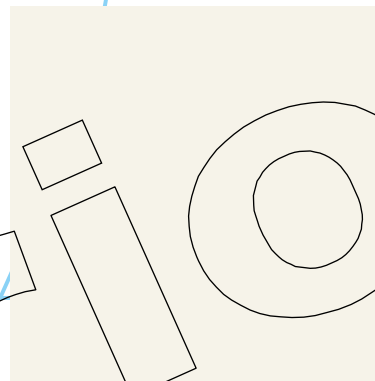


Innovation in Plastics Recycling

Roadshow 2025

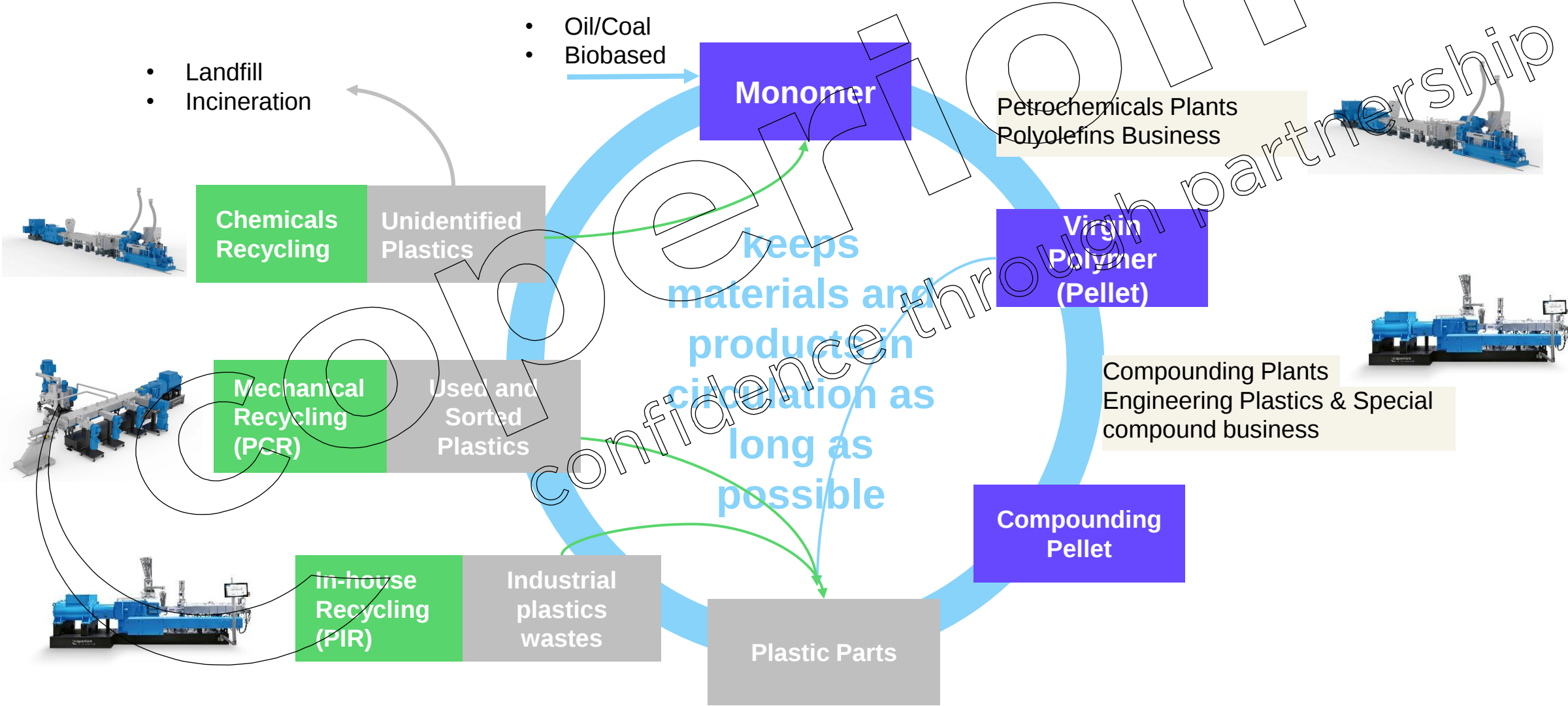
Wikanda Khomchu | Sales Manager Engineering
Plastics SEA | Coperion SEA

For more recycling
of all kinds of plastic



Plastic Value Chain

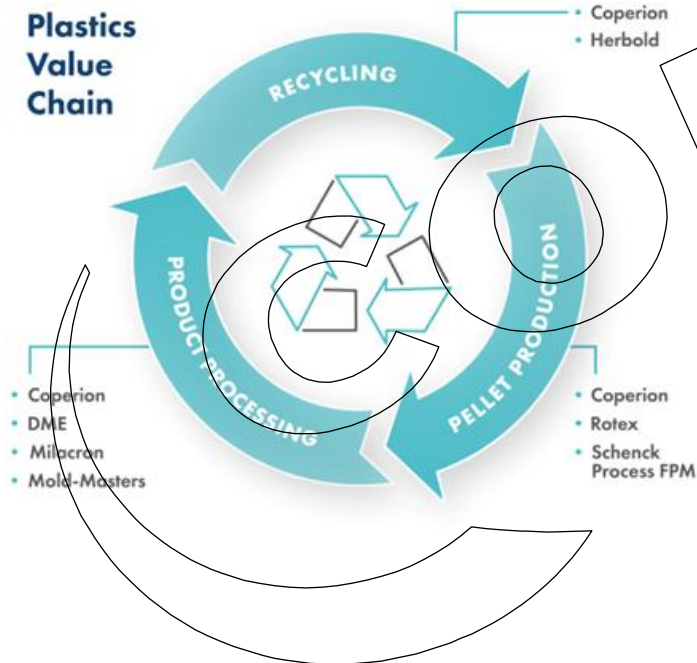
Coperion covers the entire process chain from raw material to final high-quality pellets



