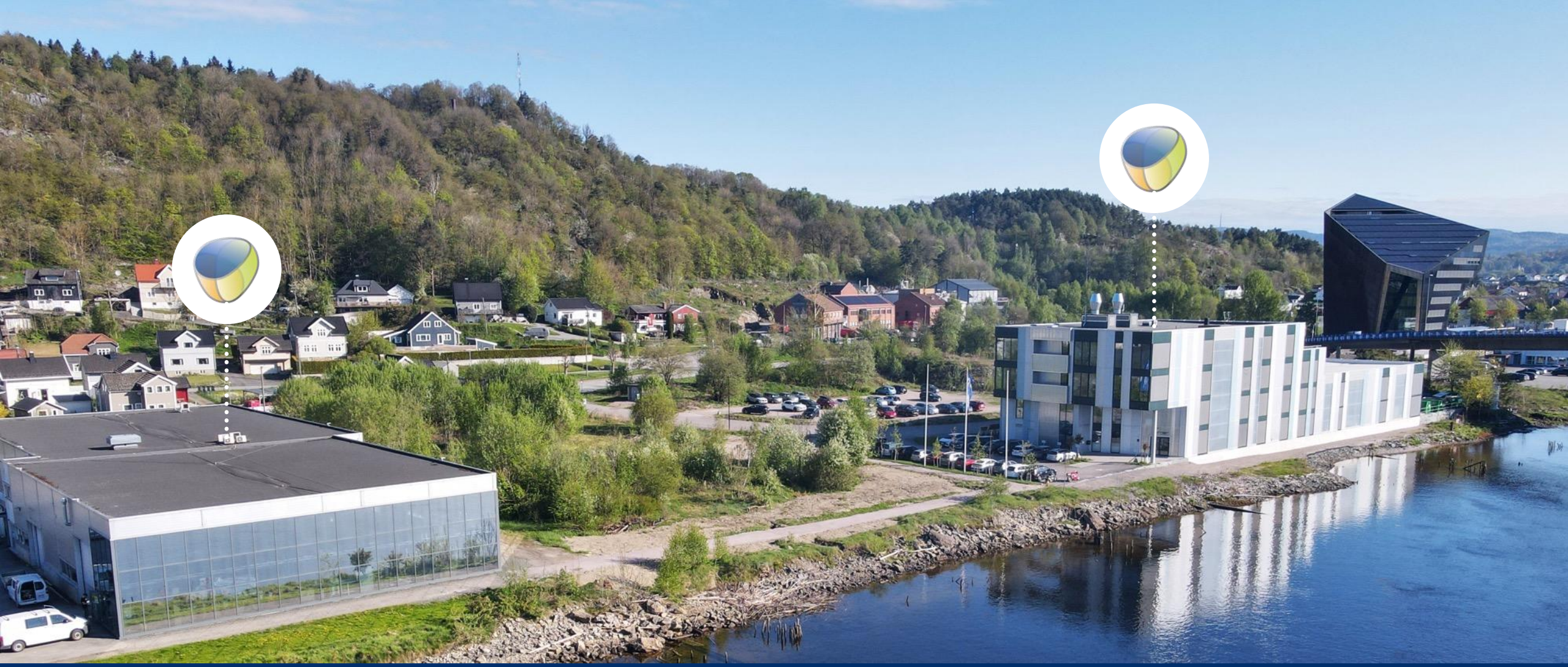
norner™
The Polymer Explorers

Sustainable Rotomoulding

Ronny Ervik

2026



Advanced Polymer Exploration Centre

Full service-portfolio in the plastics value chain from polymer to processing and end use innovations

norner™
The Polymer Explorers

Laboratories

BU PI - Lab
Polymerisation, modelling, **Process development & upscaling, Catalyst development**

Application Pilot Centre
Plastics processing, product prototypes, extrusion, moulding, film, Compounding

Material Testing & Characterization (MTC)
Polymer characterization, Ageing, Life-time prediction, Coating, Material testing

450 instruments/ machines

Are we prepared for what will come?

