



The challenges of extrusion process with recycled plastic

PIOVAN GROUP

Piovan Group is the global leader in the development and production of industrial automation systems for storage, conveying and processing of plastic and food.



Plastics



Food



Cooling

GLOBAL PRESENCE



5

Regions



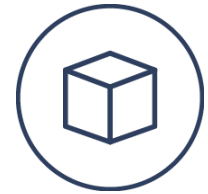
14

Manufacturing
Facilities



43

Service and Sales
Branches/Offices



More than **70**
countries covered
worldwide



ENGINEERING AND R&D



206 R&D
engineers



3.9 % R&D
investment

Plastic: a resource to use responsibly

THE ROLE OF PLASTIC IN THE WORLD

EVIDENCE ON PACKAGING CARBON FOOTPRINT*

- 560 g glass/litre
- 0.32 kWh/kg for molding from 20 °C



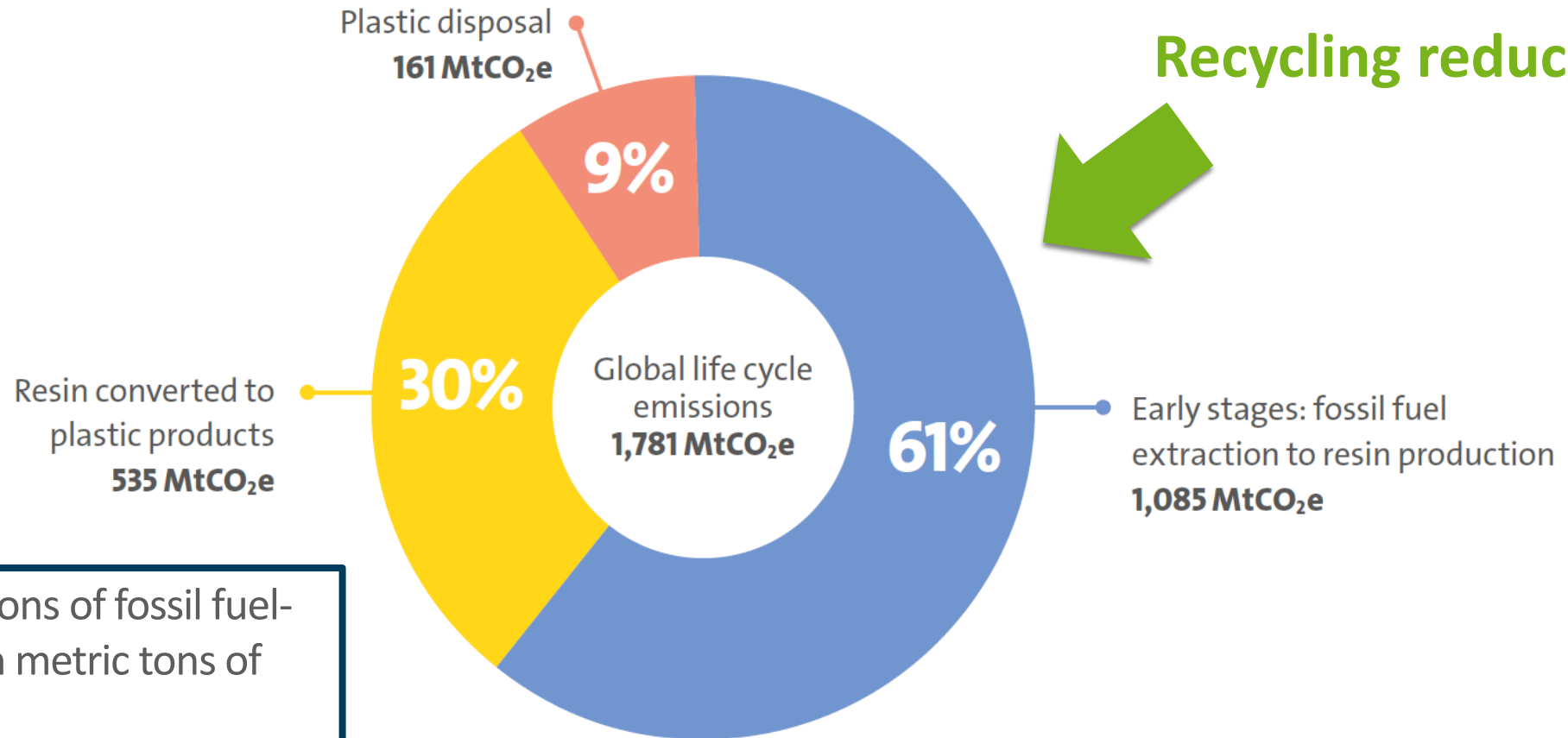
CO₂ EMISSIONS