Optimized and Closed-Loop Plastic Value Chain

A circular economy keeps materials and products in circulation as long as possible

Coperion has a system-focused approach starting with the design of our equipment to maintain their highest value for as long as possible and aims for the elimination of waste during operation for high quality products



→ **Design for Value with optimized CO2 Footprint**

→ **Lowest Energy Consumption during Operation**

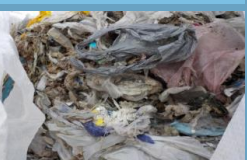
→ **Zero Waste Strategy during Operation**

→ **Optimized Process Chain from PCR/PIR to Pellets**

Coperion Recycling – Activity spectrum



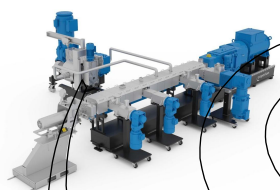
We offer a wide range of recycling solutions across a wide spectrum of plastics types, recycling technologies, customer segments and geographic regions.

Post-consumer film 	Post-industrial waste 	PET bottles 
PET trays 	Post-consumer HDPE/PP waste 	Agricultural film 
Post-consumer Big Bags 	Car battery cases 	Pulper/UBC waste 

Plastic Value Chain



Coperion covers the entire process chain from raw material to final high-quality pellets



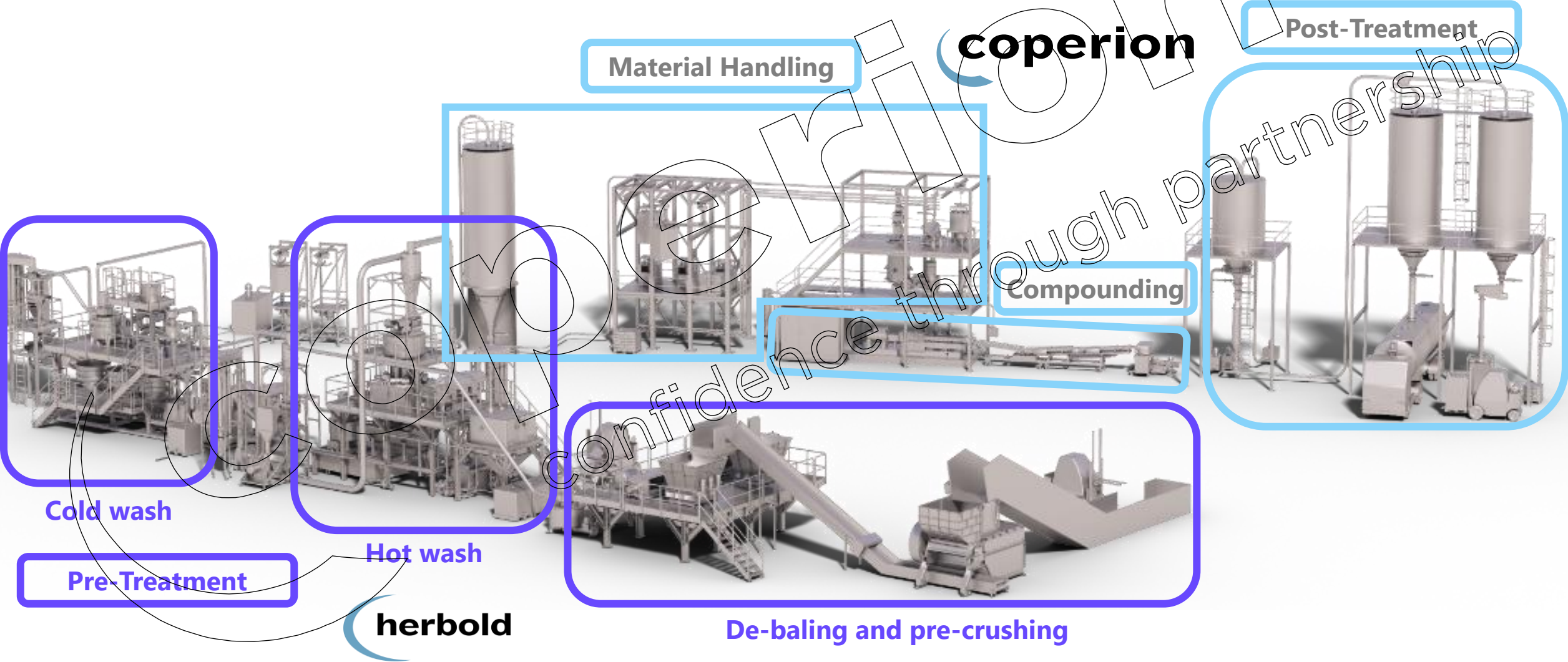
Mechanical
Recycling
(PCR)

Used and
Sorted
Plastics

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confidence through partnership

Coperion's product range : Recycling set up

Complete production plants : PCR

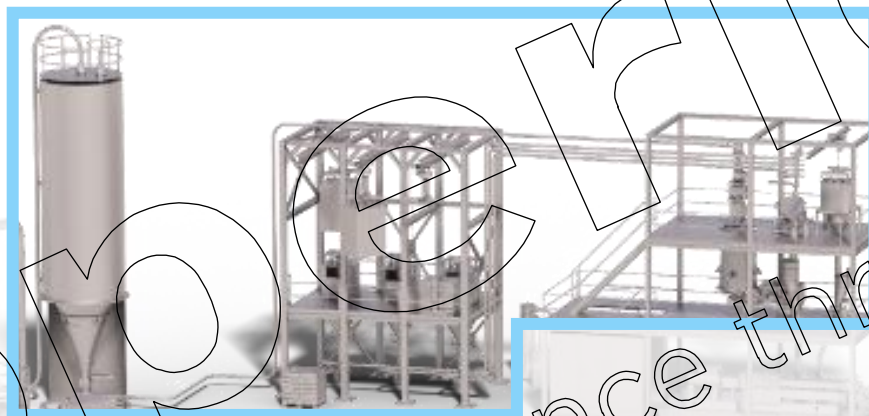


Coperion's product range

Complete production plants



Material Handling



Challenges

- Recyclates ≠ Virgin materials
- Stable handling of recyclates
- Accurate feeding of recyclates

