of experimental observations with scientific basis

Research & Development

- KP Technology has been **scientifically validated**
- Full **scientific narrative** for KP Technology has been established
- KP Products designed for application into **ISBM** and **Direct Injection**

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