

CLOSING THE LOOP:
RECYCLABLE PACKAGING, SECONDARY
MARKETS AND CRC SYSTEM



Maag at a glance

Manufacturer of flexible packaging

📍 Headquartered in Ense (North Rhine-Westphalia)

👤 80 employees

🌐 70% export share

🏭 €20 million in sales

Focus: circular packaging solutions



Circular economy is our strategic core

Major steps:

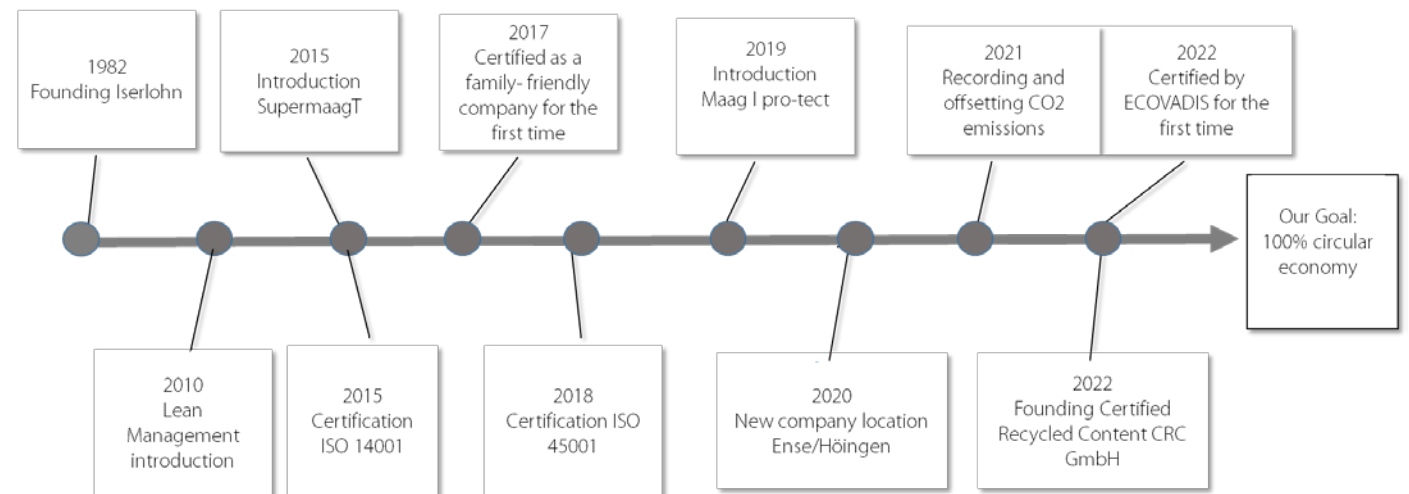
2010 Lean management

2015 First environmental certification

2021 Emissions recording

2022 Founding of CRC GmbH

2023 Grade A recyclable packaging



FIELD OF TENSION PACKAGING:



Reality in the flexible packaging market

The current market structure limits high-quality recycling.













- ~40% mixed plastic laminates
- NO high value mechanical recycling

PO-Flex waste (yellow bin collection)

