

The SIBUR logo is displayed in a bold, teal, sans-serif font. It is positioned on the left side of the slide, partially overlapping a decorative graphic of a globe made of interconnected nodes and lines. The globe is rendered in a light blue/teal color and occupies the left half of the slide.

**SIBUR**

# Recycling for Blow Moulding

Webinar

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- ООО «СИБУР»

28<sup>th</sup> May 2021

# Personal introduction – Romain LUIJKX



**2006** - graduated from Faculté Polytechnique de Mons (BE)

**2006 to 2015** - various positions in Total R&D centre (BE)

- Product development HDPE, LLDPE
- New applications for PLA, PP
- Market development Flexible Packaging & Personal Care

**2015 to 2019** - various positions with Braskem (DE, BR)

- Technical service PE for Europe
- Product development PE, including all I'm Green PE
- Technical service Recycling

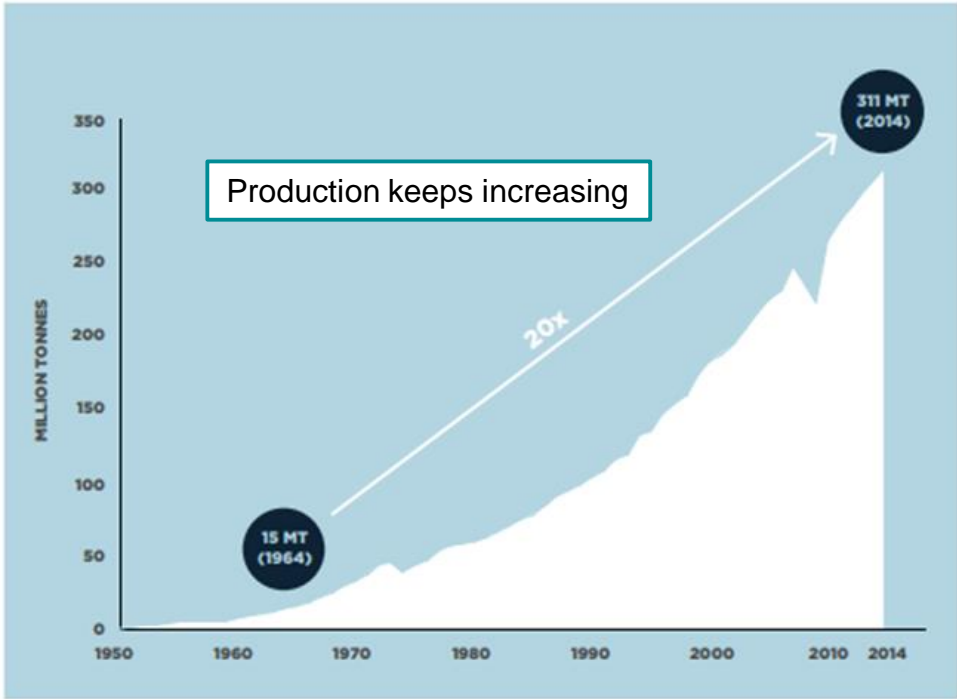
**Since 2019** - Technical service in Europe & internal specialist for Sibur

Areas of expertise relevant for this webinar:

Biopolymers, Synthetic Fibres, Mechanical Recycling of Polyolefins, Applications of Polyolefins