EU actions are transformational

Almost 32 million tonnes

of plastic waste is generated in Europe every year

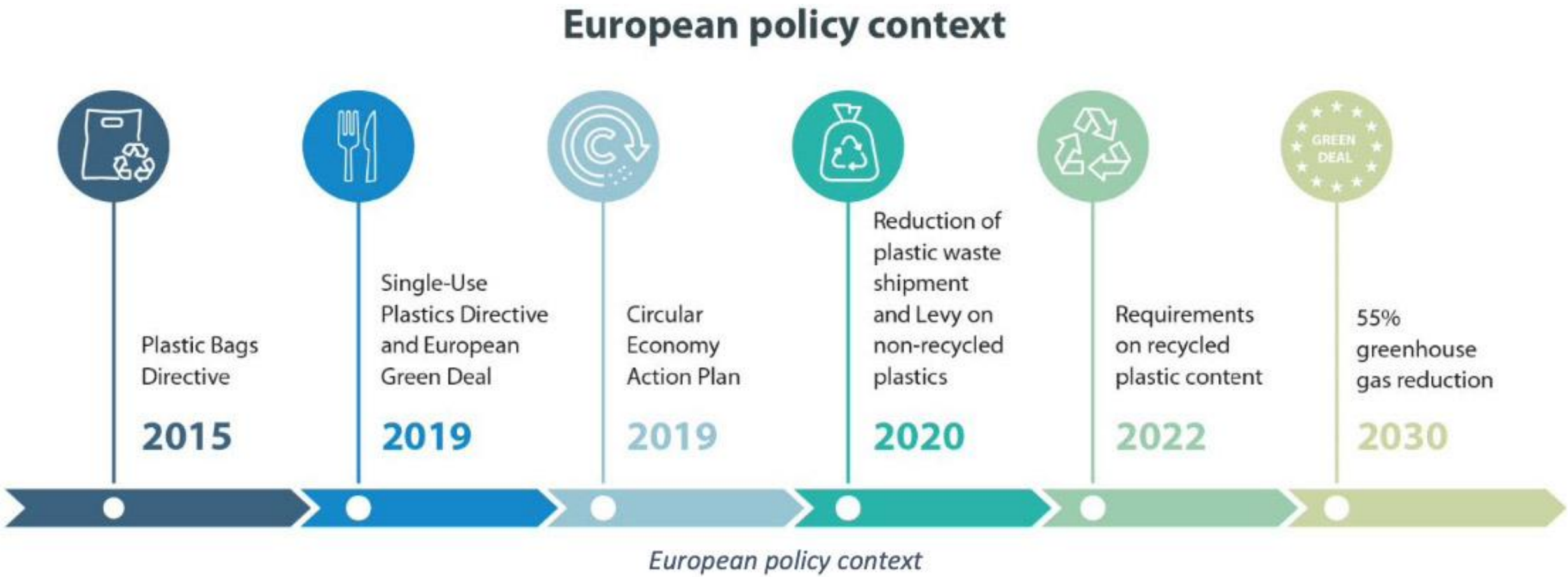
Around 80%

of marine litter is plastic

87%

of Europeans are worried about the impact of plastic products on the environment

EU Strategy on Plastic Waste



European policy context

Plastics will meet even stricter regulations in Europe

VISION = EU Green Deal + CEAP

CURRENT STATE

new record of CO_2 emissions in 2022

global consumption of materials

packaging waste generation

FUTURE STATE

climate neutral EU by 2050

economic growth decoupled from resource use

key product value chains: packaging & plastics

- EU Single-use Plastics Directive
- **Regulation on the use of recycled plastics for food contact materials**
- **Regulation of waste shipment**
- **Regulation on Packaging and Packaging Waste**
- Regulation on End-of-Life-Vehicles (ELV)

Packaging and packaging waste regulation (PPWR)

- The main objective of the revised PPWR is to establish a unified legislative framework across all EU member states, to meet packaging waste reduction targets
- The PPWR has far reaching implications for businesses throughout the entire value chain
  - Design for Recycling
  - Recycling at scale
  - Packaging Minimization
  - Minimum Recycled Content
  - Compostable and Biodegradable Packaging
  - Overall packaging waste generation reduction
  - Harmonized Extended Producer Responsibility
  - Deposit Return Schemes
  - Separate collection and labelling
  - Reuse and Refill