- ~35–40% (largest stream)
- NO high value mechanical recycling

Recycler crisis

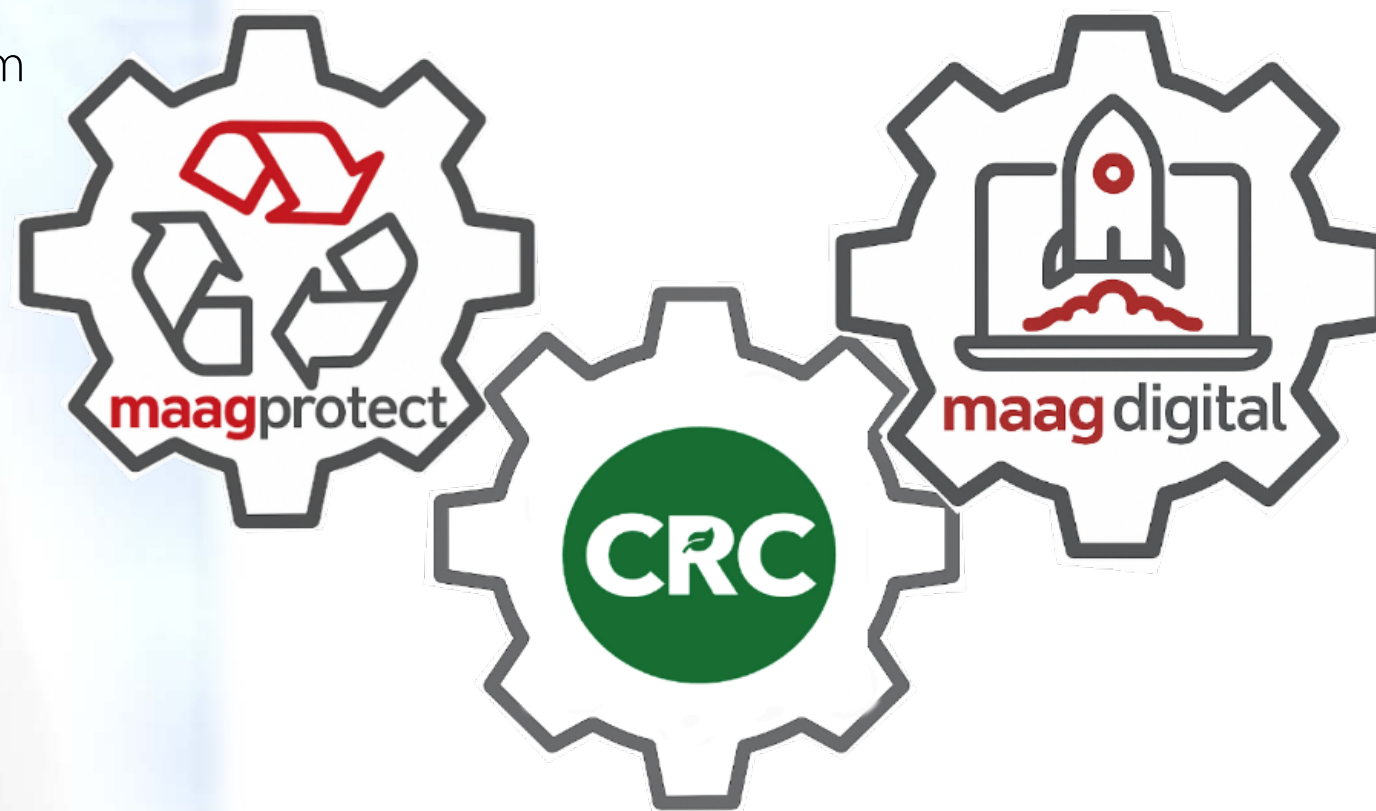
- <7% high-quality PCR from yellow bin
- Recyclate prices higher than virgin polymers
- Recyclers leaving the market

Mixed plastic packaging (market share approx. 40%)!			
	Cereals, dry food PET / PE		Sweet & Snacks PET/ ALU/ PE
	Wet wipes PET/ PE		Bread, Buns PET / PE
	Coffee PET/ALU/PE		Rice pudding PET/ ALU/ PE
	Meat, Sausage Tray PP Lid PET/PE EVOH		Pet food PET/ ALU/ PE
	Soup PAP/ ALU/ PE		Cheese OPA/ PE
	Cleaner, Detergent OPP/ PE		Sausage Tray PP/ Film PET/PE Deckel PP

and, and, and...