# Recycling of plastics

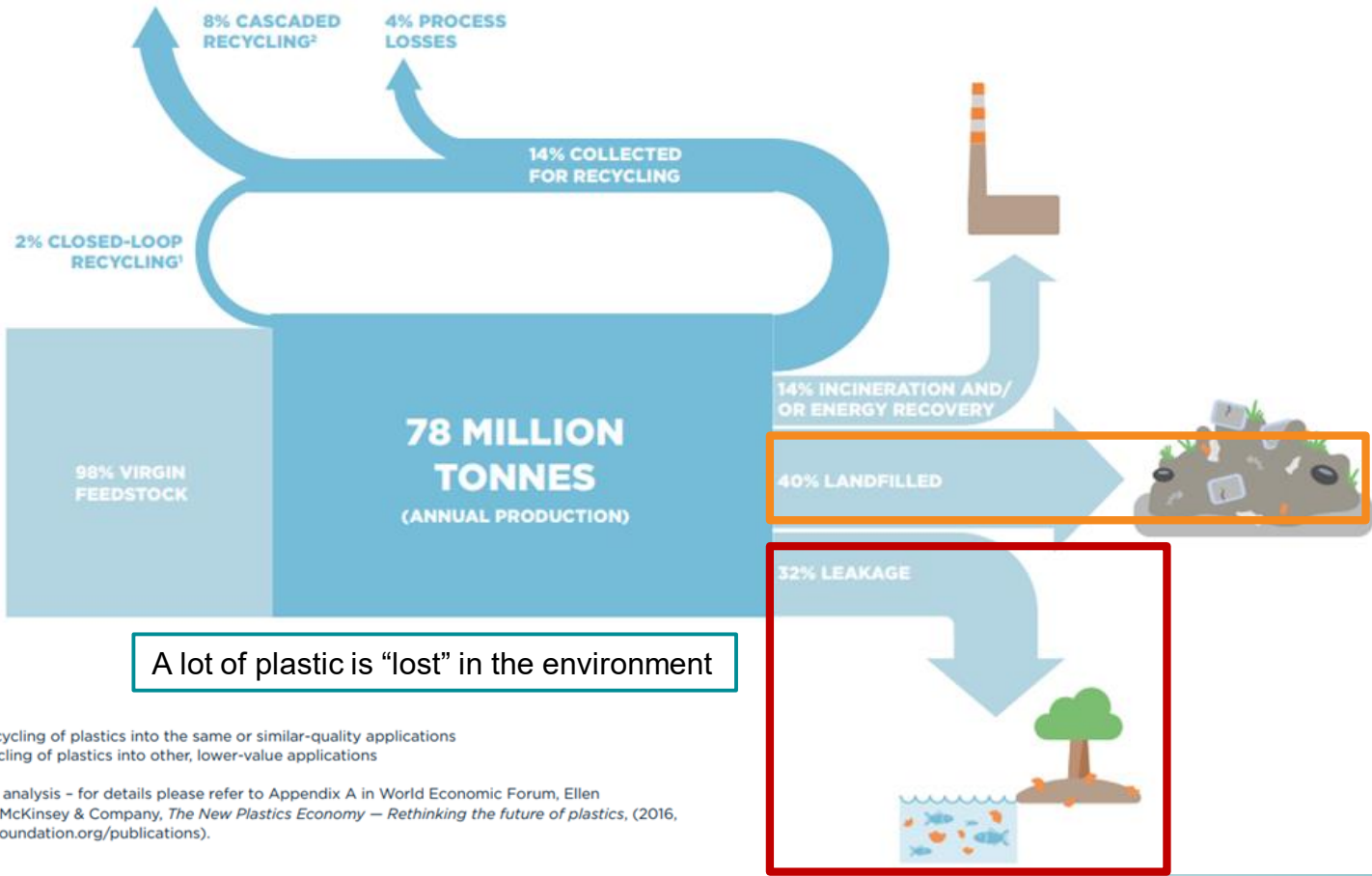
## Landscape



**Source:** PlasticsEurope, *Plastics - the Facts 2013* (2013); PlasticsEurope, *Plastics - the Facts 2015* (2015).

# Recycling of plastics

## Landscape

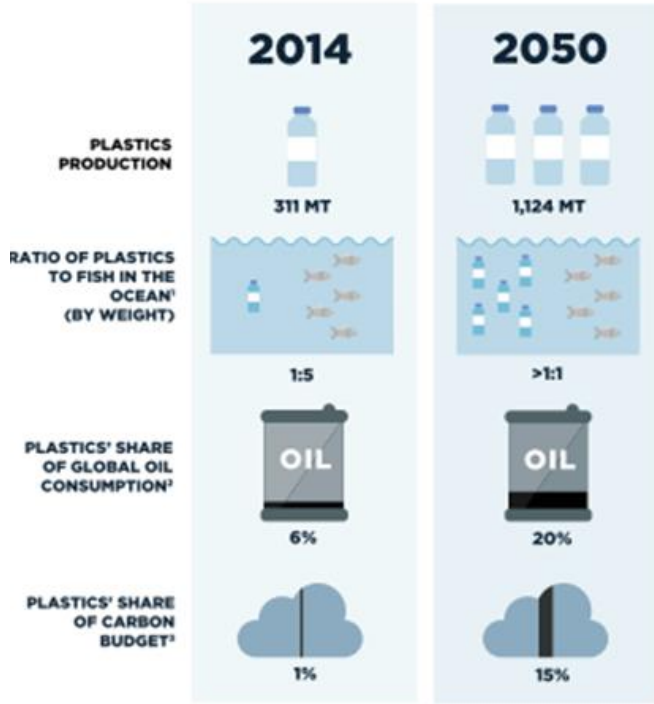


1 Closed-loop recycling: Recycling of plastics into the same or similar-quality applications  
2 Cascaded recycling: Recycling of plastics into other, lower-value applications

Source: Project Mainstream analysis – for details please refer to Appendix A in World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company, *The New Plastics Economy – Rethinking the future of plastics*, (2016, <http://www.ellenmacarthurfoundation.org/publications>).

# Recycling of plastics

## Landscape



1 Fish stocks are assumed to be constant (conservative assumption)

2 Total oil consumption expected to grow slower (0.5% p.a.) than plastics production (3.8% until 2030 then 3.5% to 2050)

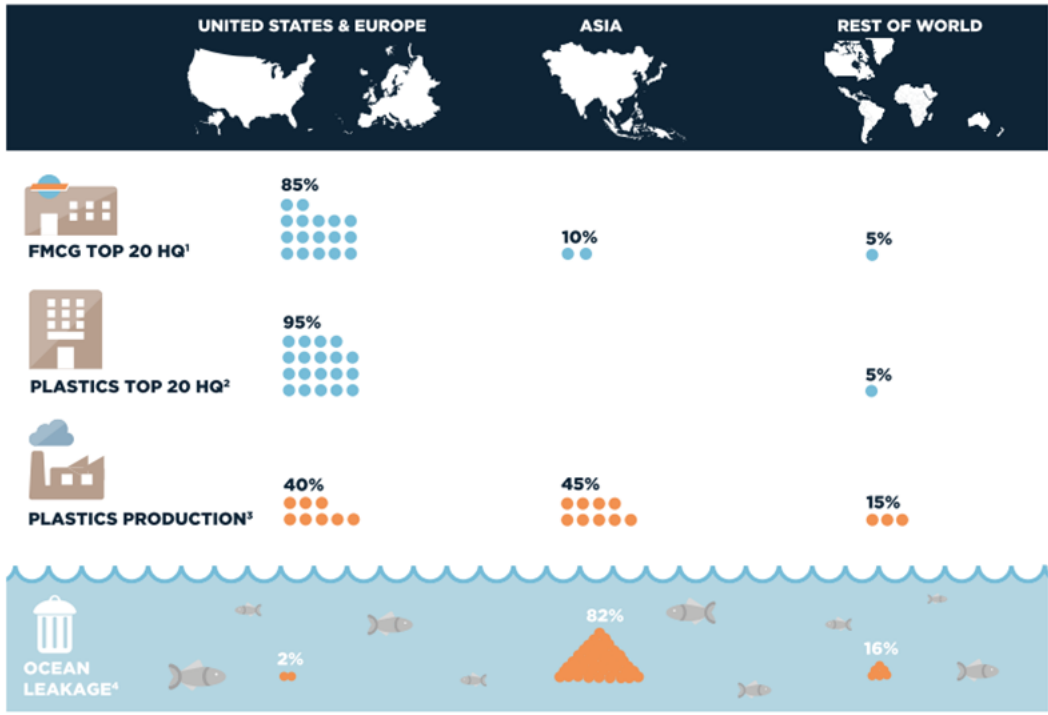
3 Carbon from plastics includes energy used in production and carbon released through incineration and/or energy recovery after-use. The latter is based on 14% incinerated and/or energy recovery in 2014 and 20% in 2050. Carbon budget based on 2 degrees scenario

