

Shedding Light on Plastic Recycling

**Opportunities to unlock additional
momentum**

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With you today



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Agenda

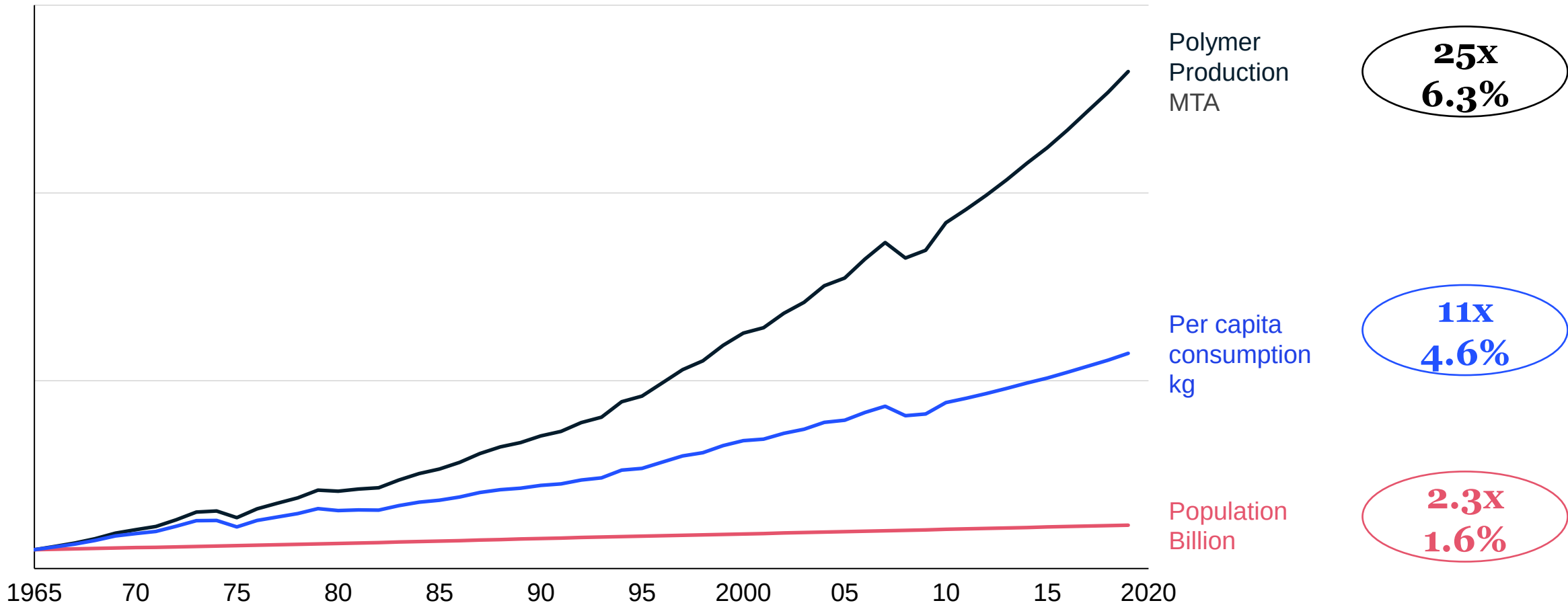
Plastic recycling – view on the current momentum

Establishing a granular and reliable fact base

Roadmap for moving forward

Long-term plastics growth has been extraordinary in particular driven by its ability to serve a growing number of applications

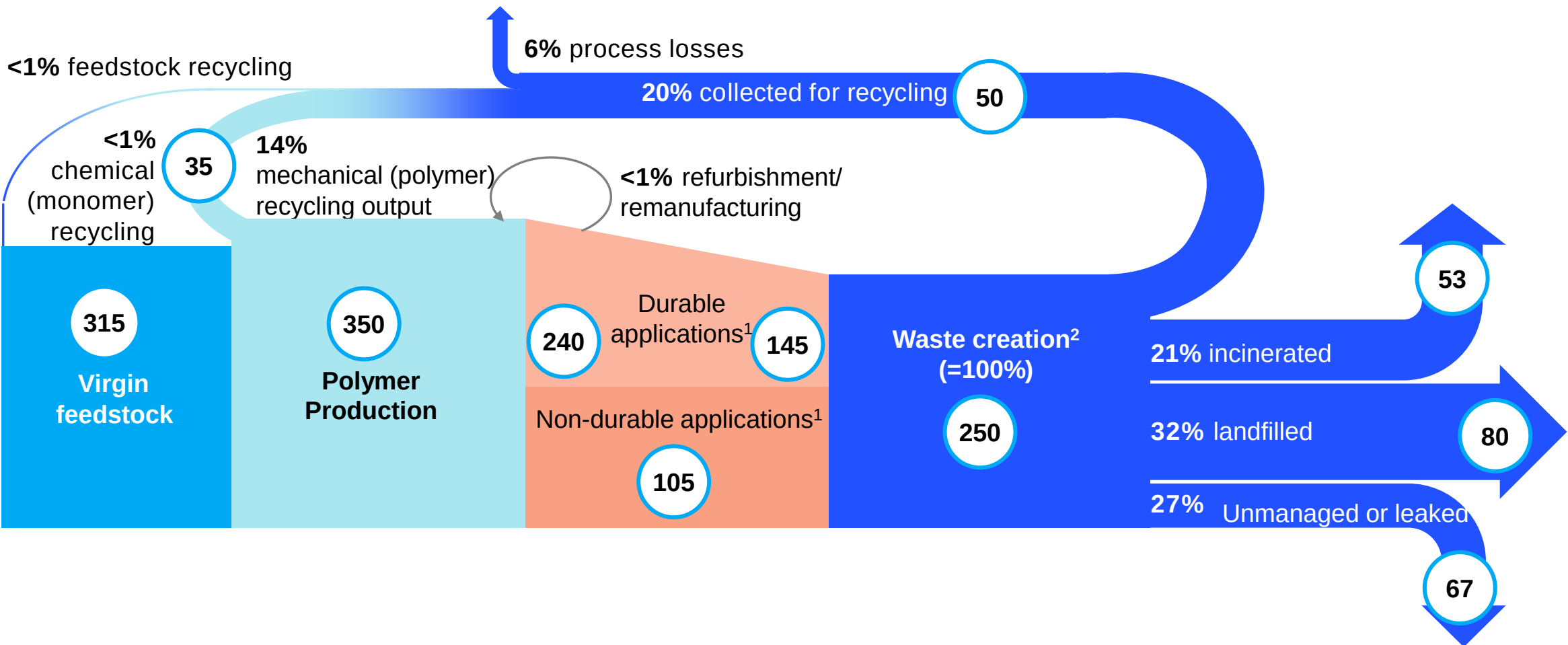
INDEXED TO 1965, MULTIPLES and % CAGR



Source: Geyer et al 2017, Worldometers, Plastics Europe, McKinsey analysis

Management of plastics waste has not kept up with the accelerated growth of plastic demand

Global polymer flows 2018, MTA



1. Durable applications with an average lifetime >1year will end up as waste only in later years, non-durable applications go straight to waste
2. 150 MT mixed plastic waste from nondurable applications that end up as waste in same year plus 110 MT of mixed plastic waste from production in previous years

1: Consumers around the world disagree on what packaging is most sustainable, but agree on the least sustainable options.

