

**Taking A Step Forward**  
**polymer industry in the context of circular economy**

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# Agenda

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- **LyondellBasell at a glance**
- **Plastics use in context of legislation and market**
- **Quality Circular Polymers getting away with downcycling**
- **Advancing chemical recycling to molecular recycling**
- **Circular Economy driving joint actions**

# LyondellBasell is a strong, global company delivering outstanding performance

## LEADING<sup>(1)</sup>

World's largest licensor of polyolefin technologies.



Producer of **polypropylene compounds** globally  
Producer of **oxyfuels** in North America and Europe  
Producer of **polypropylene** in North America and Europe  
Producer of **polyethylene** in Europe

## DIVERSE



Many of our **materials** go into products that people use every day, such as food packaging, electronics, children's toys and fuels.

## GLOBAL



Every day, our **employees** work around the clock to safely **advance solutions** to our world's biggest challenges.

## GROWING



Increased U.S. ethylene capacity by **21%** since 2012  
Expanded polypropylene compounds capacity in **China, India** and **Europe**  
Building the first world-scale **Hyperzone HDPE plant** and world's largest **PO/TBA plant**  
Acquired A. Schulman, expanding our position in the **advanced polymers markets**

**One of the world's largest plastics, chemical and refining companies producing products and materials key to advancing solutions to modern challenges**

\* 2017 data as of December 31, 2017

# Our products are advancing a range of solutions in nearly every geography and sector of the economy



## Cleaner air & fuel efficiency

Stronger, lighter plastics support increased fuel efficiency



## Food safety & access

Food packaging and films that improve freshness, portability and extend shelf-life



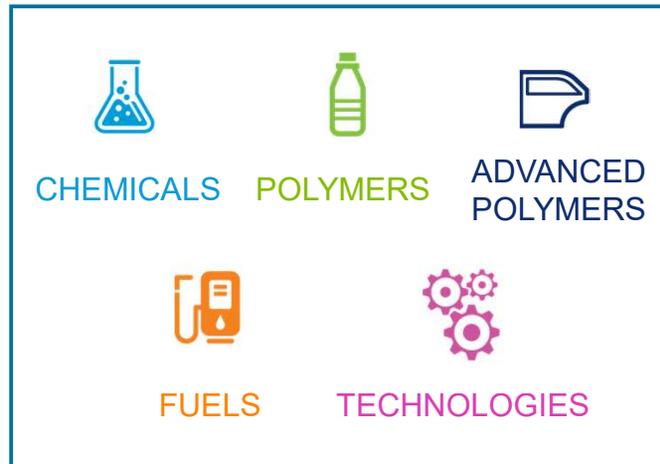
## Clean water

Stronger, longer-lasting pipes used in municipal water systems and key elements used in water filtration systems



## Sustainable & modern living

Materials that form components used in solar panels, wind turbines, children's toys, cosmetics, leak- and shatter-proof containers



## Agricultural efficiency

Lighter machinery, crop protection and soil conditioning improve efficiency in agroprocessing



## Quality healthcare

Improved medical supplies such as synthetic latex gloves, hand sanitizers, biohazard bags and pill coatings

# LyondellBasell: Advancing our growth strategy



Completion of our largest ethylene expansion to date in Corpus Christi, Texas.



Entered into JV with SUEZ to operate Quality Circular Polymers.



Expected completion of *Hyperzone* HDPE plant in La Porte, Texas.

2016

2018

2020

Began polypropylene compounding operations in Dalian, China.



Completed acquisition of A. Schulman Inc., creating the industry's largest compounding business.



Expected completion of PO / TBA project in Channelview, Texas.



# Advancing the circular economy

## Circular Economy

- In a circular economy, resources remain in use for as long as possible to extract their highest potential value
  - This means reusing materials and recycling plastics to prevent plastic waste from being sent to landfill or escaping into the environment



Source: European Commission

## Advancing the Circular Economy

- We recognize the importance of the circular economy and look for ways to apply circular economy principles in our business
  - Partnership with SUEZ
  - Researching into molecular recycling
  - Exploring the potential to manufacture products from alternative renewable sources
  - Present Developing solutions to eliminate plastic waste from the environment

# Plastics Are Important Base Materials

They help to solve many issues:



High Value Medical Applications



Protection of Beverages



Quality Materials for Higher Living Comfort

Increased Shelf Times of Food



Access to Clean Potable Water



Ligh Weight Parts for lower fuel consumption



# Key factors within the circular economy for plastics

## Legislation

### European Union

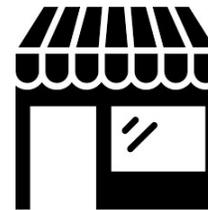
- 2018 EU Plastics Strategy
- Packaging Waste Directive: EU's 2030 recycling target of 55% for plastic packaging\*
- Directive targeting Single Use Plastic Products



## Markets

### Retailers, brand owners & consumers

- World Economic Forum Davos 2018: 11 companies working towards using 100% reusable, recyclable or compostable packaging by 2030
- Evolving consumer consciousness concerning waste and recycling

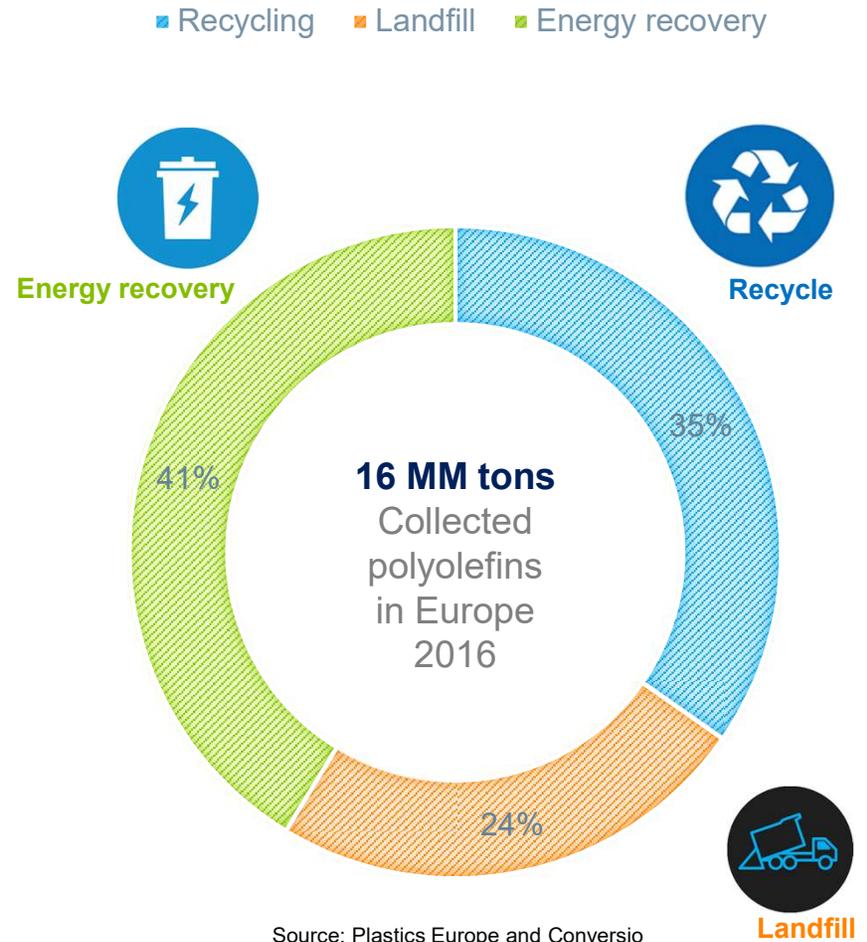


Legislators, brand owners, retailers and consumers are focused on circular solutions for plastics

# Advancing solutions to plastics waste

## Addressing plastics end-of-life

- Landfilling must be avoided
- Both mechanical and chemical recycling form part of the solution
- Recycling capacity needs to at least double, from present capacity
- Energy recovery plays a role as a transitional option, on the way to circularity with plastics



Using waste as a resource is key to becoming more resource efficient

## LyondellBasell approach to circularity



**QCP**  
**50 / 50**  
Joint Venture

suez lyondellbasell  
*Advancing Possible*

**Advance  
mechanical recycling  
through strategic  
partnership**



**MoReTec**  
*Advancing Chemical Recycling*

**Research  
Molecular Recycling  
possibilities**



**Value chain  
collaboration  
provides higher  
potential for  
circularity**

# LyondellBasell and SUEZ strategic partnership in Quality Circular Polymers (QCP) contributes to circular economy objectives



The joint business leverages the two partners' strengths

# Advancing mechanical recycling and delivering high quality circular products

## Producing high quality circular PP & HDPE

- 35kt production capacity planned
- Processing post-consumer plastic waste
- Integrated plant using leading technology ensuring high quality products