**Source:** PlasticsEurope; ICIS Supply and Demand; IEA, *World Energy Outlook (2015)* (Global GDP projection 2013–2040 and Central 'New Policies' scenario oil demand projection 2014–2040, both assumed to continue to 2050); Ocean Conservancy and McKinsey Center for Business and Environment, *Stemming the Tide: Land-based strategies for a plastic-free ocean* (2015); J. R. Jambeck et al., *Plastic waste inputs from land into the ocean* (Science, 13 February 2015); J. Hopewell et al., *Plastics recycling: Challenges and opportunities* (Philosophical Transactions of the Royal Society B, 2009); IEA, *CO<sub>2</sub> emissions from fuel combustion* (2014); IEA, *World Energy Outlook Special Report: Energy and Climate Change* (2015); Carbon Tracker Initiative, *Unburnable Carbon* (2013).

More plastic than fish in the sea by 2050

# Recycling of plastics

## Landscape



Leaks are mostly in Asia, but decision centers are in the West

1 Headquarters of the global top 20 FMCG (Fast Moving Consumer Goods) companies (measured by 2014 global net sales)  
 2 Headquarters of the top 20 plastics and resin manufacturers (measured by 2015 global capacity)  
 3 Production of plastics material volumes (excluding thermoplastics and polyurethanes)  
 4 Source of plastics leaked into the oceans (proportion of the total global leakage measured in million tonnes of plastic marine debris leaked per year)

**Source:** PlasticsEurope, *Plastics – the Facts 2015* (2015); Statista; ICIS Supply and Demand; J. R. Jambeck et al., *Plastic waste inputs from land into the ocean* (Science, 13 February 2015).

# Recycling of plastics

## Media coverage

UN Declares War on Ocean Plastic <sup>1</sup>

A World Without Waste: The Coca-Cola Company announces ambitious global sustainable packaging goal <sup>10</sup>

Health of seabirds threatened as 90 per cent swallow plastic <sup>2</sup>

Compostable and edible packaging:<sup>11</sup> the companies waging war on plastic

PEOPLE POWER APPLIES PRESSURE IN PLASTIC DEBATE <sup>3</sup>  
NEWS • CURRENT AFFAIRS • 23.04.2018 • JESS BAALDIY

Unilever commits to 100% recyclable plastic packaging by 2025 <sup>12</sup>  
14/01/2017

From sea to plate: how plastic got into our fish <sup>4</sup>

Carrefour is the first French retailer to commit to “100% recyclable, reusable or compostable packaging” <sup>13</sup>

More plastic than fish in the sea by 2050, says Ellen MacArthur <sup>5</sup>

Amazon Device Support > Amazon Device Terms, Warranties, and Notices >  
Recycling Your Amazon Device <sup>14</sup>

EU declares war on plastic waste <sup>6</sup>  
Brussels targets single-use plastics in an urgent clean-up plan that aims to make all packaging reusable or recyclable by 2030

The world is scrambling now that China is refusing to be a trash dumping ground <sup>7</sup>

Nestlé aiming at 100% recyclable or reusable packaging by 2025 <sup>16</sup>

P&G To Increase Diaper Recycling Efforts <sup>15</sup>

ENVIRONMENT MAY 28, 2018 / 2:43 PM / 3 MONTHS AGO <sup>8</sup>  
EU moves to ban single-use plastics

The importance of the Circular Economy – why we should all be interested <sup>9</sup>

PepsiCo targets 50 percent rPET in plastic bottles across EU by 2030 <sup>17</sup>

1. InterPress Service, 2017; 2. Imperial College London, 2015; 3. Delano Website, 2018; 4. The Guardian, 2017; 5. The Guardian, 2016; 6. The Guardian, 2018; 7. CNBC Website, 2018; 8. Reuters, 2018; 9. Cambridge Network, 2018; 10. Coca-Cola Website, 2018; 11. The Guardian, 2016; 12. Unilever Website, 2017; 13. Carrefour Website, 2018; 14. Amazon Website, 2018; 15. Nonwovens Industry Website, 2017; 16. Nestle Press Release, 2018; 17. Alfa Editores Website, 2018.

# Recycling of plastics in Europe

## **Legal framework - EU 2019/904 “Single-Use Plastics Directive”**

- Ban of oxo-biodegradable plastics and expanded PS by 2021
- Ban of specific items: disposable kitchenware, cotton bud sticks, straws & stirrers, sticks for balloons by 2021
- Caps and lids attached to the container by 2024
- Measure to reduce consumption (tax) of beverage cups, takeaway and fast-food packaging by 2026
- Plastics recycling target: 25% by 2025, 50% by 2030
- Single-use bottle collection rate target: 77% by 2025, 90% by 2029
- Minimum rPET content in PET bottles: 25% by 2025, 30% by 2030