Million tonnes of CO₂ in 2016 from production, if all 500 ml plastics bottles were replaced by this material.

- 30 g aluminum/litre
- 0.27 kWh/kg for molding from 20 °C
- 90 g paper/litre
- Impact on limited resources
- 19 g plastic/litre
- 0.14 kWh/kg for molding from 20 °C

* Voulvoulis N.(a), Kirkman R.(b), Giakoumis T.(a), Metivier P.(b), Kyle C.(b), Midgley V.(b), 2020. **Examining material evidence the carbon footprint.**
(a) Centre for Environmental Policy, Imperial College London (b) Veolia UK.

PLASTIC LIFE-CYCLE REDUCTION OPPORTUNITY



Life cycle emissions of fossil fuel-based plastics in metric tons of CO₂ equivalent

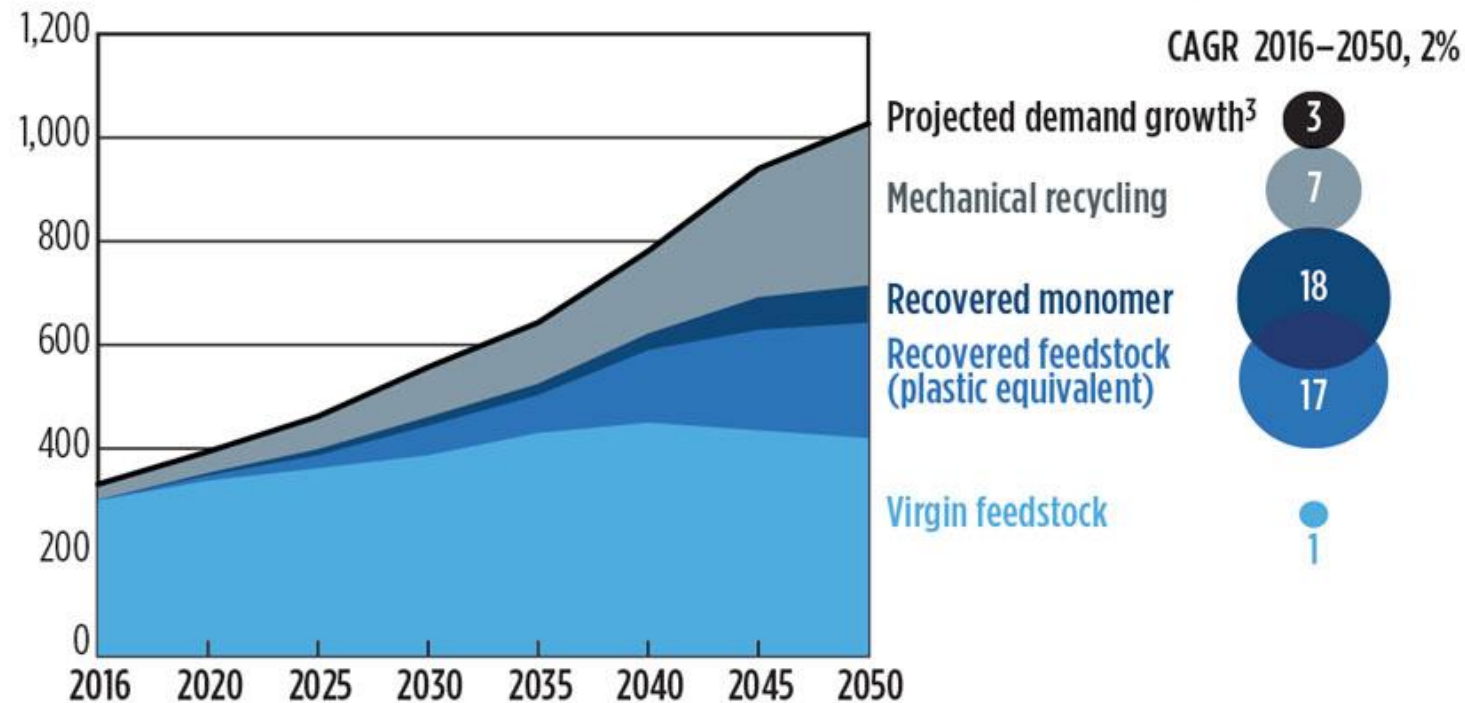
Source: Examining material evidence the carbon fingerprint, Voulvoulis N., Kirkman R., Giakoumis T., Metivier P., Kyle C., Midgley V.