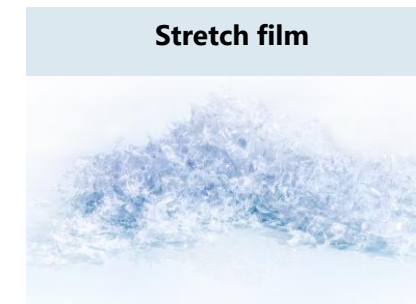
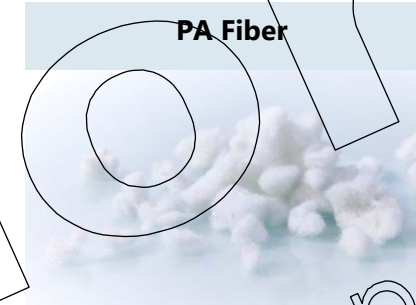
Challenges for the handling of recyclates

Raw material properties and challenges

- Irregular shape
- Non-free flowing material, compacting and bridging properties
- Low bulk density: 10-250 kg/m³
- Big particles size: 5-50 mm
- High moisture content: 1-10%
- Varying properties (MFR, moisture, etc.)
- High contamination: 0,5-5%
- Odor / Smell

Conclusion

Special equipment and measures are necessary to handle recycling material



Material Handling

Handling of Film Flakes

Features:

- Special film flake silo (ARW) as a buffer for a stable product discharge
 - Negative conical design
 - Bottom discharge agitator
- Controlled pre-feeding by the discharge screw
- Controlled belt-load by interaction silo <-> belt feeder
- Correction of varying bulk densities by continuous measurement of the actual belt load and controlled belt speed

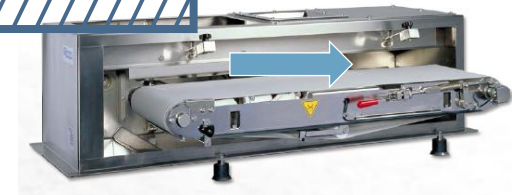
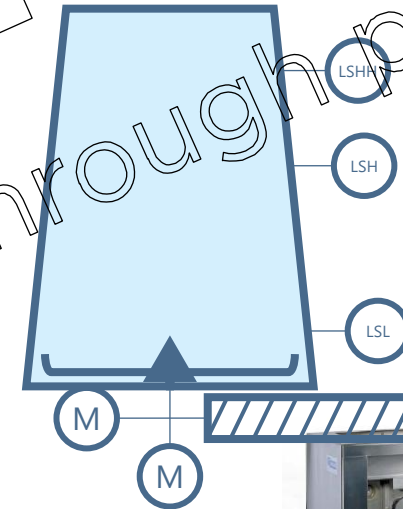
Conclusion

Combination of the special silo (ARW) with the belt feeder makes a **stable** and **gravimetric** feed of worst flowing and bridging materials possible

Wash line / crushing

Film flakes

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Extruder

Coperion's product range

Complete production plants



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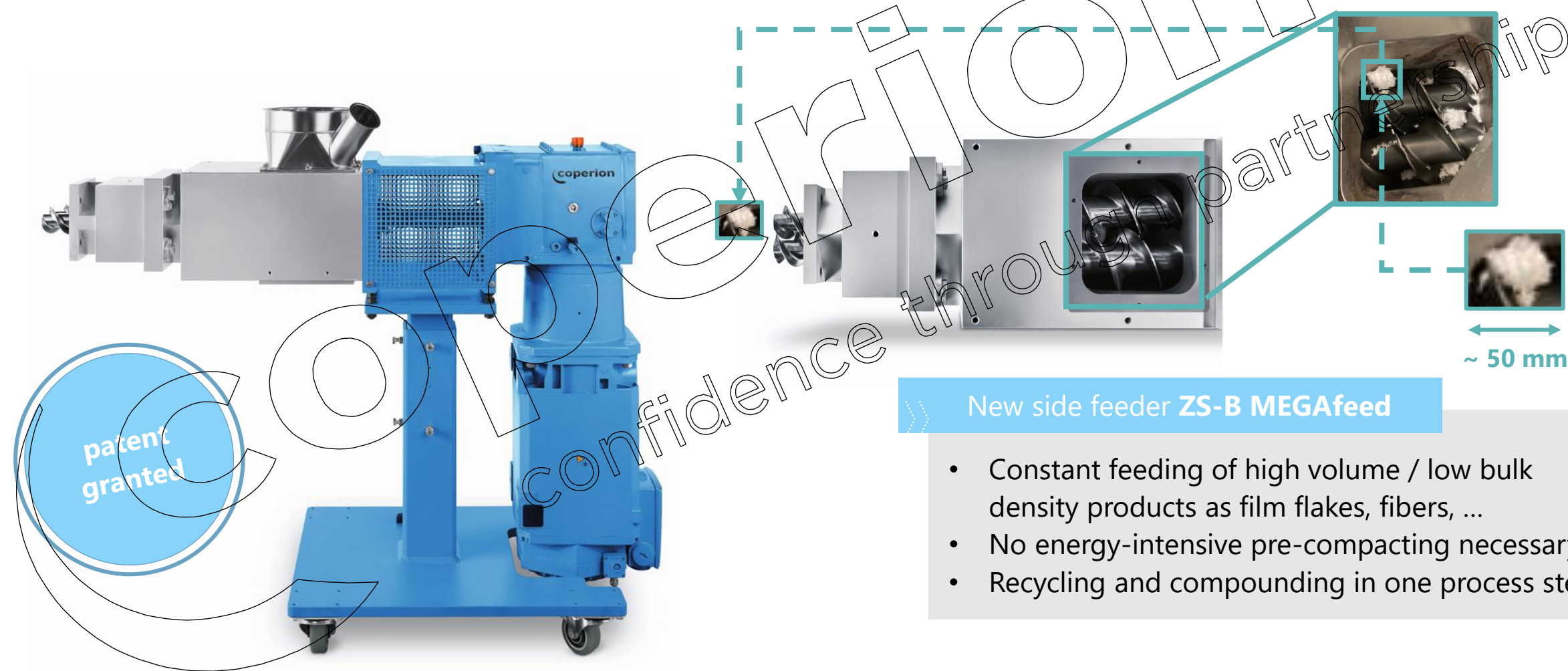
Compounding