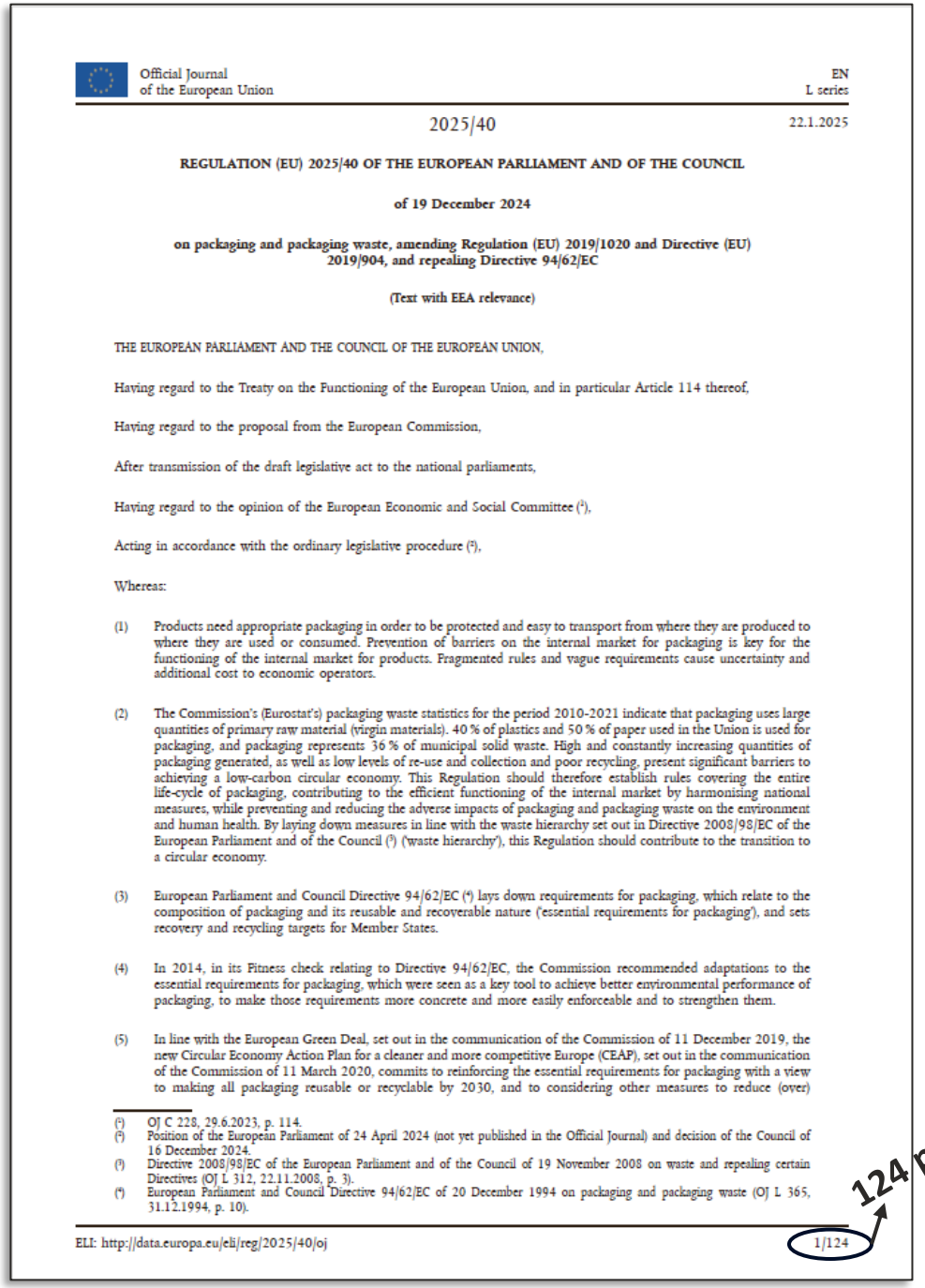
The ambitious regulation is here!