For food approval, so far no exception for recycled products

- USA: letter of non-objection from FDA
- Europe: positive opinion from EFS

As for virgin polymers

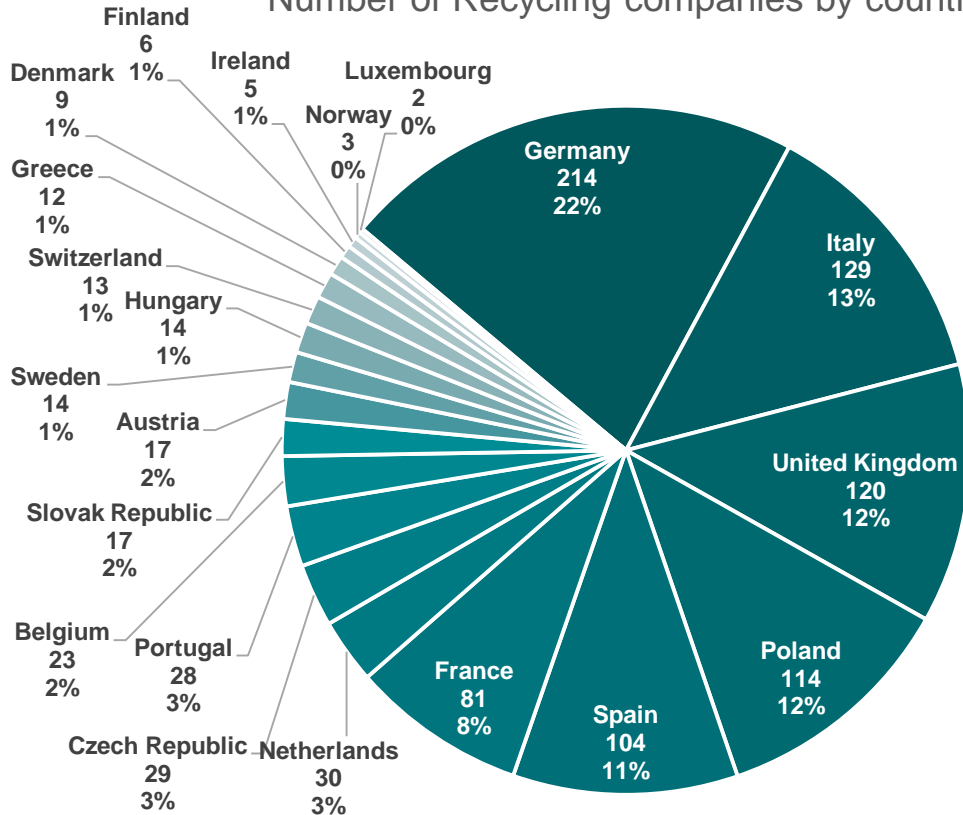


# Recycling of plastics in Europe

## Market situation

More than 1,000 recycling companies in Europe

Number of Recycling companies by country



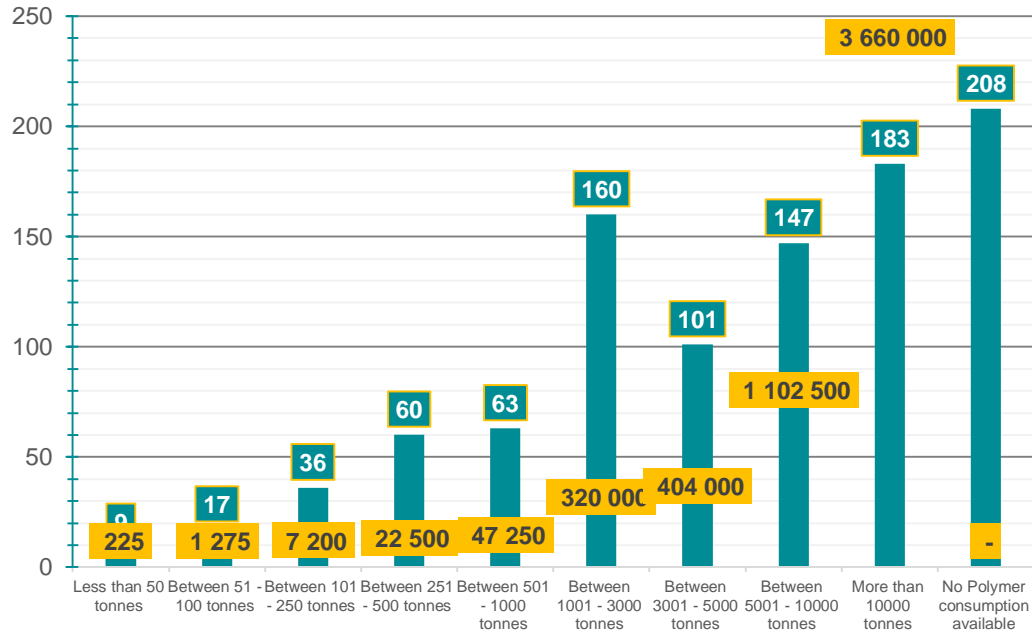
Source: AMI recycling database 2015

# Recycling of plastics in Europe

## Market situation

Most recycling companies are (very) small

Number of recycling companies and estimated total volume in tons, per company size



Source: AMI recycling database 2015

## State regulation of Russia: significant changes in the field of waste management

### Extended producers responsibility reform (EPR):

- Ensuring the collection of 100% packaging
- Focus on waste collection and treatment
- Recycling targets