Challenges for high quality recyclates

- Varying properties based on the feedstock
- Feed-intake of low bulk density materials
- Post-consumer materials with many kinds of contamination

ZS-B MEGA feed

Feed intake for challenging materials | New side feeder ZS-B MEGAfeed



New side feeder ZS-B MEGAfeed

- Constant feeding of high volume / low bulk density products as film flakes, fibers, ...
- No energy-intensive pre-compacting necessary
- Recycling and compounding in one process step

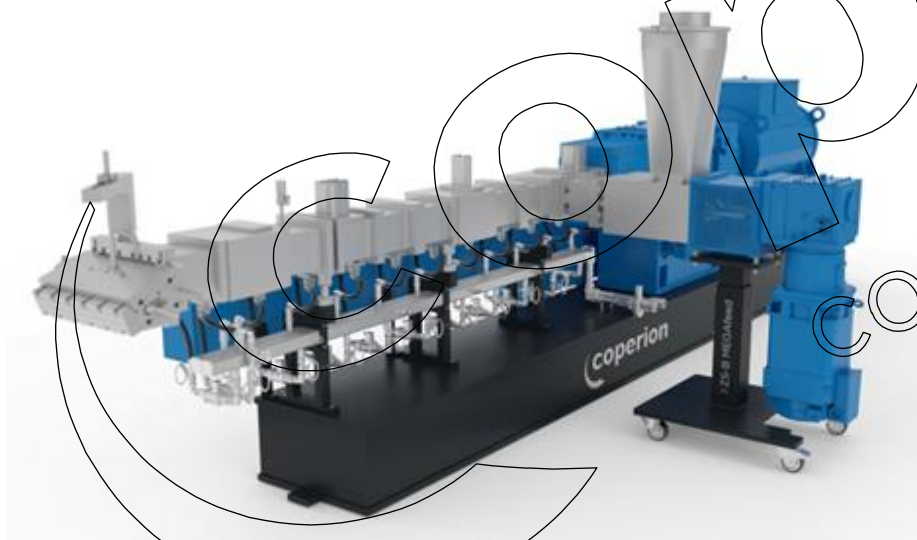


Raw Material Handling

Raw Material Properties and Challenges



Throughput
Increase
x 10 -15



New innovative feeding device

Even with very low screw speeds at the **NEW side feeder**, higher throughputs can be achieved with very fluffy materials