## High quality polypropylene and high density polyethylene:

- Cleaner products
- Enhancing Colors
- Odor treatment
- Consistent Quality

QCP

50 / 50  
Joint Venture



lyondellbasell  
Advancing Possible

Technology configuration offers high quality products

# LyondellBasell's new Circular HDPE product portfolio

High quality circular HDPE use in small blow molding applications:



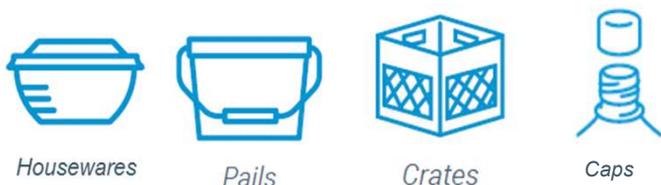
**Enlarging our HDPE portfolio with High Quality Circular Products**



Note: Hostalen QCP products are not approved for food contact

# LyondellBasell's new Circular PP product portfolio

High quality circular PP use in injection molding applications:



**Enlarging our PP product portfolio with High Quality Circular Products**



Note: Moplen QCP products are not approved for food contact

### Advancing molecular recycling innovation:

- **Unlock the potential of recycled plastics:**
  - Converting residual / mixed plastic waste (including multilayer and hybrid plastic materials) back to plastic feedstock
- **Provide solutions for all applications, removing all contamination**
  - Solution for food contact applications

### We invest resources into the evaluation of potential waste-to-cracker feeds for polyolefins production

- **New cooperation between LyondellBasell and Karlsruhe Institute of Technology (KIT) in Germany**
  - Focus of the venture is to develop a new catalyst and process technology to decompose post-consumer plastic waste
  - Building on thermochemical technology to match cracker requirements
  - Leveraging our leading competencies in catalyst and technology



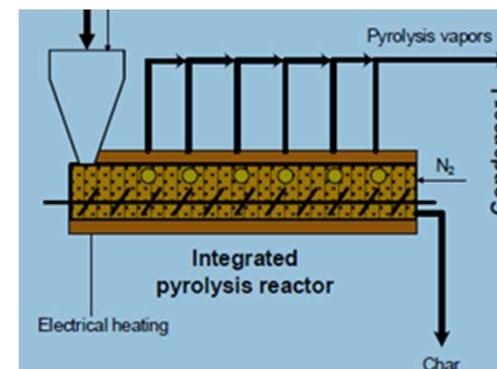
**KIT is one of the largest research and educational institutions globally**

# Chemical Recycling Roadmap

- **Evaluation of existing technologies operating at commercial level**
  - Plant visits in Europe, China and Japan
  - Evaluation of liquid hydrocarbons from depolymerization technologies as cracker feedstock
  - Raw material sorting is a key element of the technology package
- **Identify external expertise to partner with for pilot scale experiments**
  - Cooperation agreement with Karlsruhe Institute for Technology to develop processes in line with the requirements in our petrochemical processes
  - LyondellBasell's strong know-how on catalyst technology for chemical processes
- **Proof-of-concept: based on the results of external cooperations:**
  - process design for clean depolymerization
  - start-up of a semi-industrial plant



Source: LyondellBasell



Source: KIT ITC

# LyondellBasell is actively engaged with industry associations to deliver practical global solutions

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## Our trade association commitments

- **To achieve 100% re-use, recycling or recovery of all plastics packaging**
  - In Europe by 2040
  - In the United States by 2040
- **Operation Clean Sweep**
  - Zero pellet loss
- **Demonstrate and promote the sustainability of plastics**
  - Being part of the solution to plastics marine litter and pollution

## Our trade association commitments

- **Alliance to End Plastic Waste**
  - [Alliance to End Plastic Waste](#) (AEPW)



# A new global alliance to help end plastic waste

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Commitment to invest  
**\$1.5 Billion** over the next five years

# Proposed Alliance Strategic Pillars



## INFRASTRUCTURE

Catalyze investment in enhanced waste infrastructure to prevent plastic from reaching the environment



## INNOVATION

Innovate new sustainable materials, designs, technologies and business models based on sound science and economics



## EDUCATION

Engage and collaborate with governments, industry and consumers to drive effective solutions



## CLEAN UP

Develop solutions to address and clean up areas of existing plastic waste in the environment

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