DATA CLASSIFICATION: CONFIDENTIAL, NOT FOR DISTRIBUTION

CIRCULAR ECONOMY

SHAPING THE FUTURE OF THIS BUSINESS

Global polymer demand 2016–2050 and how it could be covered, MMtpy¹



¹ Scenario based on a multi-stakeholder push to boost recycling, regulatory measures to encourage recycling, consistent progress on technologies, and \$75/bbl oil price.

² Compound annual growth rate. Mechanical recycling limited by downcycling and applicable materials, monomerization limited by applicability to condensation polymers only, pyrolysis limited by likely rise in input costs.

³ After demand reduction, assuming annual global GDP growth of 3.1%.

Source:

<https://www.hydrocarbonprocessing.com/>

RECYCLING AND TRANSFORMATION

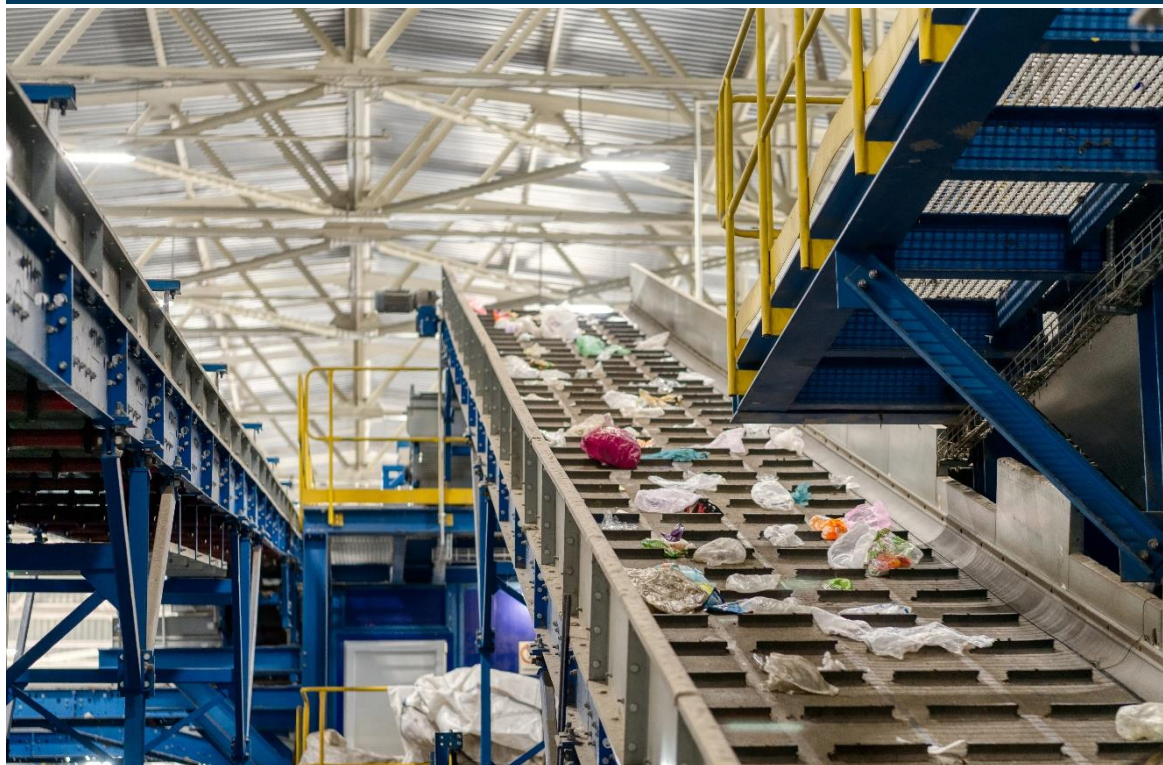
Waste
Collection

 Recycling

Pellets



Primary Transformation: Recycler



Pellets



 Packaging production

Product



Secondary Transformation: Component manufacturer





Solutions for extrusion process

Our sectors of applications

PIOVAN GROUP SOLUTIONS

THERMOFORMING & TECHNICAL SHEET / FLEXIBLE FILMS

Typical final products in thermoforming:

Thin wall containers, Beverage glasses, Tanks and Vases



Typical final products in flexible film:

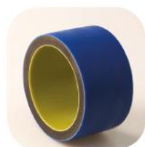
Labels, Bottles packaging, Plastic Bags, Food packaging, Agricultural packaging, Chemical packaging, Medical disposal



PIOVAN GROUP SOLUTIONS

PIPE, PROFILES & CABLES / FIBRES & STRAPPING

Typical final products in pipe, profiles & cables:
Irrigation, Water, Windows profiles, Gas pipe,
Sewage pipes



3-layer gas pipe



Irrigation pipes



PVC pipes



PVC pipes and tubes



Large diameter pipes for gas, water and sewage, with diameters up to 2,500 mm



Window profiles



Technical profiles

Typical final products in fibres & strapping:
Carpet, Clothes, Textile yarn, Sports clothes,
Strapping





A constant focus on circular economy

WITH A FOCUS ON CIRCULAR ECONOMY



Solutions for **post consumed plastic and biopolymers**



Systems for **reduction and control of contaminants**



Safe, traceable and stable processes



Service team for **CAPEX life maximisation**



Several patents registered for technologies related to recycling



What are the main constraints of working with recycled materials?