by 2022

### Presidential Decree:

- Sorting 100% of MSW
- Reduce the amount of landfilled waste by 2 times

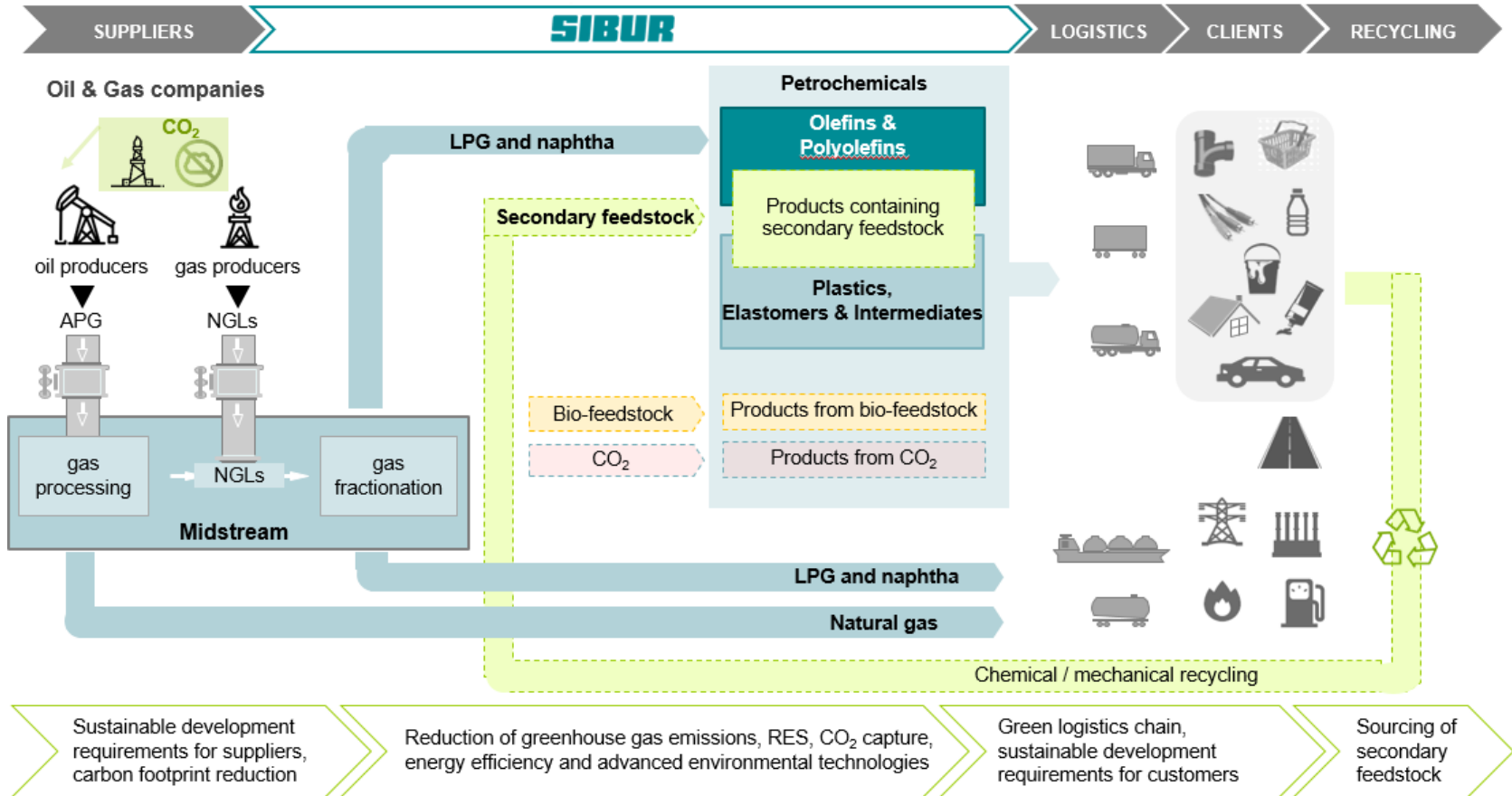
by 2030

### Use of recyclable materials:

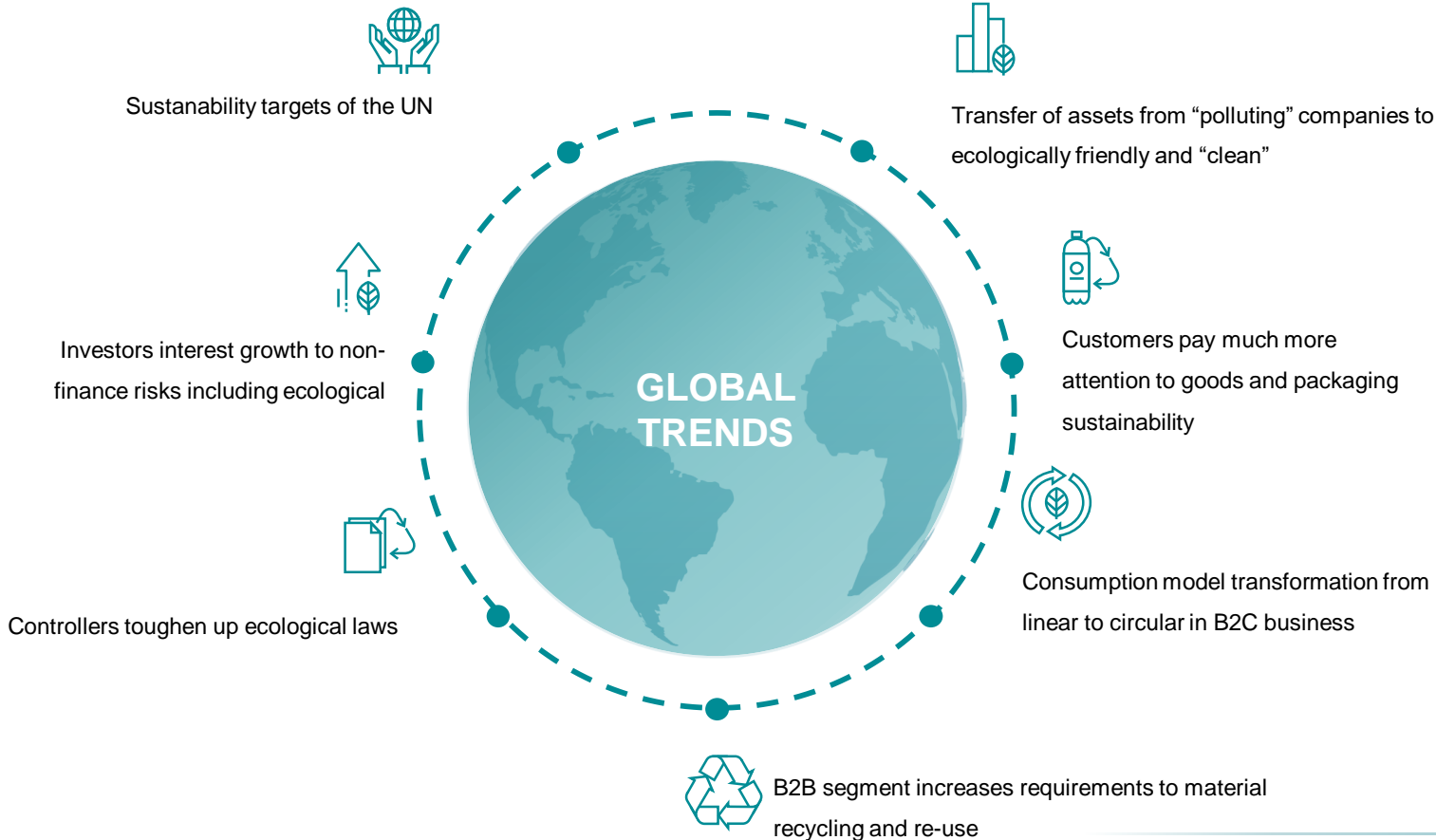
- Recycled content targets for packaging