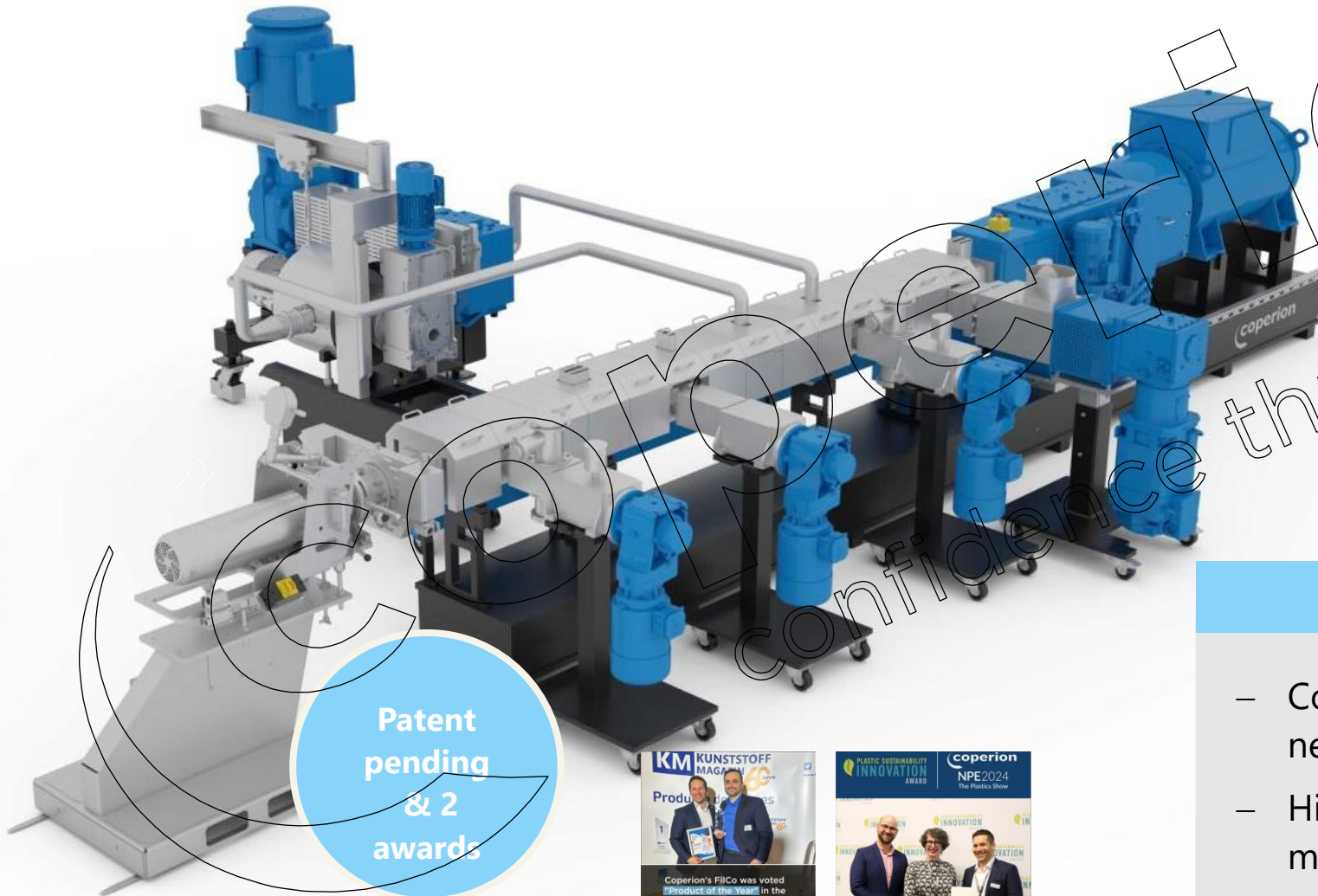


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Recycling and Compounding in one step

Coperion's new concept: **ZSK FilCo** (Filtration Compounder)



Patent
pending
& 2
awards



Filtration and **C**ompounding of pre-washed and sorted PCR streams in **one** process step

- Melting and blending of different polymers, **discharging** the melt from the twin screw and **returning** the filtered melt
- **Adding** of coarse fillers, fibers or cross-linking additives such as peroxide after filtration

- Cost and energy savings due to reduction of the necessary aggregates (only one extruder required)
- Higher quality of recycled plastics due to one-time melting (low temperature history)
- Modular design offers efficiency and flexibility

FilCo – Energy Efficient – High Quality – Less Space



Filtration

- Installation of filters with different fineness and manufacturers

Discharge and return of the melt

MegaFeed

- Addition of flakes and fiber with different sizes, bulk densities and moisture contents

First Degassing

- of moisture, VOC etc.

Addition and Incorporation of

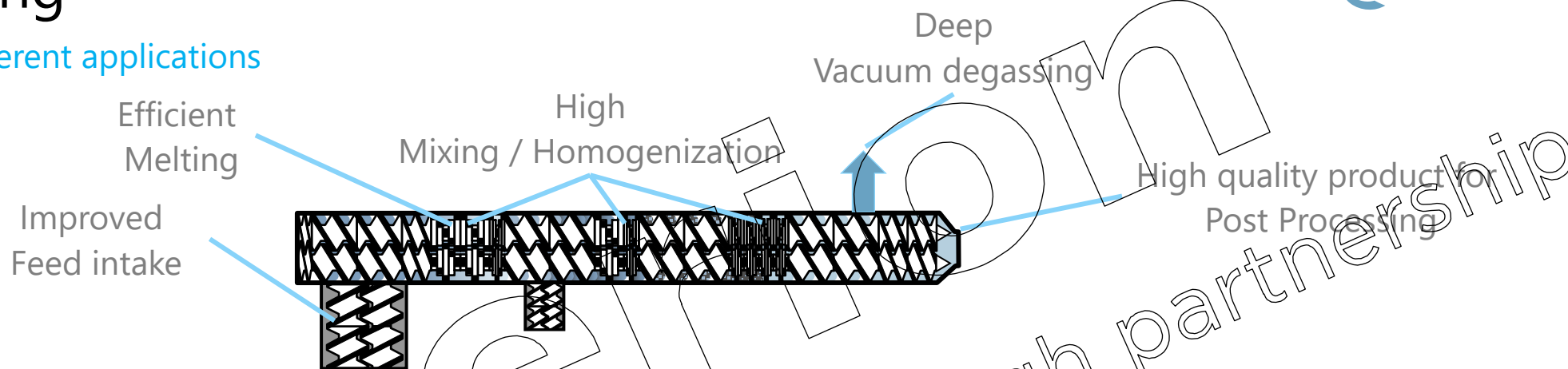
- Cross-linked additives (PEX, rubber)
- Additives
- Fiber (wood/glass/carbon fiber)
- Fillers

Final Degassing

- of moisture, reaction components, VOCs etc.