How sustainable do you think each of these packaging types is?

Packaging substrates ranked by number of respondents who indicated “extremely” or “very” strong.

 Ranked top 3  Ranked lowest 3

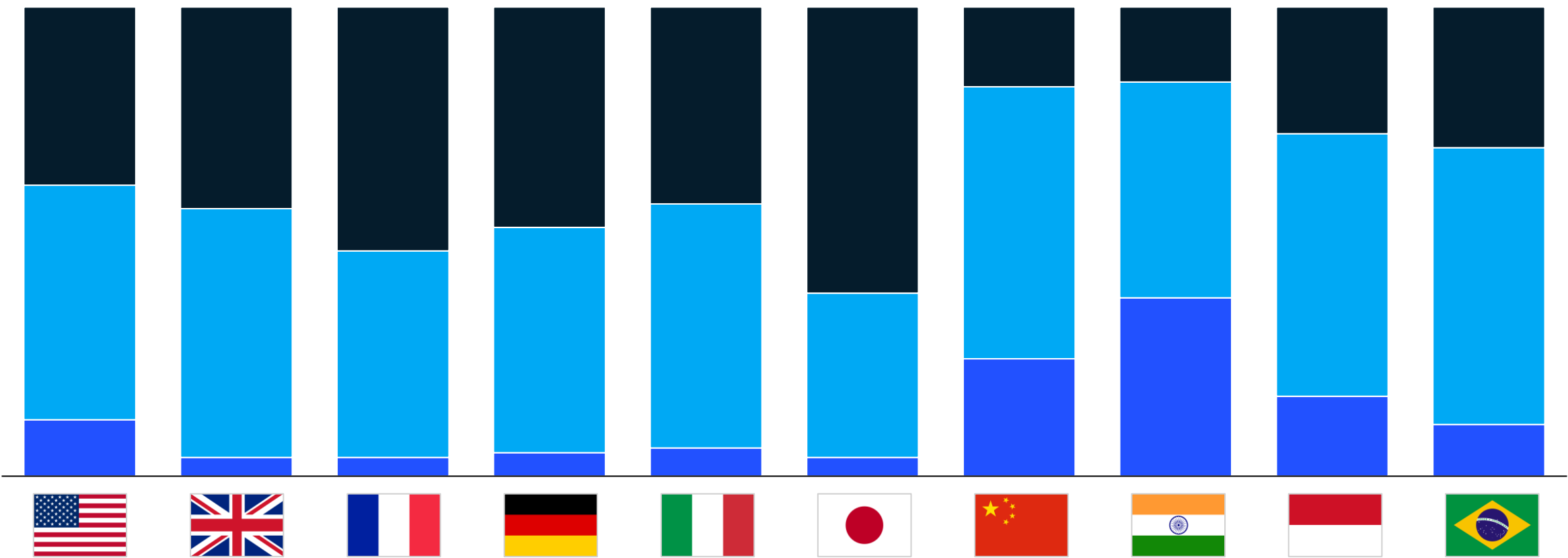
										
Paper-based cartons	1	2	4	3	3	4	4	1	4	5
Glass bottles and jars	2	1	1	1	1	6	6	3	7	7
Plastic films made from renewable raw materials that can be compostable	3	4	2	2	2	1	1	4	1	1
Flexible paper	4	3	5	4	6	5	5	2	5	6
Plastic bottles and containers that are fully recyclable	5	5	3	6	4	2	2	5	2	3
Plastic films that are fully recyclable	6	7	6	5	5	3	3	6	3	2
Metal containers	7	6	7	8	8	8	8	7	8	8
Plastic bottles and containers made from recycled plastic materials	8	8	8	7	7	7	7	9	6	4
Aluminum foil wraps	9	9	9	9	9	9	10	8	9	9
Packaging combining plastic, paper, and aluminium foil	10	10	10	10	10	10	9	10	10	10

1: In most countries, a majority of customers claims to be willing to pay more for sustainable packaging

Packaged Food Example

Willing to pay a lot more little more Not willing to pay more

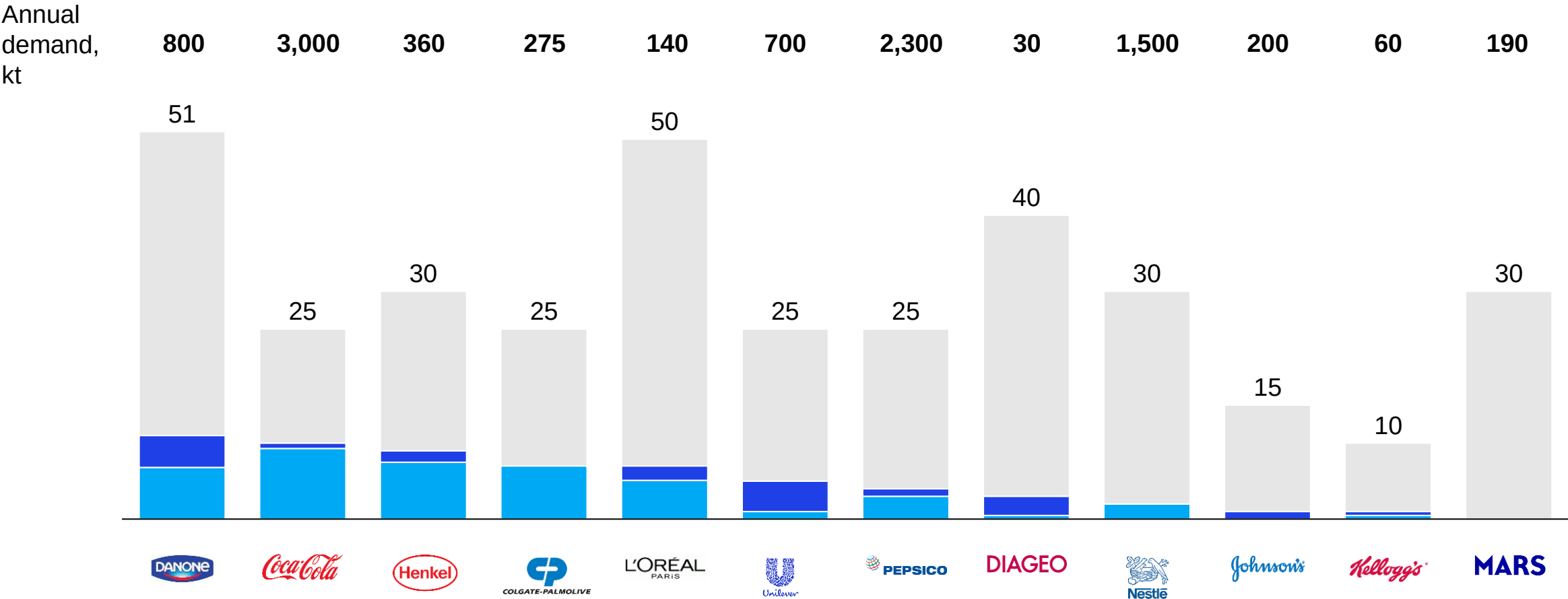
To what extent would you be willing to pay more for sustainable packaging for the following product categories:
Packaged food?