Entered into force on 11 February 2025 and its general date of application is 12. August 2026

"This Regulation should apply to all packaging placed on the market in the Union and to all packaging waste, regardless of the type of packaging or the material used."

"Packaging should be placed on the market only if it complies with the sustainability requirements and labelling requirements laid down in or pursuant to this Regulation"

- **Prevent and reduce** packaging waste, including through more reuse and refill systems.
- Make all packaging on the EU market **recyclable in an economically viable way by 2030.**
- **Safely increase** the use of recycled plastics in packaging.
- **Decrease the use of virgin materials** in packaging and put the sector on track to **climate neutrality by 2050**.



Official Journal of the European Union — EN, L series

2025/40 — 22.1.2025

REGULATION (EU) 2025/40 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 19 December 2024

on packaging and packaging waste, amending Regulation (EU) 2019/1020 and Directive (EU) 2019/904, and repealing Directive 94/62/EC

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 114 thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee (1),

Acting in accordance with the ordinary legislative procedure (2),

Whereas:

(1) Products need appropriate packaging in order to be protected and easy to transport from where they are produced to where they are used or consumed. Prevention of barriers on the internal market for packaging is key for the functioning of the internal market for products. Fragmented rules and vague requirements cause uncertainty and additional cost to economic operators.

(2) The Commission's (Eurostat's) packaging waste statistics for the period 2010-2021 indicate that packaging uses large quantities of primary raw material (virgin materials). 40 % of plastics and 50 % of paper used in the Union is used for packaging, and packaging represents 36 % of municipal solid waste. High and constantly increasing quantities of packaging generated, as well as low levels of re-use and collection and poor recycling, present significant barriers to achieving a low-carbon circular economy. This Regulation should therefore establish rules covering the entire life-cycle of packaging, contributing to the efficient functioning of the internal market by harmonising national measures, while preventing and reducing the adverse impacts of packaging and packaging waste on the environment and human health. By laying down measures in line with the waste hierarchy set out in Directive 2008/98/EC of the European Parliament and of the Council (3) ('waste hierarchy'), this Regulation should contribute to the transition to a circular economy.

(3) European Parliament and Council Directive 94/62/EC (4) lays down requirements for packaging, which relate to the composition of packaging and its reusable and recoverable nature ('essential requirements for packaging'), and sets recovery and recycling targets for Member States.

(4) In 2014, in its Fitness check relating to Directive 94/62/EC, the Commission recommended adaptations to the essential requirements for packaging, which were seen as a key tool to achieve better environmental performance of packaging, to make those requirements more concrete and more easily enforceable and to strengthen them.

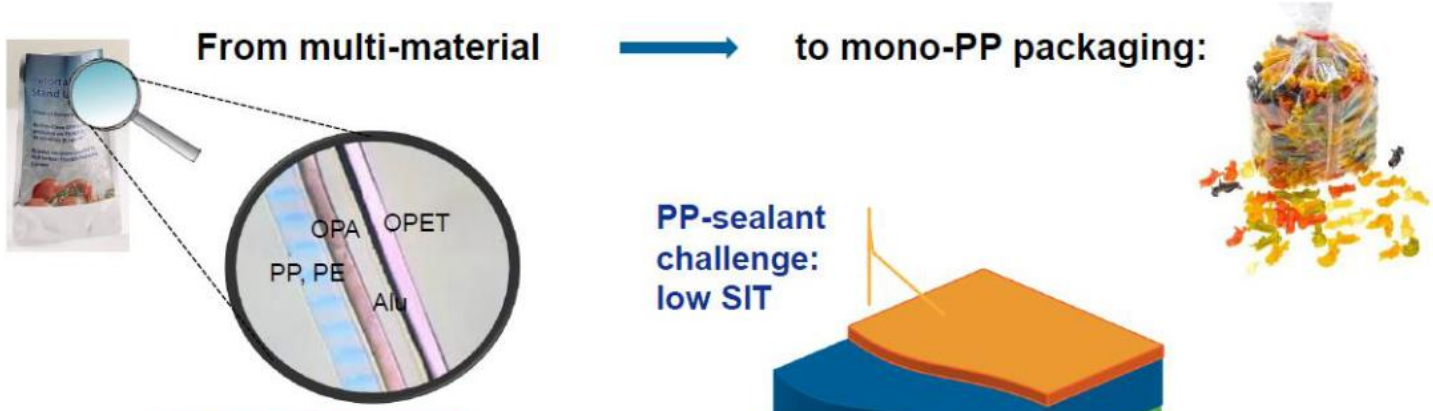
(5) In line with the European Green Deal, set out in the communication of the Commission of 11 December 2019, the new Circular Economy Action Plan for a cleaner and more competitive Europe (CEAP), set out in the communication of the Commission of 11 March 2020, commits to reinforcing the essential requirements for packaging with a view to making all packaging reusable or recyclable by 2030, and to considering other measures to reduce (over)