PET Recycling

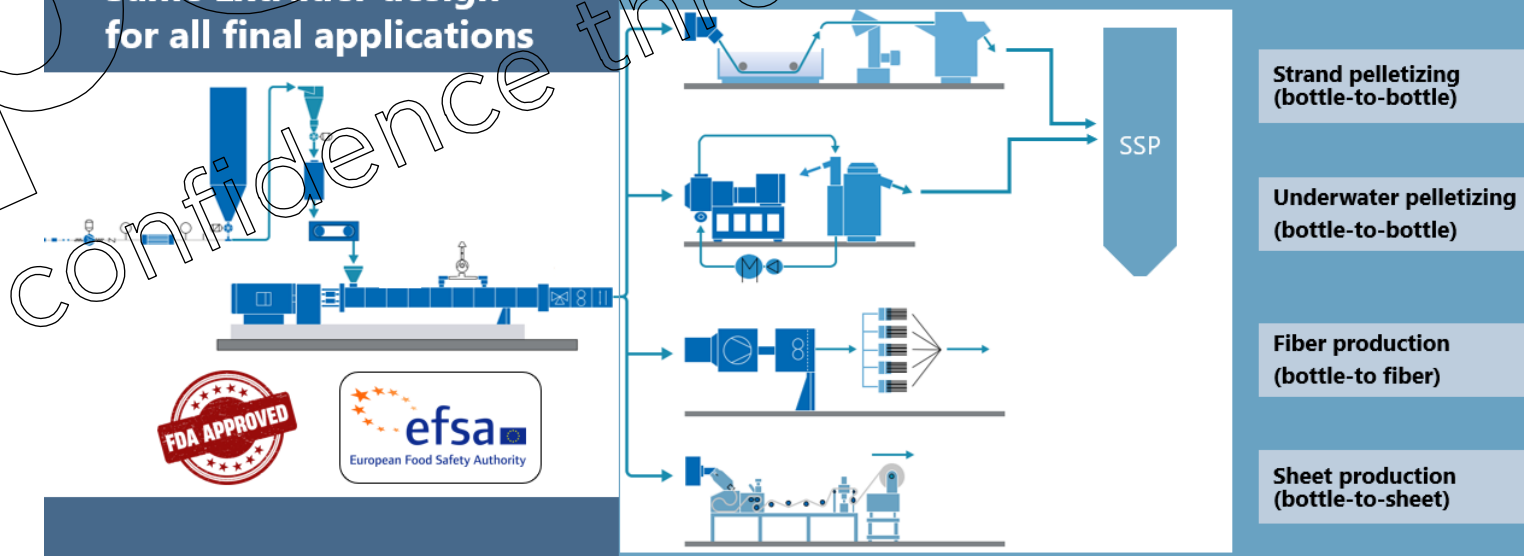
Advantages for different applications



PET Recycling

- Highest output with up to 11 t/h with one extruder
- High energy efficiency -> Low OpEx
- Vacuum degassing -> No pre-drying
- Low residence time -> Good b-value

Same Extruder design for all final applications

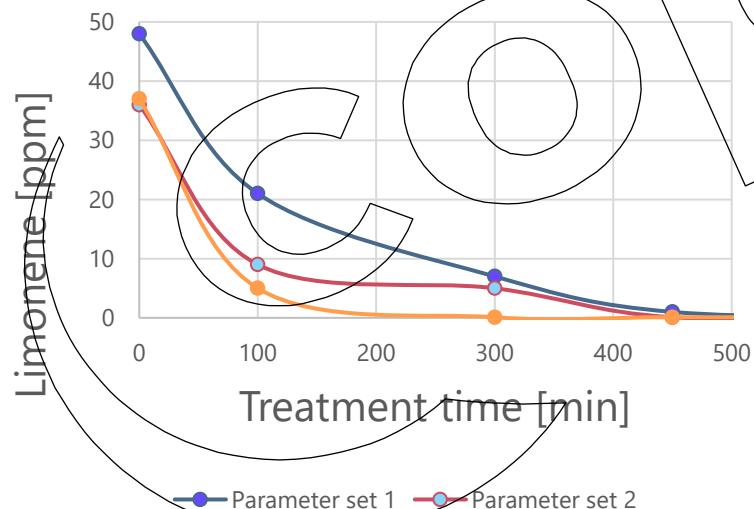


Silo Deodorization

VOC reduction in a degassing silo

Depending on the parameters set, the VOC content can be reduced to residual levels of less than 1 ppm within 3-6 hours.

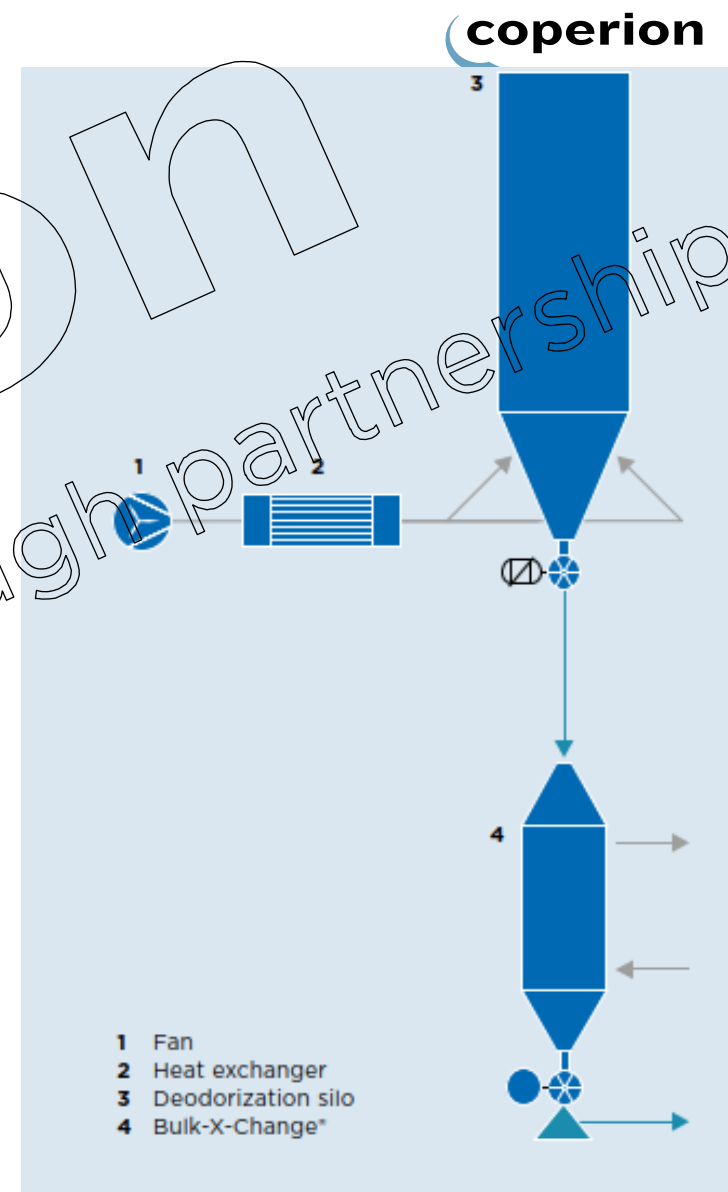
Deodorization of PP (PCR)



- The process heat from the bulk material cooler is used to preheat the supply air
- Energy consumption **0,05 kWh/kg**

→ **Continuous process**

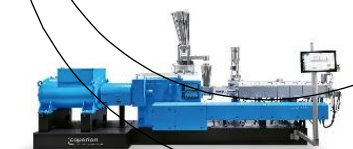
- Low energy consumption
- Energy is kept in the system



Plastic Value Chain



Coperion covers the entire process chain from raw material to final high-quality pellets