2. Achieving high ambition set by customer is a significant challenge – primarily due lack of available materials

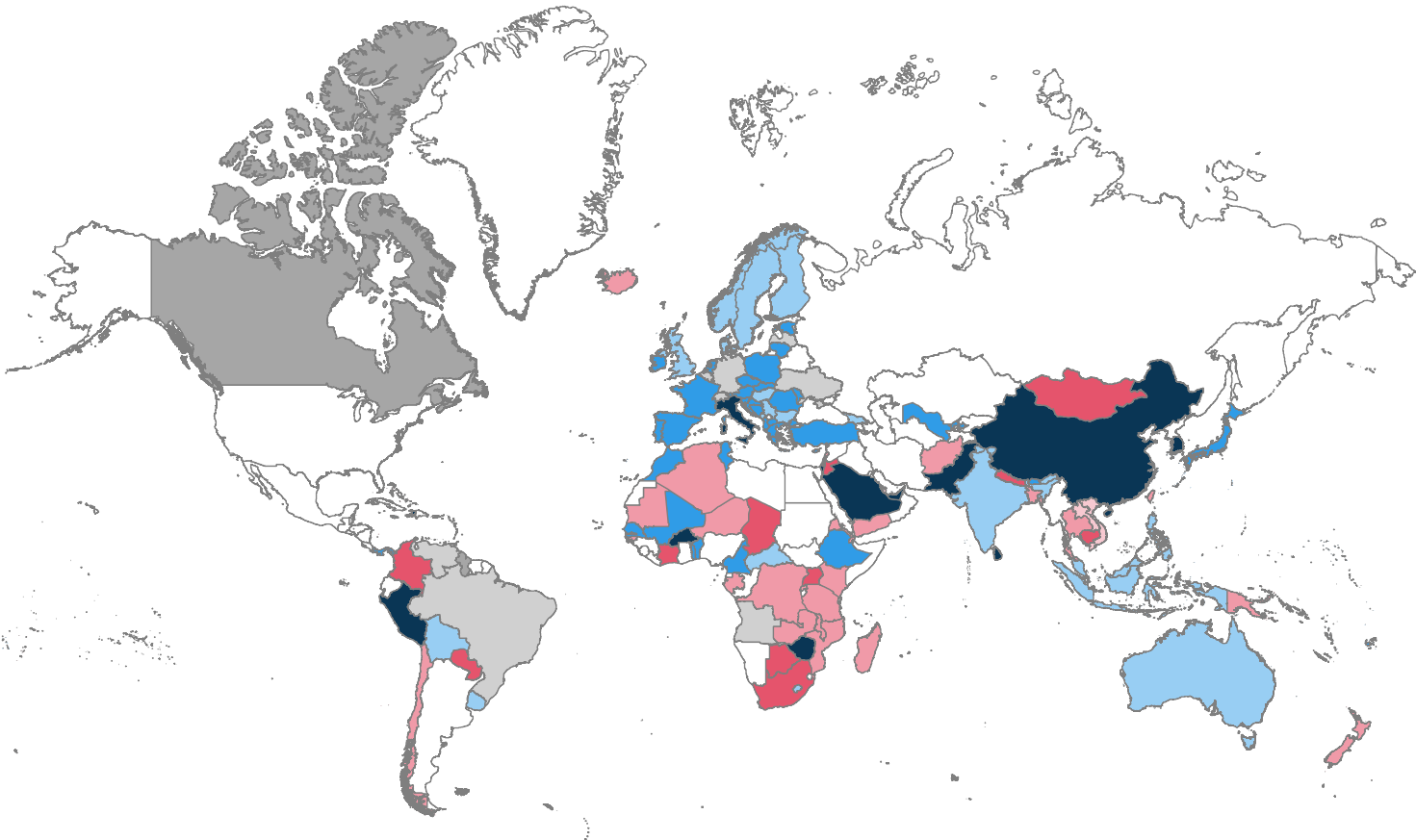
CPG's 2019 recycled content and 2025 targets

Target 2025 2019 incremental 2018 actual



3: Initially, majority of countries implemented plastic bag or single use plastic legislation to help address end of life challenges

Not exhaustive



Number of countries with plastic legislation

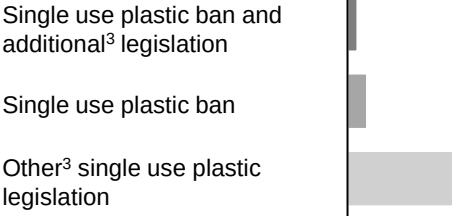
Plastic bag & single use plastic legislation



Plastic bag legislation only



Single use plastic legislation only



Total: 140

1. Plastic bag bans include bans on retail distribution (with and without levy), manufacturing, import and various combinations thereof
2. Single use plastic ban include bans on free distribution (with and without levy), manufacturing, import and various combinations thereof
3. other/additional single use plastic legislation includes taxes, EPR schemes and recycling mandates (requirements, targets or financial incentives)
4. other/additional plastic bag legislation includes taxes, levies (charges to consumers), EPR schemes and recycling mandates

4: Chemical industry with increasing activity but unclear is keeping up with growth in virgin production