PITFALLS USING PCR

The use of material with unknown contamination implies

CAPEX degradation



Dryer lifespan reduction up to 50%
Additional maintenance cost

Process instability



Quality reduction
Scrap increases up to 4%

Potential contaminants in final product



Potential risk of heath for consumer
Unquantifiable reputation damage

PITFALLS USING PCR

Consequences of the previous life

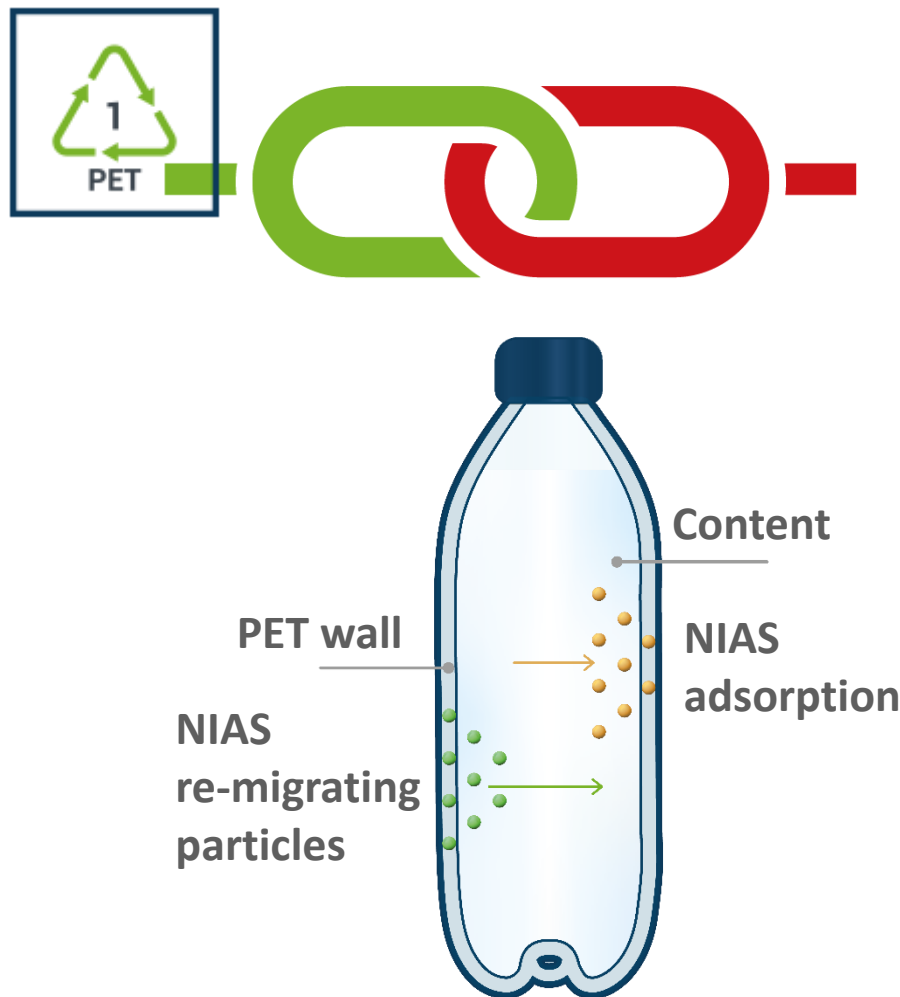


PET PREFORM

RECYCLED RAW MATERIAL INFLUENCE ON SCRAP

Because of its history and origin, post consumed plastic has:

- No consistency among batches
- Chemical-physical characteristics wide variations
- Presence of contaminants (NIAS) or low-boiling oils (VOC)



Scrap can increase due to:

- Aesthetical or mechanical non conformities
- Presence of contaminants in final product

Preservatives = Benzoate

Aroma and sugar compounds

HOW TO DEAL WITH RECYCLED PLASTIC?





PIOVAN SOLUTION FOR RECYCLING

Inspecta INSTRUMENT OF ANALYSIS