**In-house
Recycling
(PIR)**

**Industrial
plastics
wastes**

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Multilayer film recycling (In-house Recycling)

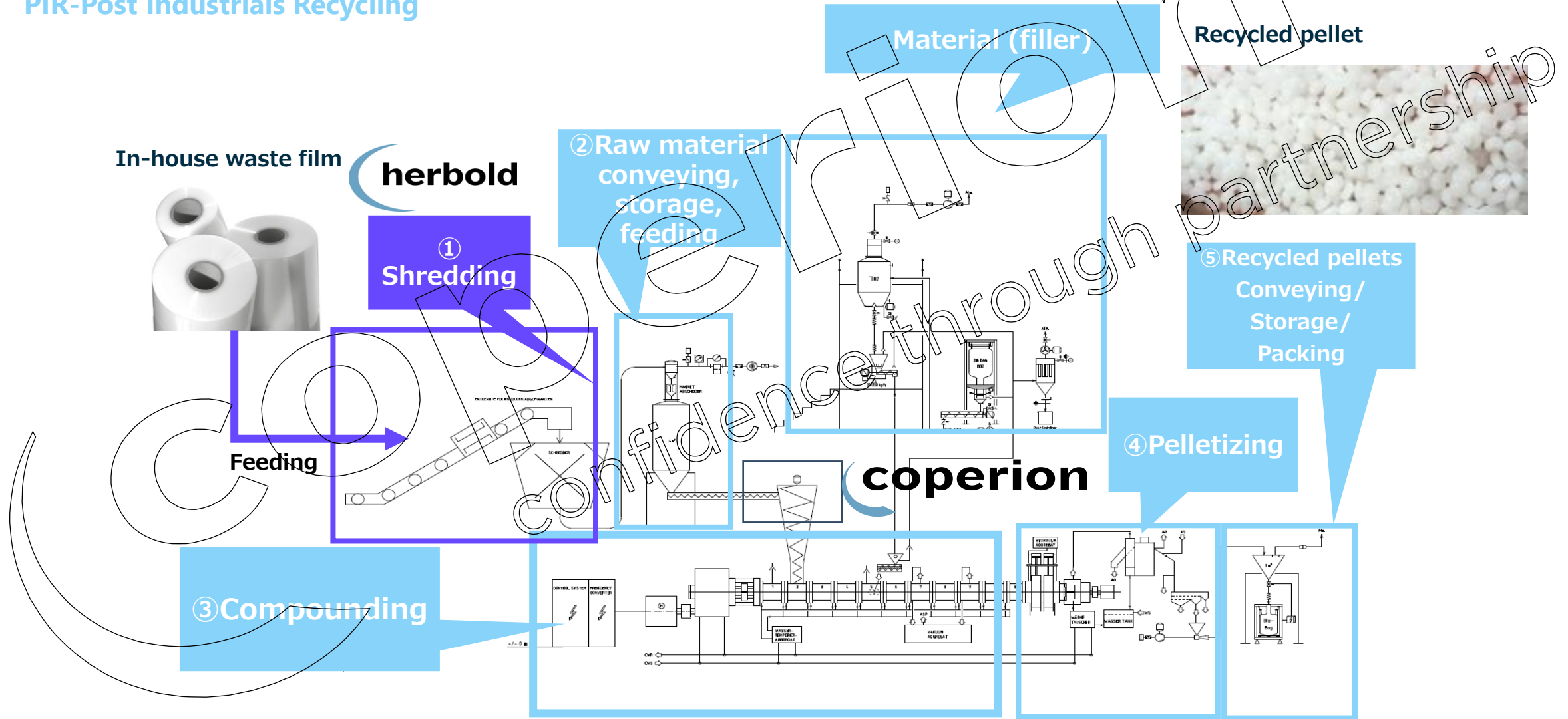
PIR-Post Industrials Recycling

- High quality of recycled pellets from multilayer film waste and reuse of the pellet as raw material for multilayer film as a substitute for virgin PE, virgin PP materials, etc.
- Basically, no compatibilizer is used.



Multilayer film recycling (In-house Recycling)

PIR-Post Industrials Recycling

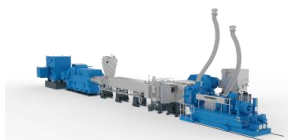




Plastic Value Chain



Coperion covers the entire process chain from raw material to final high-quality pellets

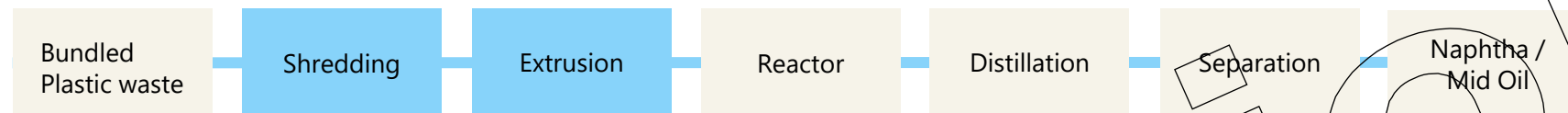


Chemicals
Recycling

Unidentified
Plastics

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Chemical Recycling - Pyrolysis



ZSK Twin-Screw vs. Single-Screw Extruder

1. Throughput

ZSK Twin-Screw: Over **20 t/h**

Single-Screw: Up to **2 t/h**

2. Rapid Melting

Achieves **320–350 °C** within **~30 seconds** (depending on material)

