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.
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.

- Increased CONSUMPTION
  - Increased product commoditization
  - Insufficient after-life value creation
  - PET: 15 MT (1964) -> 311 MT (2014)

- Reduced MARGINS
  - Systemically increased operating costs
  - Opex and/or Capex
  - Reduced sustainability
  - Insufficient after-life value creation

- Increased SUSTAINABILITY
  - Perception issues
  - Quality concerns
  - Lack of stable regulations...
  - 14% is collected for recycling
  - < 2% closed loop recycling

- Increased INNOVATION
  - Technology sophistication
  - Systemic innovation?

- Product SKU proliferation
- Technology sophistication

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 crude 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.

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

Technology evolves:

- **CKP Technology**
  - Understanding science
  - Developing technology
  - Building a foundation
  - Improving, augmenting, supplanting

- **New Technology Curve**
- **Growing EcoNP science**
- Profiting for new possibilities
- Improving, evaluating, testing

by application of the KP Technology
Redesigning plastic processing technology for improved environmental and economic sustainability

**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

**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

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

**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

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488, Route de Longwy, L-1940 Luxemburg (Luxemburg)
RCSL B 190 814
National Number 2014 2219 604