Our Solution

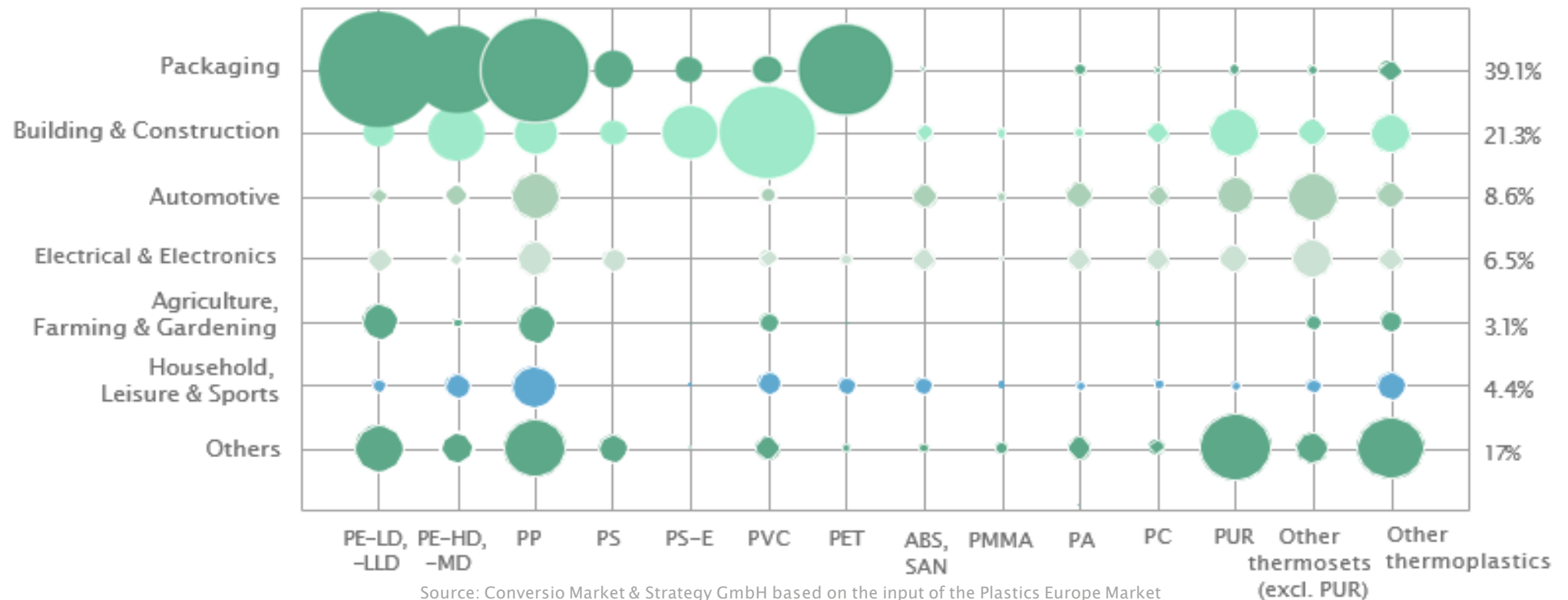
An integrated system



PROOF OF CONCEPT

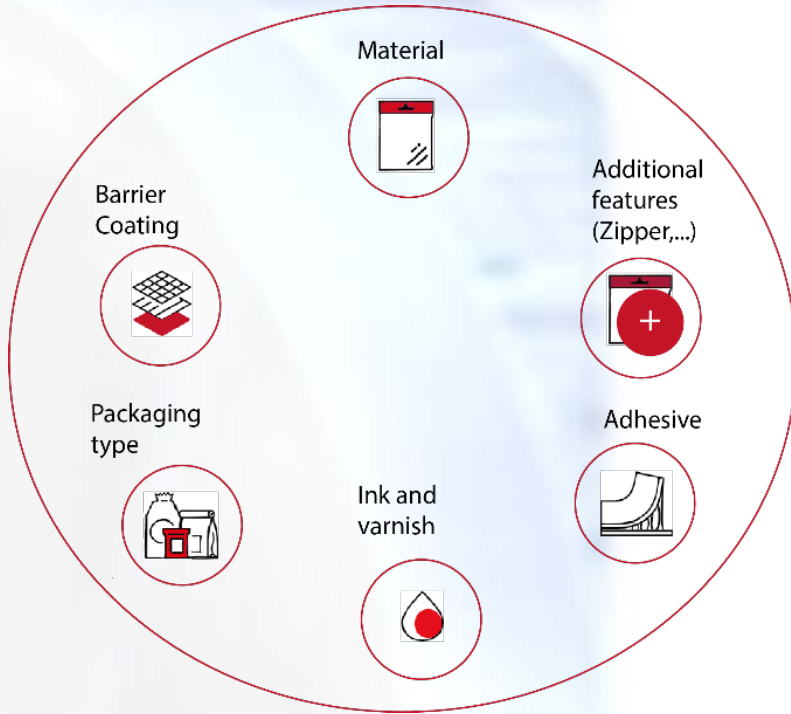


EU CONVERTERS' VIRGIN DEMAND ACROSS INDUSTRIES

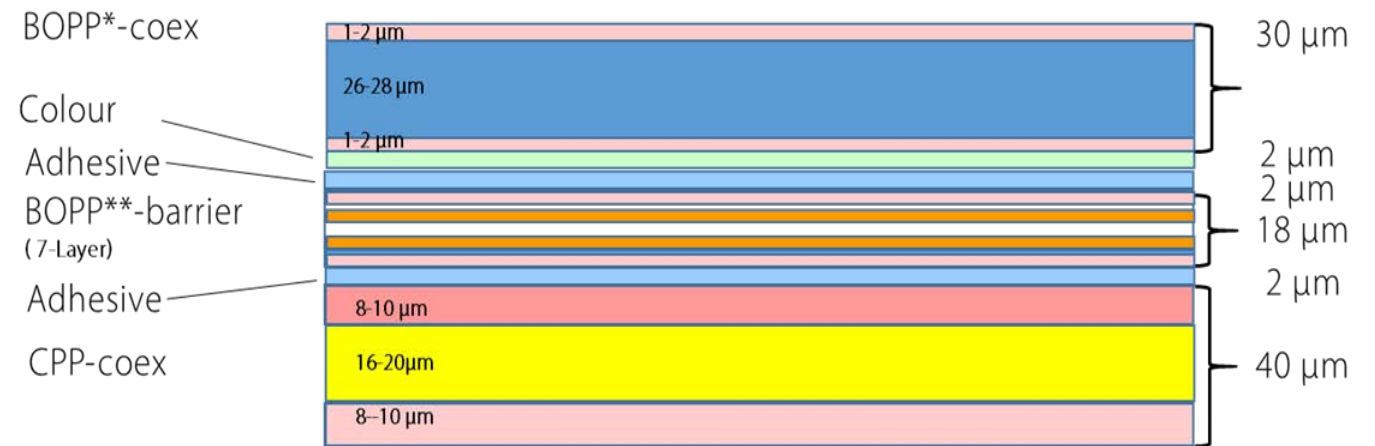


Source: Conversio Market & Strategy GmbH based on the input of the Plastics Europe Market Research Group (PEMRG) The above data are rounded estimations.

DESIGN FOR RECYCLING



Complexity of packaging films



All elements have an influence on recyclability



Design for Recycling

- Recyclable mono-material solutions (Polypropylene)
- Grade A recyclability >95% Recyclable inks – no use of NC inks
- Your advantage: Low weight, low DSD license costs!
- Reduced carbon footprint