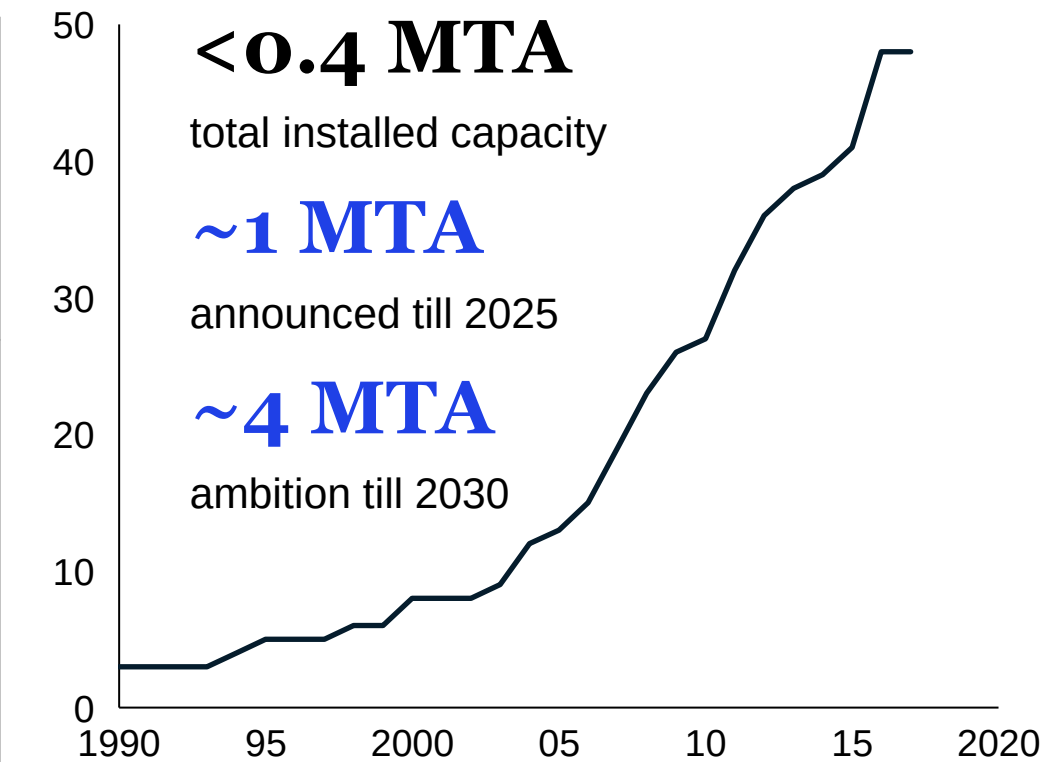
As of Jan 2021
Estimates

Recycling / Renewable performance of selected PE competitors Europe

	 BOREALIS	 ExxonMobil	 Dow	 lyondellbasell	 ساساب sasab
Mechanical	✓		✓	✓	
Chemical	✓	○	✓	○	✓
Renewables	○		○	✓	
Circular aspiration 2025 – 2030 ¹	7%+			13%	6%+

 Commercial scale
  Pilot scale / tech. develop

Cumulative number of new technology providers in feedstock recycling



1. Recyclable and renewable content. Note: Borealis and Sabic goals are 2025

5: Capital is already targeting recycling from many angles and investors are circling the space

Examples

Brand owners willing to invest significantly

>USD 2 bn

willingness to pay for higher recycling cost by Nestle

> USD 1.1 bn

planned Investment by the Schwarz Group into waste collection and recycling (including Suez)

~USD 90 mn

Investment by the Unilever into recycling JV in Italy

Funds committed by to recycling by the industry

USD 1.5 bn

capital committed by Indorama for recycling investments

USD 1.5 bn

investments committed by the Alliance to End Plastic Waste (e.g., USD 20 mn per chemical recycling project)

USD 200 mn

investments by Eastman in first at scale PET monomer recycling plant

Valuations are going through the roof as a result

~USD 700 mn

Market Cap of QuantaFuels expanding by 5x since March 2020

>USD 150 mn

Funds raised by Agilyx to date

~USD 2.8 bn

Market cap of Danimer Scientific tripling in the past 8 month

Many commitments and actions – but potentially failure to launch

Success factors in other Sustainability segments (e.g. Renewables, Biofuels, Hydrogen)

- **Well working value chains** – consistent product quality, availability, pricing
- **Technology innovation and scaling** – improvement of performance/ cost and competitiveness with alternatives
- **Ensure investability** – reliable insights on market growth in terms of volume and value, and risk/return
- **Collaboration platforms** – bringing together complementary value chain players to drive understanding and standardization
- **End to end partnerships (hand shakes) to get going** – connecting large customers and producers at scale
- **Supporting regulatory framework** – targeting right metrics and providing incentives to solve



Granular and reliable fact base to guide

- Operations and strategy
- New business models, and innovation
- Investment decisions and resource allocation

Agenda

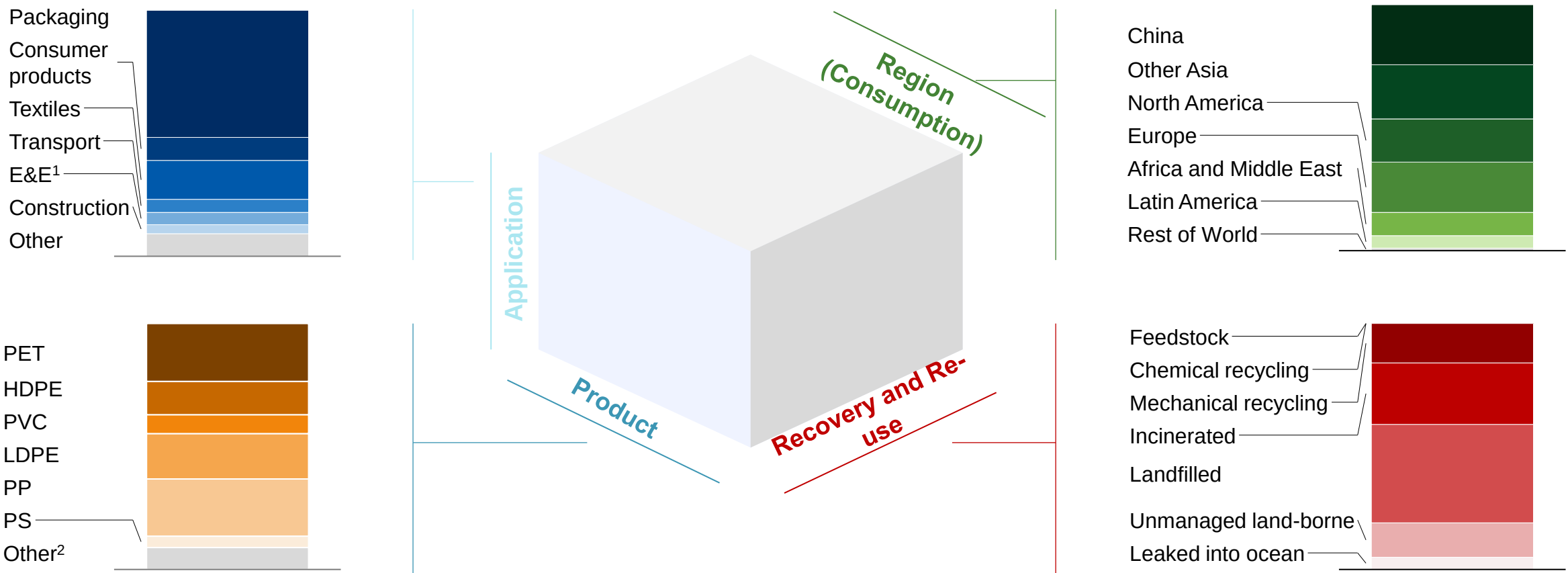
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We have developed a digital twin of the end-to-end global plastics value chains including plastic waste management and recycling

Global Post-Use Plastic Flows



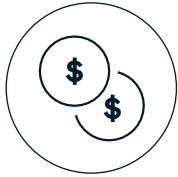
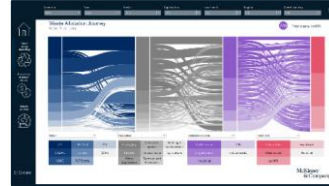
1. Electrical and electronics; 2 Plastics categorized as “Other” under the Resin Identification Code system and indicated by the number “7”. Includes ABS, epoxy resins, polyamide/nylon, polycarbonate, PMMA, EVA, SAN., rubbers, and others.