by 2022

# WHAT IS SIBUR'S PERSPECTIVE ON CIRCULAR ECONOMY?

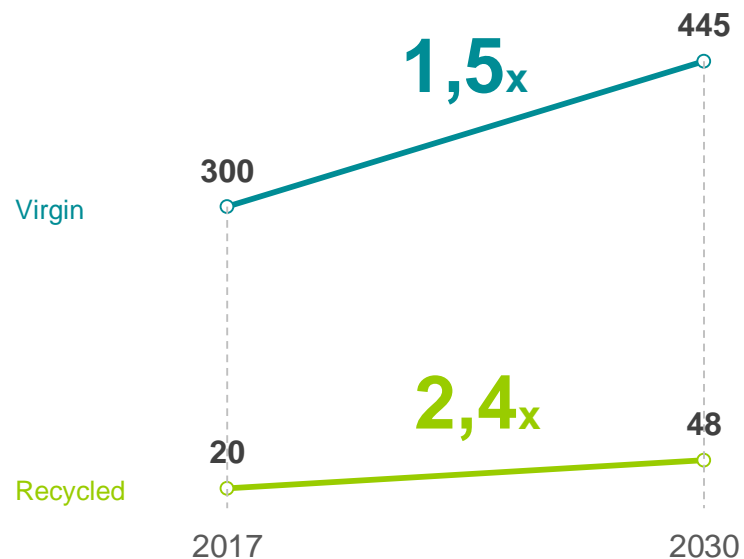


# Sustainability is a global trend



Global demand on recycled polymers will grow faster than for virgin during the short run. But absolute consumption still is not big

World demand growth for polymers, mio tonns



# International petrochemical companies respond to request from transnational leaders and governments for sustainable solutions

					
 <b>CHEMICAL RECYCLING</b>	✓	✓	✓	✓	 <i>under investigation</i>
 <b>RENEWABLE RAW</b>	✓	✓	✓	✓	 <i>under investigation</i>
 <b>COMPOUNDS</b>	✓		✓	✓	✓
 <b>RECYCLED PELLETS</b> (integration into waste management system)		✓			
 <b>«MODIFIATORS»</b> for recycled polymer properties improvement				✓	

# Advantages and disadvantages of different sustainable solutions

	Price	Quality	Availability	Special aspects
 <b>CHEMICAL RECYCLING</b>	XXX	XXX	X	<ul style="list-style-type: none"> <li>No technology available for scale application</li> <li>Almost same quality as virgin polymer</li> </ul>
 <b>RECYCLED RAW</b>	X	X	XX	<ul style="list-style-type: none"> <li>Low quality in average</li> <li>Wide spread of properties among suppliers and each supply</li> </ul>
 <b>COMPOUNDS</b>	XX	XX	XX	<ul style="list-style-type: none"> <li>Balanced properties of blend</li> <li>Processing without significant change of process condition</li> </ul>
 <b>RENEWABLE RAW</b>	XXX	XXX	X	<ul style="list-style-type: none"> <li>Raw sources are limited</li> <li>Possible competition with food application</li> </ul>





# SIBUR CIRCULAR ECONOMY PROJECTS

	Project description	Progress
Mechanical recycling	PET resin with recycled content	The project is under implementation. Modernization of the POLYEF plant by Q1 2022 (~25% PCR content)
	Special HDPE/ PP resin grades with recycled content for blow molding, injection molding and special applications	<ul style="list-style-type: none"> <li>✓ Clients demand assessment</li> <li>✓ PCR feedstock identification</li> <li>➤ Contract processing resin with recycled material content</li> <li>➤ Formulation development in R&amp;D Center SIBUR PolyLab</li> <li>➤ External tests</li> </ul>
	Special LDPE/ HDPE resin grades with recycled content for flexible packaging of non-food products	
	Internal project: FFS packaging for SIBUR products made with PCR recycled material	Second stage of trials at Tomsk
Chemical recycling	Pyrolysis of mixed plastic waste to provide recycled petrochemical feedstock	<ul style="list-style-type: none"> <li>✓ PCR feedstock secured</li> <li>✓ Potential partners in Russia identified</li> <li>➤ Complex R&amp;D program</li> <li>➤ Technology providers assessment</li> </ul>
	Chemical recycling of PET – production of virgin-quality PET resin from low-quality feedstock	Exploring the potential of technology

# Projects within mechanical processing technology for recycled products

RESPONSIBLE APPLICATIONS		SECONDARY PACKAGING			OTHER APPLICATIONS	
<b>EXTRUSION BLOW MOLDING GOODS</b> (Cans, bottles)	<b>INJECTION MOLDING GOODS</b> (Boxes, pails)	<b>SHRINK FILM</b> holds together the individual units of a good	<b>INTRA-FACTORY PACKAGING</b> (crates, containers, pallets)	<b>PACKAGING FOR RAW MATERIAL</b> (FFS-bags, raffia bags)	<b>CONSTRUCTION MATERIALS</b> different examples	<b>INTRA-COMPANY GOODS</b> (Stationery, office supplies, furniture and decorations)