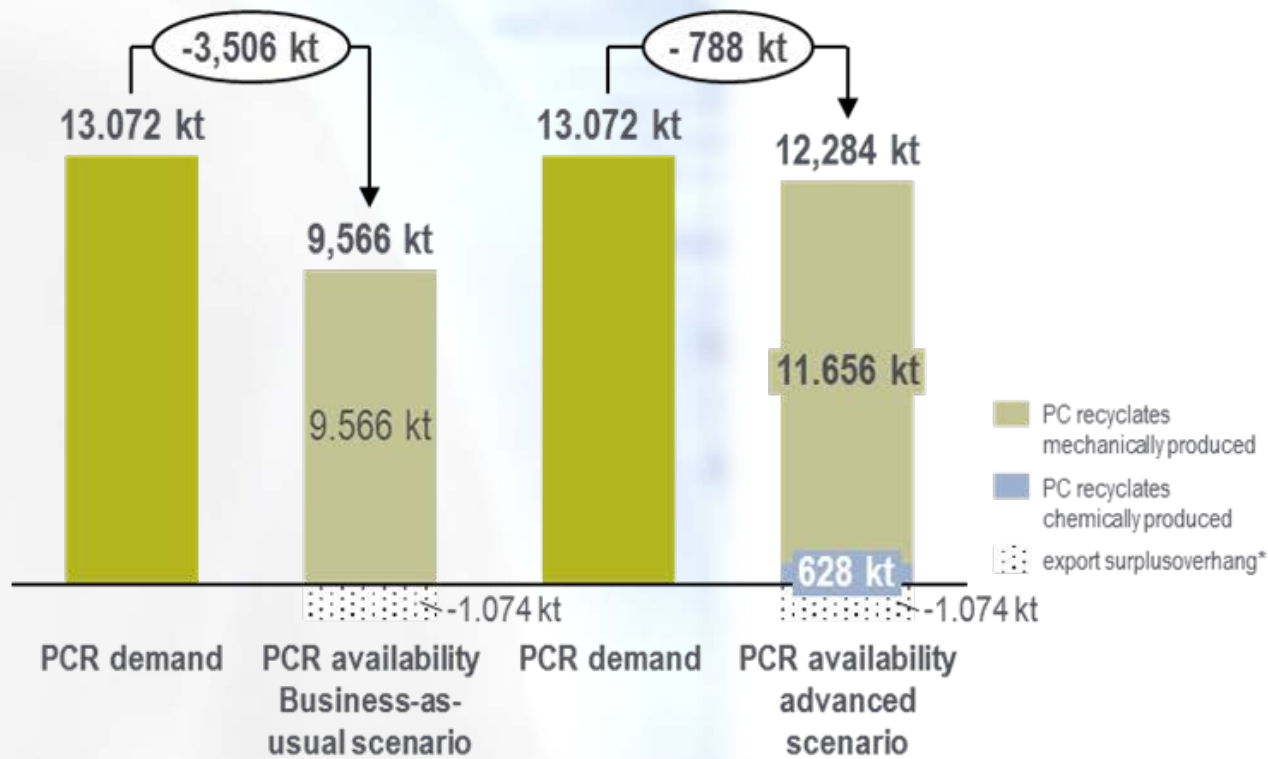
Our Solution



NEW CHALLENGES



Supply gaps in the scenarios



*In both scenario models, the current export surpluses were extrapolated to the year 2030.

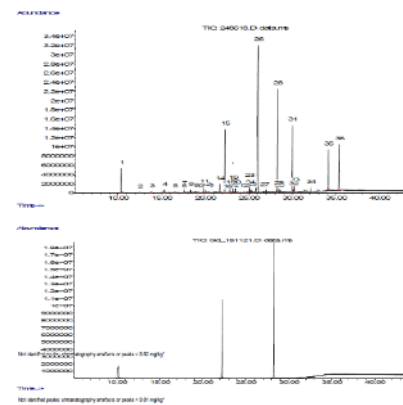
NEW CHALLENGES



EFSA permit for food grade polyolefins not expected in time (cautionary principle)



Scan #	RT min.	MW	Identification	CAS #	mg/dm ² *	mg/kg	Legislation	Ref No.	Restriction [mg/kg food]	Compliant
1	10,38		d-Phenol (IS)							
2	12,52	142	Nonanal	124-19-6	0,002	0,01	CH-List B	CH-ID No.: 895	0,01	see below
3	13,86	144	Octanoic acid	124-07-2	0,01	0,06	CH-List A and (EU) No 10/2008	FCM-No.: 304	none	Yes
4	15,35	158	Nonanoic acid	112-05-0	0,02	0,09	(EU) No. 1334/2008	Fl.No. 08.029		
7	17,58	162	Diacetylbenzene Isomer	N/P	0,005	0,03				
8	18,33	N/MW	probably cyclic ketone	N/P	0,004	0,02				
9	18,93	202	probably Ethyl hydrogen suberate	N/CAS	0,002	0,01				
10	19,19						#NV	#NV	#NV	#NV
11	19,84	N/MW	possibly branched Alkylester	N/P	0,01	0,04				
12	20,03	N/MW	probably Alkylxyester	N/P	0,003	0,02				
13	20,34									
14	21,06	250	2-Ethylhexyl salicylate	118-80-5	0,01	0,06	NIAS (1)	-	50	see below
15	22,28		di-Nonadecane (IS)							
18	22,83	276	7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-8,9-diene-2,8-dione	82304-86-3	0,004	0,02	NIAS (1)	-	0,09	see below
19	23,21	256	n-Hexadecanoic acid	57-10-3	0,02	0,10	CH-List A and (EU) No 10/2008	FCM-No.: 105	none	Yes
20	23,48	284	Ethyl palmitate	628-97-7	0,01	0,03	(EU) No 10/2011	FCM-No.: 879	none	Yes
22	24,44	N/MW	possibly Alkylotrater	N/P	0,002	0,01				
23	25,08	342	probably Tributyl aconitate	7588-58-3	0,01	0,07	NIAS (1)	-	1,8	see below
24	25,12	284	Octadecanoic acid	57-11-4	0,003	0,02	CH-List A and (EU) No 10/2008	FCM-No.: 106	none	Yes
25	25,32	380	probably n-Butyl citrate	77-94-1	0,003	0,02	CH-List A	CH-ID No.: 94	0,05	see below
26	26,10	402	Tributyl acetyltrater	77-90-7	0,07	4,04	CH-List A and (EU) No 10/2008	FCM-No.: 138	none	Yes
29	28,41	N/MW	probably Alkylamide	N/P	0,002	0,01				
31	30,01	337	Eucylamide	112-84-5	0,10	0,63				
33	30,22	N/MW	possibly sugar derivative	N/P	0,005	0,03	CH-List A and (EU) No 10/2008	FCM-No.: 271	none	Yes
34	32,10	N/MW	possibly Alkylxyester	N/P	0,003	0,02				
35	34,13	648	Irgafos 168	31570-04-4	0,04	0,23	CH-List A and (EU) No 10/2008	FCM-No.: 671	none	Yes
36	35,38	682	Irgafos 168 ox	95906-11-9	0,07	0,43	NIAS (1)	-	60	see below
Sum		N/MW	sum of branched hydrocarbons	N/P		1,12				