Our fact base provides access to proprietary plastic recycling industry data and data models as basis for investment decision making

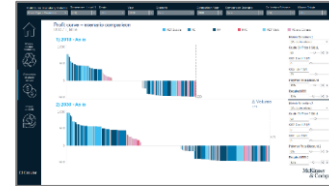
Our models and proprietary data sets



Plastic waste and re-use modelling



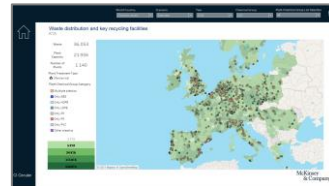
Economics of plastic re-use



Impact on CO₂ emissions



Geospatial analytics



Granular Analytics Platform

75+ million datapoints

100+ countries

20+ plastic types

100+ applications

5 collection methods

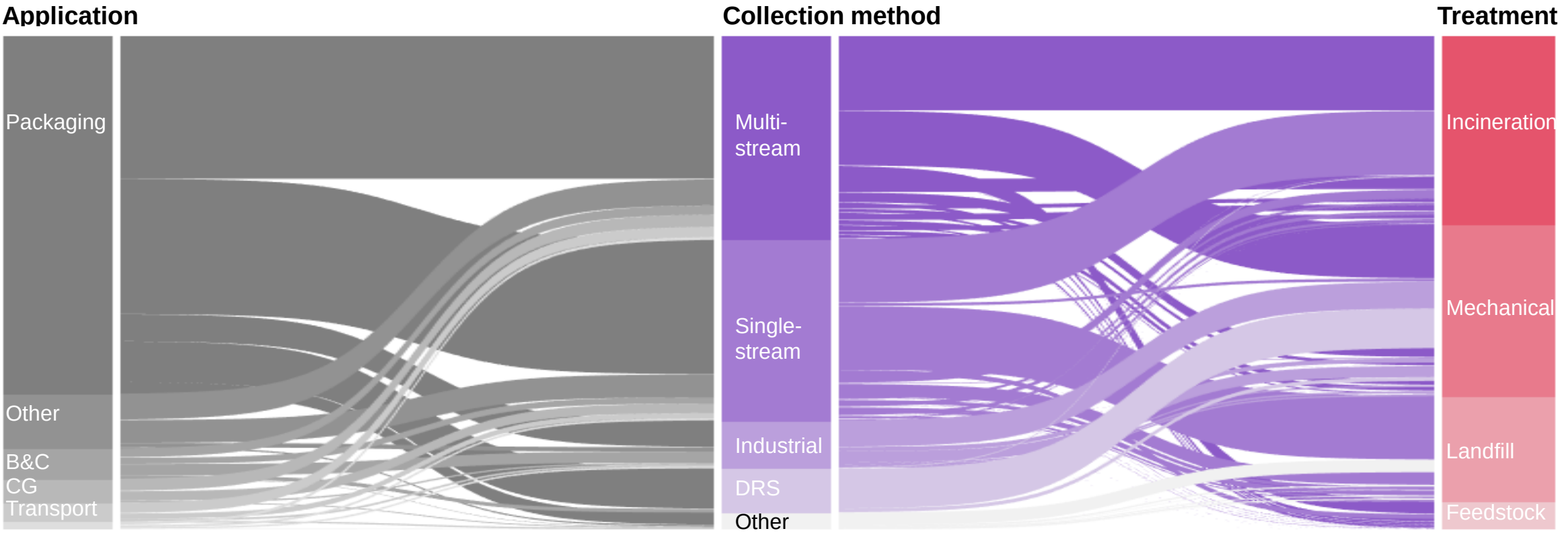
7 treatment methods / technology archetypes

1950-2050

Insight – Waste collection and separation complexity of plastic from cradle to grave is high and will require significant investment