EXAMPLE OF THE PRODUCT							
DEVELOPED RECIPE	✓	✓	✓	✓	✓	✓	✓
PROCESSING PARTNER	✓	✓	✓	✓	✓	✓	✓

# Sustainable Packaging: Cans/bottles

## PROCESSING METHOD - EXTRUSION BLOW MOLDING

## TARGET: TO DEVELOPE A NEW "GREEN" rHDPE GRADE

% PCR content: rHDPE 25%

COLOR: white/grey

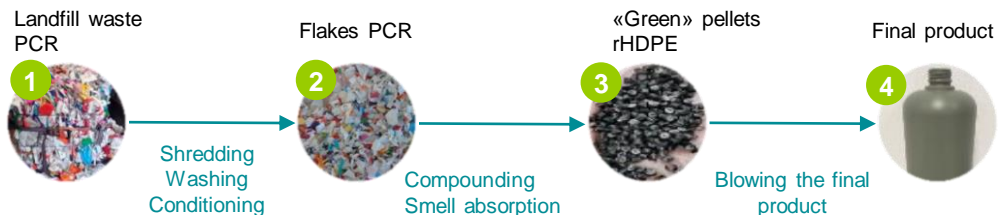
PRODUCTS : Cans, bottles with screw-on cap

POLYMER BASE : bimodal polyethylene PE HD 03580 SB

## SPECIFICATION

Property / Parameter	Typical test method		rHDPE-BM-25
	ISO	ASTM	
Density	1183	D 792	0,960
Melt flow rate (MFR) g/10min, 190°C, 2,16kg	1133	D 1238	0,3
Pellet Size (average)			3-4
Flex Modulus	178	D 790	1330
Tensile Strength @ Yield	527	D 638	22,7
Impact Strength	180	D 256	9,4
Ash Content	3451-1		0,36
Polypropylene content			<5
Filtration (Melt Screen Size)	micron	micron	<250
Foreign bodies (wood, plastics, metal, etc...)	Visual inspection		no

## PRODUCT CREATION CHAIN (NATURAL GRAY BOTTLE )



## EXAMPLES IMPLEMENTED BUSINESS CASE

- Flacons for liquid household chemicals and shampoos
- Jars for household needs and dry household chemicals

## FEEDBACK FROM PROCESSORS

### FINAL PRODUCTS FROM rHDPE SIBUR MEET TECHNICAL SPECIFICATIONS

Geometric parameters	✓
Top load resistance	✓
Drop test	✓
Impermeability	✓

# Applications of PCR plastics

## Examples

### Alpla moves into HDPE recycling in Spain

Packaging major Alpla has acquired Spanish recyclers Suminco and Replacal, expanding its recycling activities from PET to polyolefins. Alpla has not disclosed financial terms of the deal.

The group operates two PET recycling plants in Austria and Poland, under the PET Recycling Team name, along with joint ventures in Mexico and Germany. These operations currently have an annual capacity of 70,000 tonnes.

Its new acquisitions in Spain mark Alpla's first move into recycling HDPE, another large-scale rigid packaging material. In the UK market, Alpla currently uses 13,000 tpa of recycled HDPE in its production of milk and juice bottles.

"The investment in the two recycling plants in Spain brings us one step closer to our overall goal of being the leading manufacturer of sustainable plastic packaging," said Georg Lässer, Head of Recycling at Alpla. Suminco, located in



Alpla uses rHDPE in its milk bottle production for the UK market

Montcada (near Barcelona), and Replacal in Palencia (north of Madrid), have 50 employees in total and will continue to operate under the existing management. Their joint annual capacity will be expanded to 35,000 tonnes, said Alpla. The companies' rHDPE production has mainly been used in corrugated pipes for sewage and rainwater and other special pipes.

Alpla said it now intends to use suitable recyclates from the operations for packaging production. "We are safeguarding our production plants' material supply and are doing our bit to

achieve a functioning circular economy," said Lässer.

Suminco and Replacal's former owner Jose Peruga said: "The strong and recognised quality of our products in post-consumer recycling for more than three decades together with the synergies that will be created with Alpla will allow us to improve the quality of our products even more. And Alpla can produce HDPE packaging with a high content of recycled post-consumer material, as their customers and consumers demand."

> [www.alpla.com](http://www.alpla.com)  
> [www.suminco.com](http://www.suminco.com)

35 kt/y HDPE in SP  
+ 13 kt/y in UK  
+ 70 kt/y PET in AT, PL

### All-HDPE toothpaste tube is launched

Colgate-Palmolive aims to switch from non-recyclable laminate tubes

PHOTO: COLGATE-PALMOLIVE



Colgate-Palmolive has begun roll-out of a new recyclable toothpaste tube, replacing laminate versions. The tube meets recyclability standards set by the Association of Plastic Recyclers.

The all-HDPE tube for Antiplaque & Whitening toothpaste under the company's Tom's of Maine brand is now appearing in US stores. The Tom's brand will complete the switch in 2020, when the Colgate brand will start the transition in Europe and North America.

By 2025, the company expects to complete modifications to tube-making equipment at more than a dozen of its facilities around the world.

Colgate-Palmolive said it is sharing details of its technology, including information subject to Colgate patent applications, and is engaging with packaging and recycling stakeholders, to build awareness and acceptance of the tube.

> [www.colgatepalmolive.com](http://www.colgatepalmolive.com)

All-HDPE tube is easier to recycle

### Henkel turns to rHDPE content

Brand owner Henkel says all the bottles for its Perwoll detergent brand in Western Europe now contain 25% PCR HDPE. Henkel's recycling partner is Alpla Packaging.

"This is a great achievement - and a starting point to move further: we are already working on expanding the usage this recycled material also in other categories," said Vineet Varman, Head of International Packaging Development for Special Detergents at Henkel.

For the black bottle of



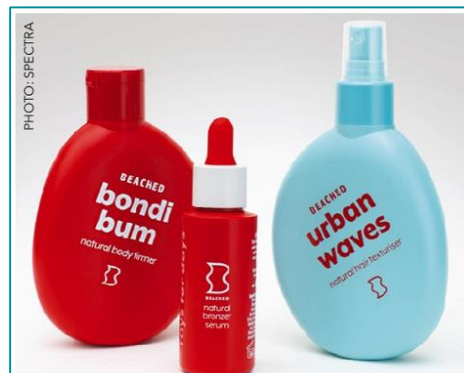
Detergent bottles in Western Europe now contain 25% PCR HDPE

Perwoll's Renew & Repair variant, a black colorant was used that is not based on carbon black, in order that when the bottles enter the

waste stream they can be detected by near-infrared sorting systems at recycling facilities.