DIVERSITY OF POLYMERS IN INDUSTRY



(Flexible) packaging

PA

PET

PAP

LDPE

PP

Automotive,
construction, ..

PVC

ASA

ABS

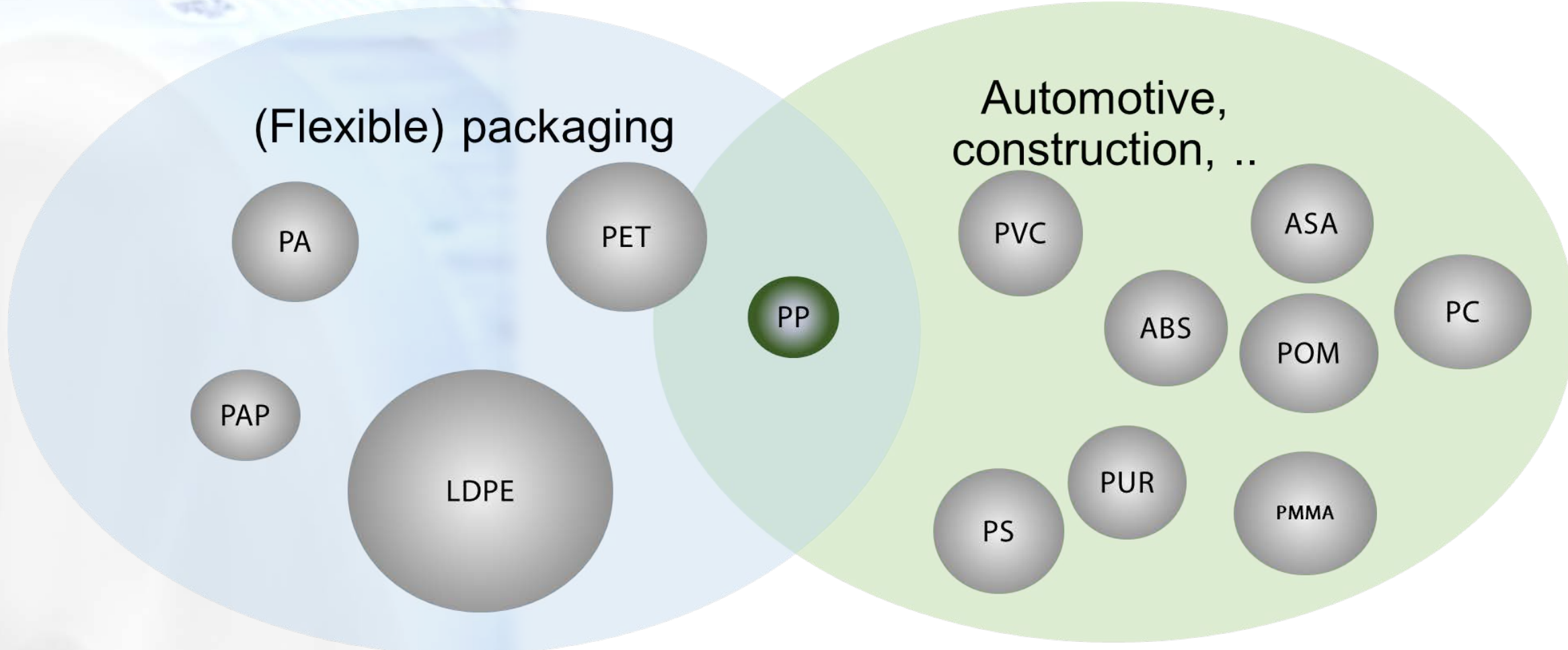
POM

PC

PS

PUR

PMMA



COOPERATION?



- Why don't we connect the two sectors working together already?