EXAMPLE: HDPE waste in Western Europe, 100% = 4.3MTA

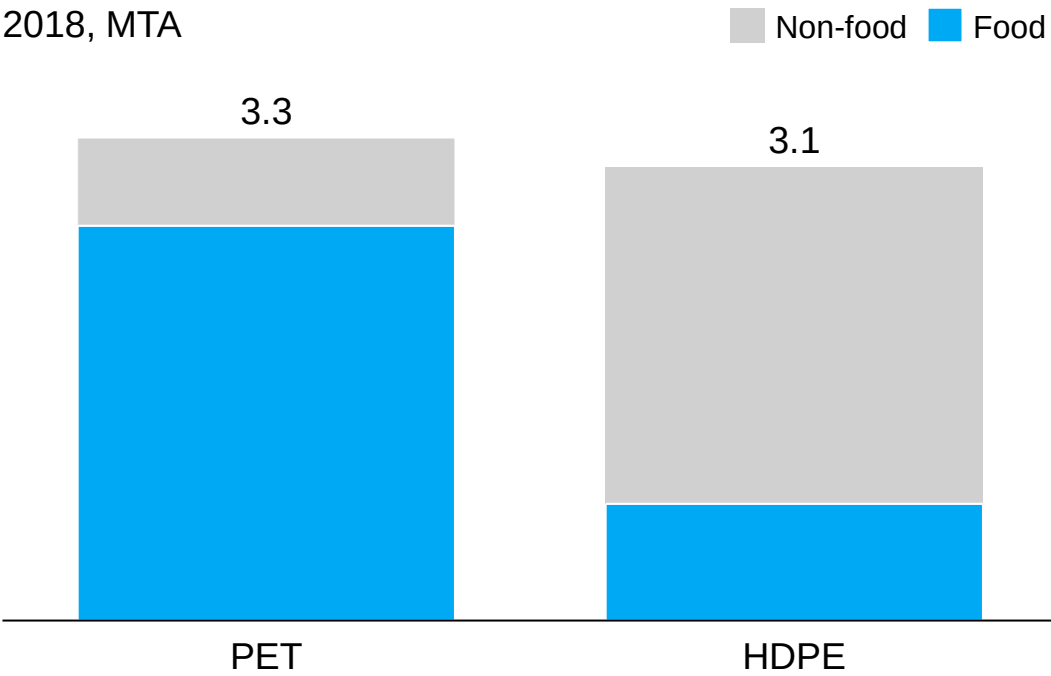
Sample Outputs



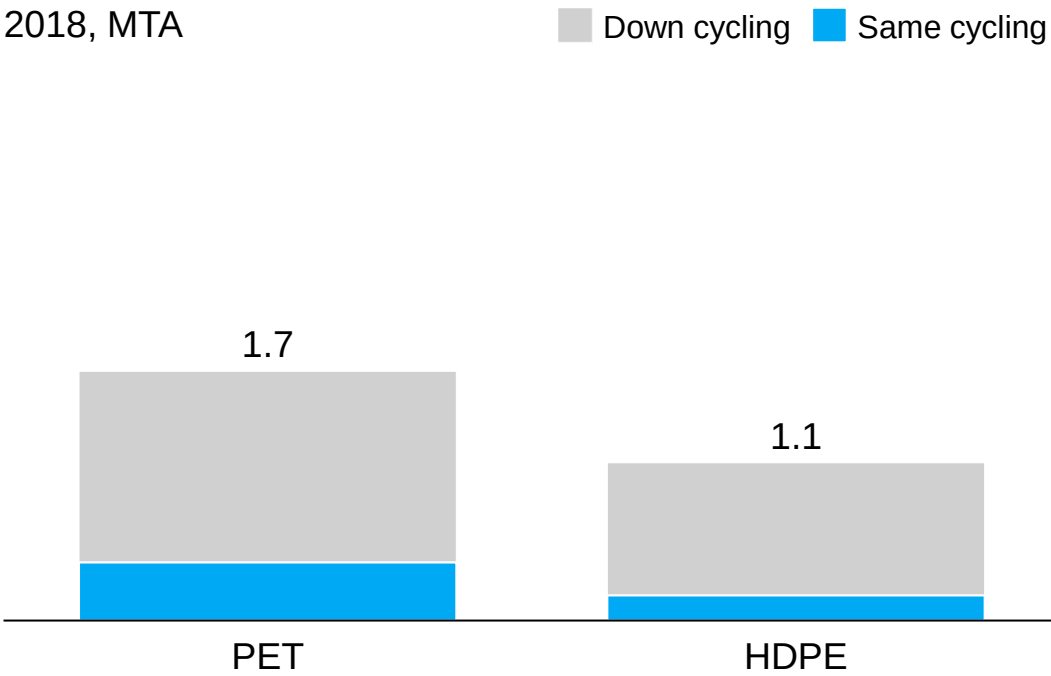
Detailed understanding is required to re-route streams for more value

Insight – Quality gap in recycled materials needs to be closed

Plastic consumption for packaging application in Western Europe



Mechanically treated plastic waste from packaging application in Western Europe



There is significant headroom to upgrade existing streams to cater brand owner demand

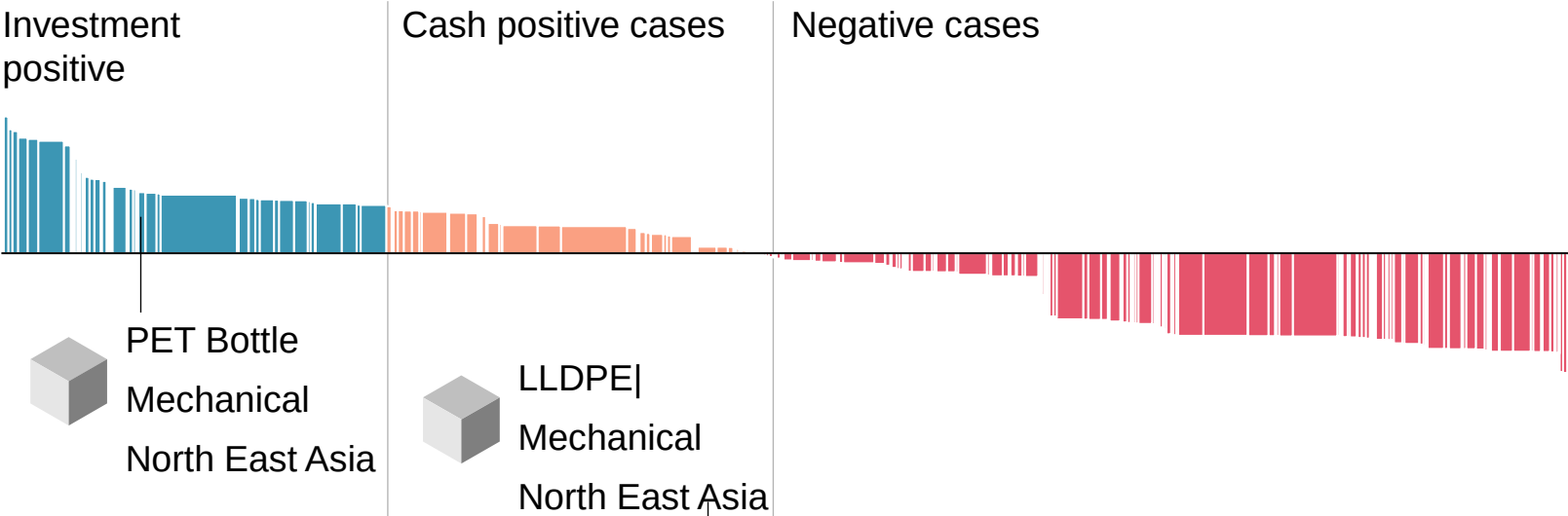
Insight – Solving the recycling challenge will require significant investment and likely additional running costs

USD/t

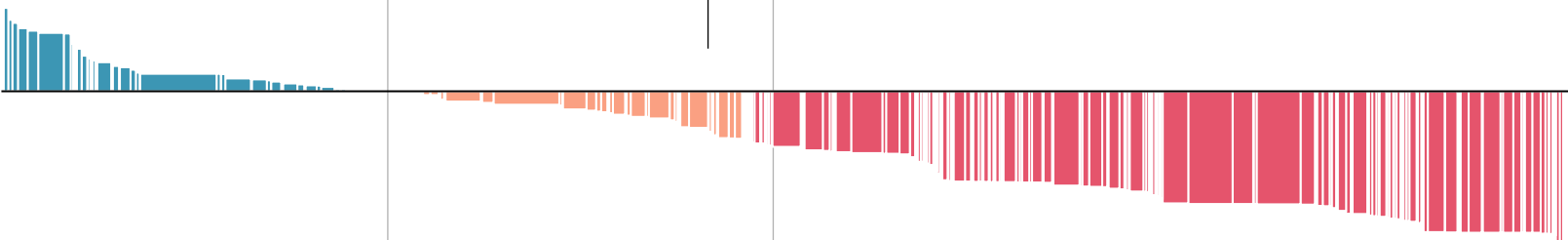
Plastic waste treatment profit curve target state¹