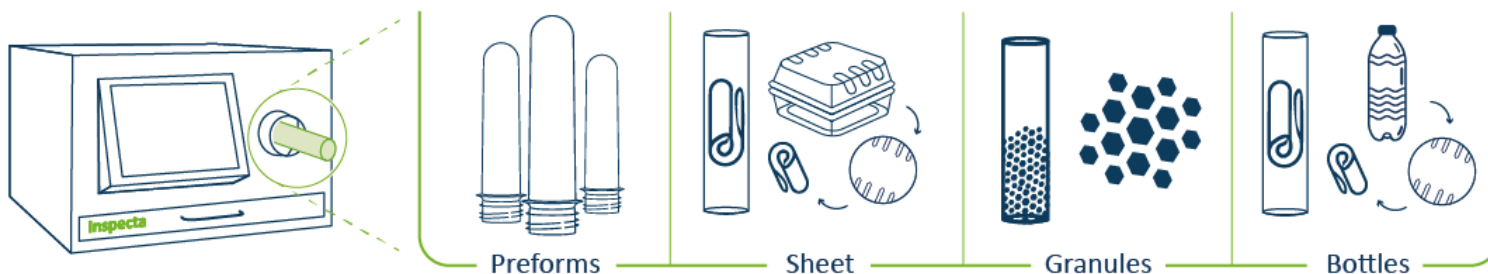
Detect the presence of:

InspectaAc: ACETALDEHYDE

InspectaBe: BENZENE

Rapid (≤ 60 minutes) and accurate tests, essential for Quality procedures, assures comparability worldwide.

Test results store for up to 10 years with Winfactory 4.0



Sustainability for products
but also for the Group

ESG RATING

In November 2021, Piovan Group obtained an ESG Risk Rating issued by Sustainalytics - a Morningstar company and leading independent ESG research, rating and data firm.

The mark of 21.9 places Piovan in the Medium Risk category, with the best score in the following categories: Carbon-Own Operations, E&S Impact of Products and Services and Occupational Health and Safety.

In the global Sustainalytics ranking, Piovan is placed in the 29th percentile with the position improving further in the industrial **Machinery Subindustry**, where **Piovan is placed in the 5th percentile**.



Thank you



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