**contact sensitive
packaging⁽³⁾**
(all except PET)

2030

> 10%

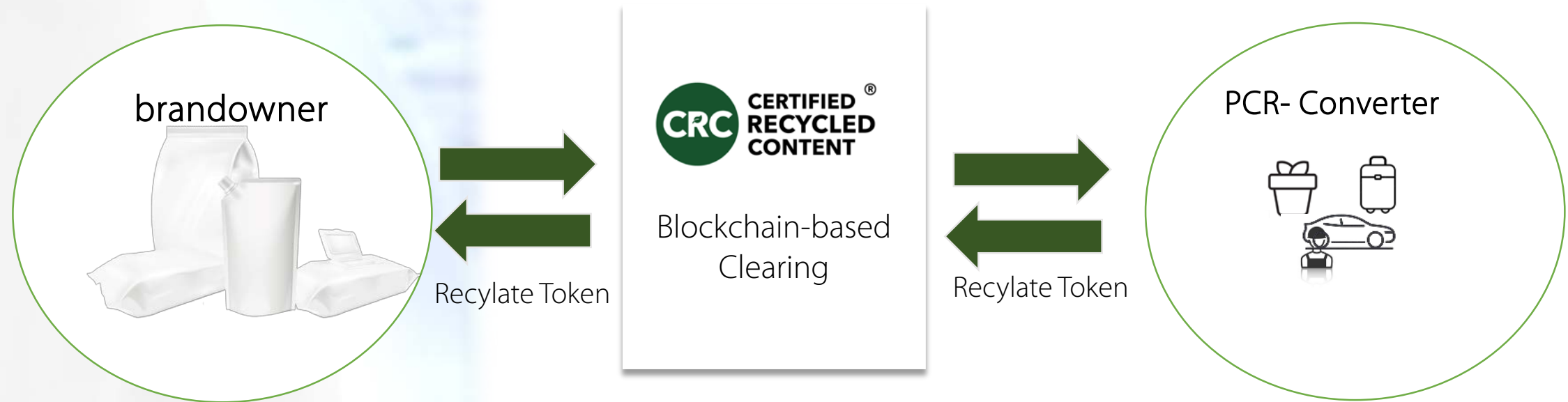
2040

> 25%

**Automotive, household, sports,
leisure, construction, ...**



CRC-Recycled Content Clearing



Recycled materials are used wherever it makes technical sense. Overachievement is certified
Token compensate for sectoral differences

BENEFITS IN SUMMARY



Utilisation of existing sorting routes and infrastructure

- ✓ No additional bureaucracy, efficient
- ✓ Strengthening the existing recycle market



Optimisation of the recycling ecosystem through economic incentives

- Token will be scarce, with prices higher than the prices for physically available recyclates
- ✓ Optimisation of the packaging design
 - ✓ Increasing the qualitative quantity of recycle for all sectors



Promotion of high-value recycling = replacing fossil-based plastics in typical polymer applications. (Definition according to German Central Body ZSVR, PPWR (Art 3.1 (41))

- ✓ Contribution to decarbonisation



Proof of recyclability through officially recognised test procedures

- ✓ Quality, traceability, safety

OUR SOLUTION



PPWR REQUIREMENTS 12.08.2026

New requirements include, amongst others:

- Technical documentation & Declaration of Conformity
- Evidence of material, recycling and compliance data
- Provision of structured data for authorities and customers
- Long-term documentation requirements

-> Manual Excel consolidation is not scalable for this purpose

THE PATH TO DIGITALISATION

Standardised processes



Clear responsibilities & data structures



Digital platform / system integration



Automated compliance & reporting capabilities

DIGITAL VAUE CHAIN



Efficiency through modular data integration

Your other benefits:

- Efficiency (reduced error, faster processes)
- Cost control
- Traceability through digital transparency
- Optimized production planning
- Waste reduction
- PPWR documentation and reporting

Economic and efficient



Material loss of films in production has been reduced by 68% since the implementation of LEAN.

530

Production waste in t

430

330

230

2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022



Efficiency benefits through conversion from push to pull orders

Inventory turn

13
(old: 4)

Delivery time

48h
(3 weeks)

OTIF:

99%
(65%)

Complaint rate

0,05%
(1,5%)

Employees

./. 35%

Circular plastics require systemic innovation

It needs:

circular packaging design

digital transparency

market-based incentives

Our approach:

Making flexible packaging smarter,
more sustainable, and more efficient.