60 USD/BBL

Excluding
CAPEX



Including
CAPEX

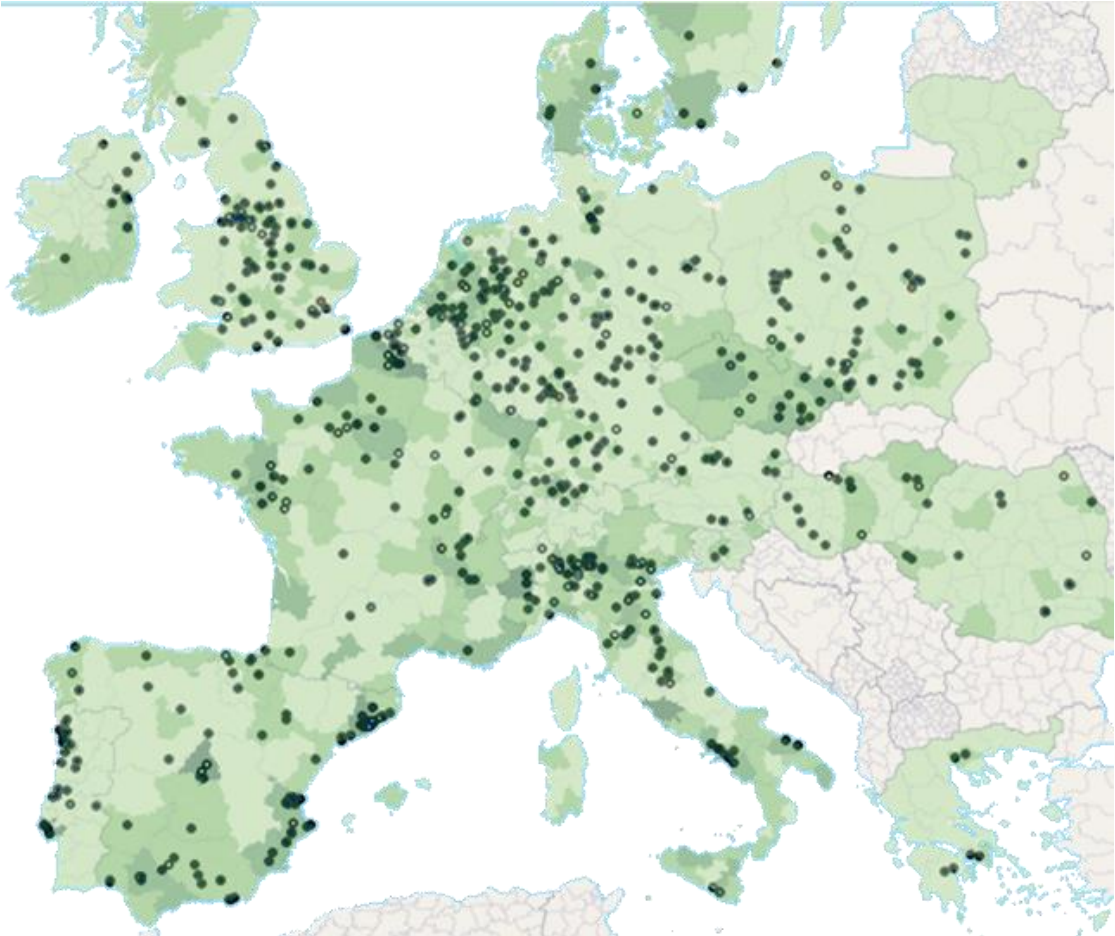
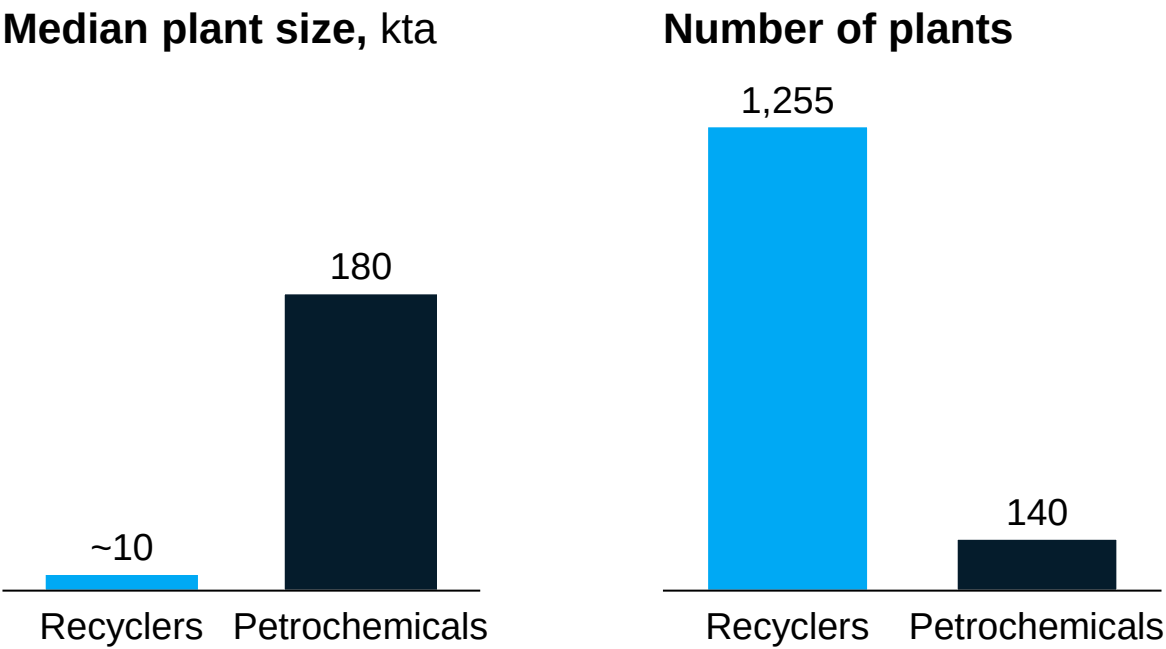


Investability
has to be
significantly
improved but
many value
pockets can
be harvested
already

1. 2030 view for Coalition for a change scenario. Excluding managed and unmanaged landfill

Insight – Existing recycling industry is complex and no match or partner for the virgin plastic value chain