> [www.henkel.com](http://www.henkel.com)

25% rHDPE detergent bottles



Above: Spectra Packaging has recently created packs for the Beached range of face, body and hair products using 100% PCR HDPE

Spectra Packaging has recently created new packs for the Beached range of face, body and hair products using 100% PCR HDPE. The Australian brand's packaging has been designed for a more natural look, incorporating an ergonomic pebble-like profile. The company says that the design illustrates what can be achieved with extrusion blow moulding. As well as the flexibility to achieve complex shapes, extrusion blow moulding is also well suited for using high levels of recycled materials. Beached chose to take full advantage of this benefit by using 100% PCR content.

100% rHDPE cosmetic packaging

# Applications of PCR plastics

## Examples

### Roll-out of rPET mineral water bottles

**Alpa** has shown that when the feedstock is of the right quality, even such critical items of packaging as mineral water bottles can be made from mechanically recycled rPET.

With a more than 40% share of the market, **Vöslauer** is Austria's number one mineral water. The family-owned group founded its own recycling company called PET to PET in 2006 together with four other Austrian beverage manufacturers. It launched Austria's first beverage bottles made of 100% rPET in October 2018. There have been 100% rPET bottles for mineral water from Vöslauer in Germany since the beginning of 2019. The plan is now to switch all of its PET bottles to sustainable materials as quickly as possible.

The preforms for Vöslauer's PET mineral water bottles are produced at the Alpa plant in Steinabrüttl, Lower Austria. The proportion of rPET used is being steadily increased. "In 2018, we had a recycle rate proportion of 60%," says Vöslauer Managing Director Herbert Schlossnikl. Werner Rosenberger, who manages the Alpa plant, adds: "We had our first Vöslauer bottle made entirely using recycled PET bottles back in 2011. But at that time, the quality of the raw material wasn't sufficient for us to achieve a consistent colour."

**Vöslauer bottles with "ohne" on the label are made in 100% rPET**



100% rPET water bottles

### Werner & Mertz boosts recycling in Germany

Home cleaning products company Werner & Mertz has invested €30m in a new production building in Mainz, Germany, which will enhance its use of recycled PET in its packaging. The group said that from 2016 to 2018, revenue for its Frosch brand products grew by 21% and its market share by 14%. The investment in the new production centre will allow Werner & Mertz to keep up with the growing demand. When all stages of the expansion are completed, Frosch production can be doubled.

Rigid packaging manufacturer Alpa has for years produced the transparent Frosch bottles made of 100% recycled plastic on the Werner & Mertz premises, and is also moving into the new building. Up to May 2019, 266 million PET bottles of 100% recycled



Recycled PET is used in Frosch brand bottles

post-consumer plastic had been manufactured and filled in Mainz.

"With the construction of the new production centre, we are creating the world's largest recycle bottle production," said Werner & Mertz owner Reinhard Schneider.

Gunther Lehner, owner of Alpa Werke Alwin Lehner,

said: "We are very pleased about the many years of close cooperation with Werner & Mertz. For ultra-modern and efficient packaging manufacturing in the new production centre, we have invested €13m."

The new building has many sustainability features. > [www.werner-mertz.de](http://www.werner-mertz.de) > [www.alpa.com](http://www.alpa.com)

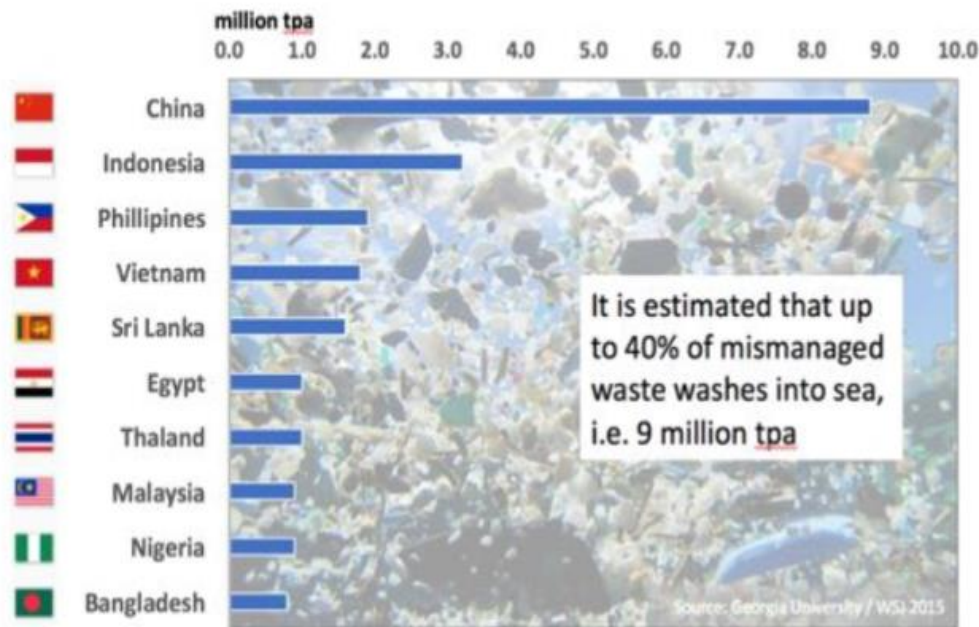
100% rPET detergent bottles

Questions?

# Appendix



# Marine plastic litter: 8 countries in Asia account for 75% of plastic waste washed into the oceans



- India, despite its 1.3bn people, falls outside the top ten thanks to armies of rag pickers, although this statistic is being challenged
- Only China could afford Western-style waste management in the near future