3. Energy Efficiency

Consumes **~33 % less energy** than a comparable single-screw extruder

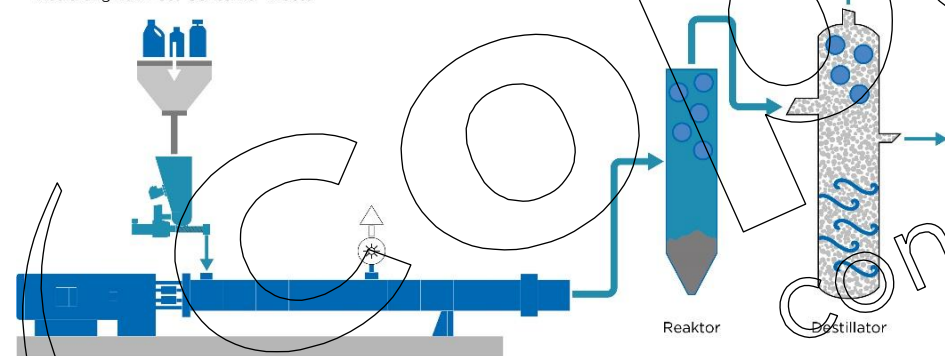
4. Superior Degassing

Effectively removes **water and volatile compounds** during processing

5. Cleaner Output

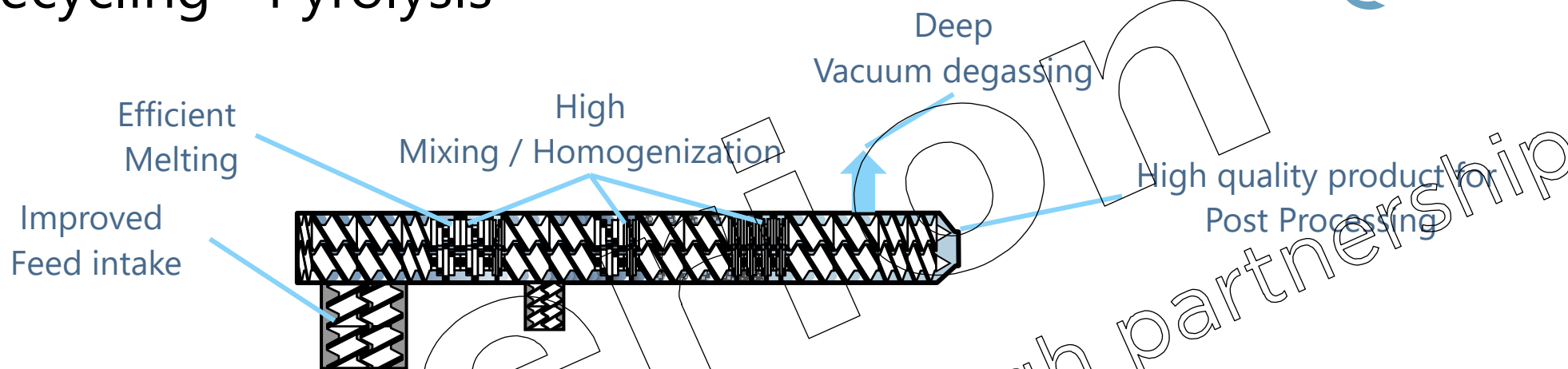
Eliminates up to **90 % more organic PVC** and other contaminants

Dosierung von Post-Consumer-Waste



Doppelschneckenextrusion – Dispergierung, Entgasung, Einbringung von Energie

Chemical Recycling - Pyrolysis



Chemical Recycling (Pyrolysis)

- Highest Outputs up to 20 t/h
- Low OpEx due to low energy consumption
- Tailored MoC
- Patented process, which makes handling of PVC contamination possible (Patented)

ZSK119Mc¹⁸ at Indaver (Belgium)
in operation with 4.000 kg/h

ZSK133 in Netherlands in
start-up phase for 6.000 kg/h

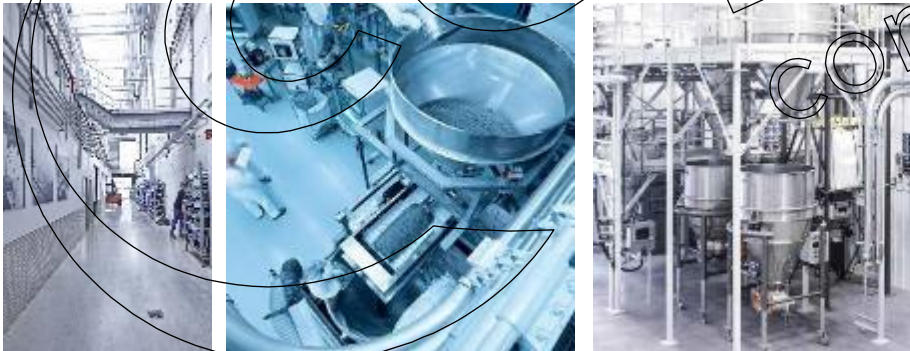


Coperion Recycling Innovation Center

Coperion's strengths and competence

Coperion provides know-how and equipment to optimize the complete process from

- Washing and Shredding
- Storage and Homogenization
- Conveying and Drying
- Dosing
- Compounding
- Degassing and Deodorization



Recycling Innovation Center for Coperion Product Line Weingarten, Germany



Recycling Innovation Center for Herbold Product Line Meckesheim, Germany



Test facilities

for Materials Handling, Dosing and Compounding are available worldwide to prove the working principle of Coperion equipment with YOUR products

- Size reduction
- Washing
- Drying
- Separation
- Agglomeration



Business Unit Recycling –Why we are the right partner

Coperion and Herbold – A new level of expertise in plastics recycling

coperion

herbold

What makes Coperion Recycling unique and the best partner:

- **Bringing strong brands together** – Offering best in class process
- Serving you **globally**
- Targeted product development with **high in-house production rate**
- **Decades of experience and process know-how** in plastics and plastics recycling.
- **Tailor-made solutions** for all recycling processes.
- **Food-grade PET bottle-to-bottle references** with brand approval with our SSP partner
- **Recycling Innovation Centers** in Europe and testing facilities around the world to support our customers.

Industry leading technology offering best quality, lower opex, maximal throughput and flexibility

Best Total Cost of Ownership

Worldwide support

Thank you for your attention.

You're very welcome to follow us.

For Performance Materials



For Food, Health and Nutrition



Contact

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