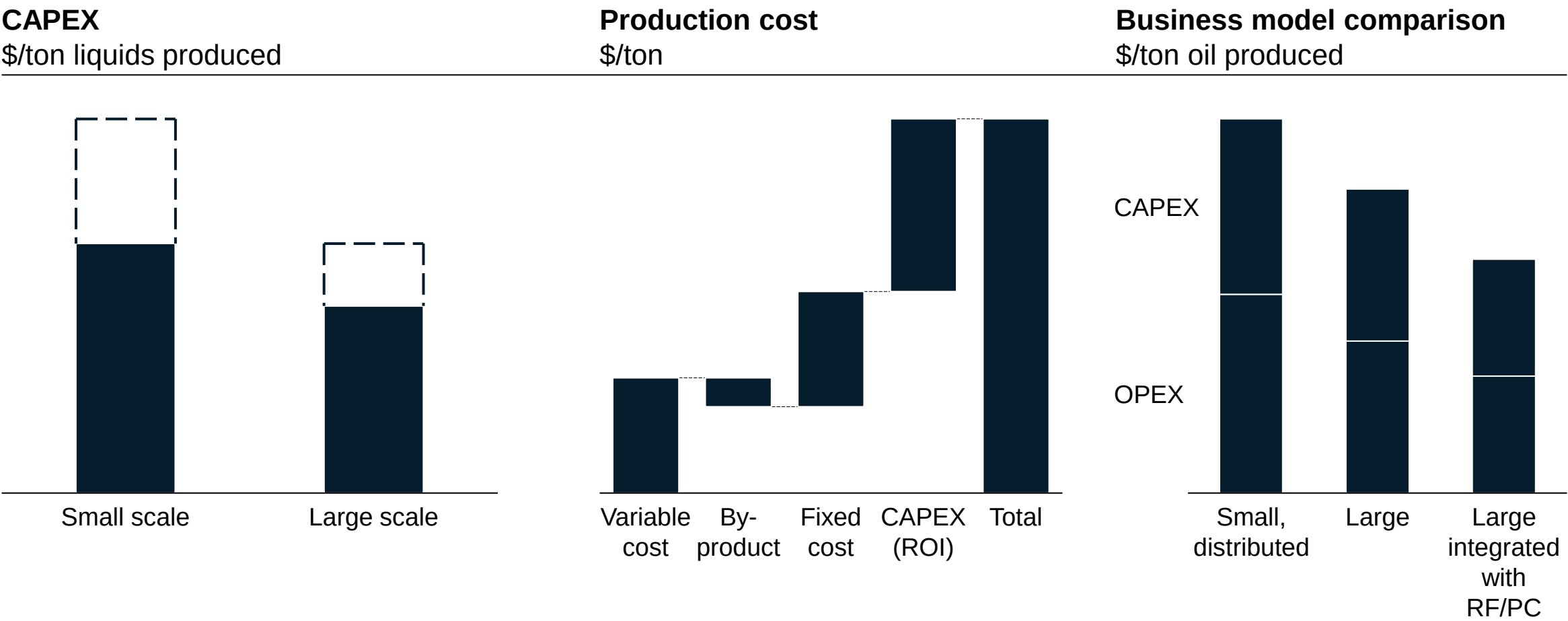
Europe



Significant structural improvements required but also high value creation potential

Insight – Chemical recycling will play important role, but need for much learning and optimization

ASSUMES ZERO COST OF WASTE (PLASTIC FEEDSTOCK)

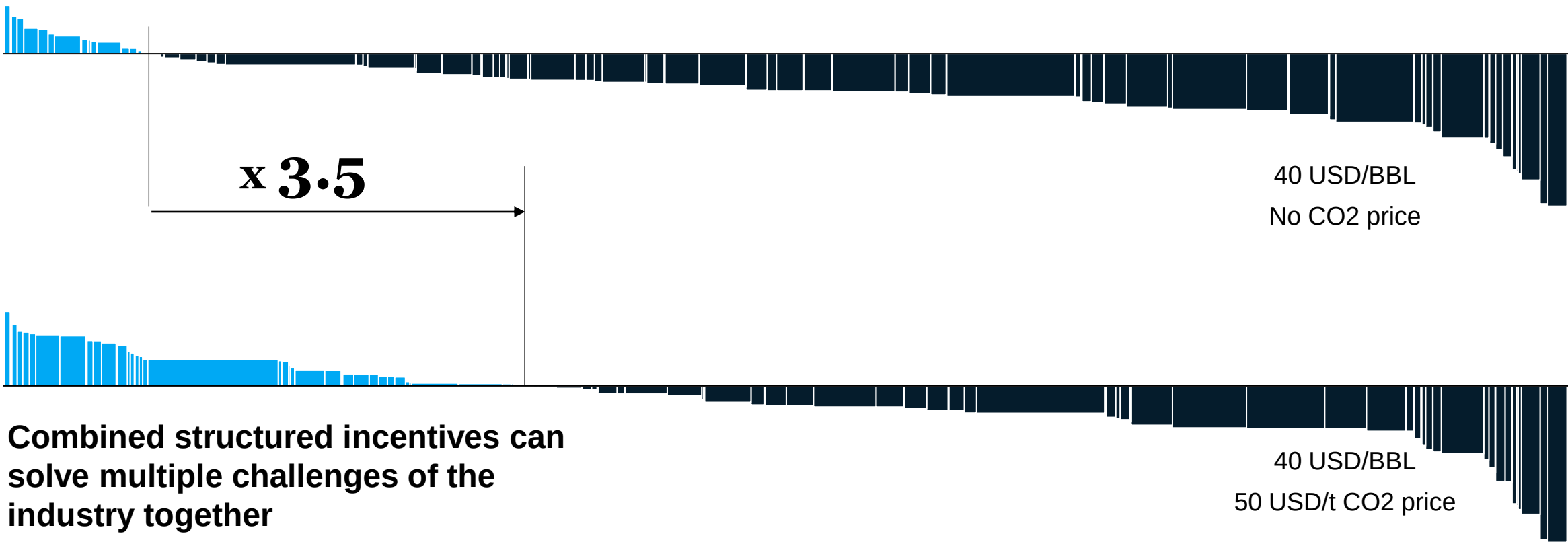


Scale and integration are the main profitability drivers in chemical recycling

Insight – Recycling can save CO2: leveraging that can improve economics

USD/t

Global plastic waste profit curve for mechanical recycling 2018 (excl. CAPEX)



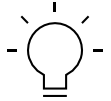
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A few closing thoughts: core questions and considerations



Drive innovation in materials, applications and designs



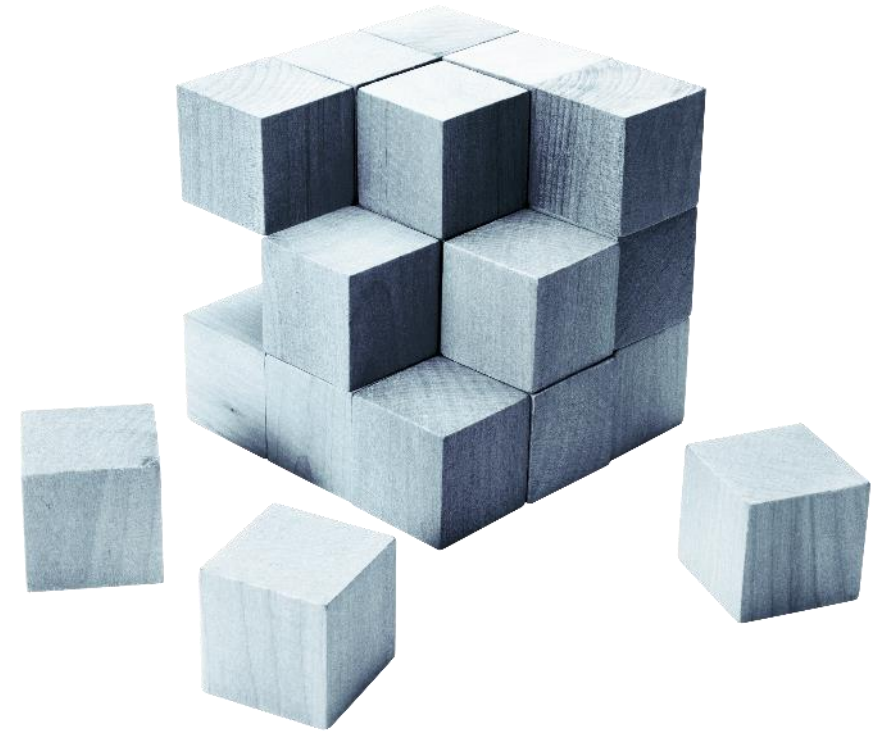
Dramatically improve collection, sorting and allocation of waste to different recycling streams



Make recycling technologies batter and more economic but do not struggle to find a winner first



Make the recycling sector investable – de-risk investments and improve market liquidity



Thank you!

If you have any questions or would like to continue the discussion from today's session please reach out to chem_ag_briefing@mckinsey.com