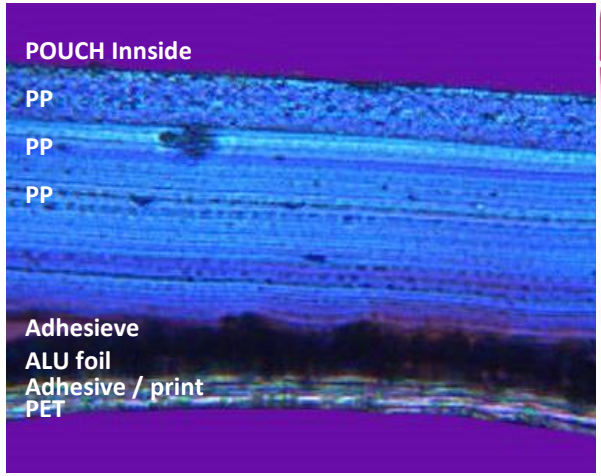
(1) OJ C 228, 29.6.2023, p. 114.
(2) Position of the European Parliament of 24 April 2024 (not yet published in the Official Journal) and decision of the Council of 16 December 2024.
(3) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (OJ L 312, 22.11.2008, p. 3).
(4) European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste (OJ L 365, 31.12.1994, p. 10).

ELI: http://data.europa.eu/eli/reg/2025/40/oj — 1/124

124 pages

From Multi – To Mono-material solutions..





UK Packaging preferred materials and formats guidelines 2025 – Own branded and Branded.

Version: PM07
Date: 010125

Red

Not to be used as customers cannot easily recycle

Materials	Formats & Designs
Compostable/PLA & biodegradable plastics	Rigid black plastic
Oxy/Oxo degradable plastics	Expanded/ foamed/density modified plastic, except EPP
Polystyrene – expanded and rigid	Complex laminates using aluminium layers for decoration
PVC	Hi/mid-cones
PVdC	Plastic straws & cutlery
Water soluble plastics	Glitter
MDF	Paper/board laminated on both sides
Waxed & siliconised paper	Paper/board with plastic lamination >10% by weight[1]
	Composite drums
	Packaging with batteries

Amber

Agreement for use required – only to be used if approved by the Tesco packaging team

CONTACT THE PACKAGING TEAM –
packaging.team@tesco.com

Materials	Formats & Designs
NIR black HDPE (non-food grade)[2]	Liquid or food cartons
Complex laminates[3]	Shrink sleeves
Foil laminated paper	Mixed material spouted pouch
Barrier papers	Expanded PP (EPP)
Bio-based polymers	Security/RFID stock tagging on plastic packaging
PET flexible films	
Wood	
Ceramics	

New material, formats and designs not listed should be presented to our packaging team for evaluation.

Green

Preferred for recycling via kerbside or store

Materials	Formats & Designs
Glass	Paper/board with plastic; single side lamination <10% by weight (incl. windows)*[1]
PET (Rigid)	Mono material spouted pouch
Polyethylene	
Mono PE or PP flexible film	
Polypropylene	
Steel & aluminium	
Sustainably sourced Cardboard & paper	
Non siliconised glassine	

1. Must be easily separated in the recycling stream to maximise fibre recovery and reduce contamination. Maximum 15% plastic lamination is currently acceptable on 120 gsm paper or less.
2. Dependant on utilising coloured (Jazz) recyclate only. No natural food grade HDPE should be used. Only to be used in non-food applications.
3. Rigid and flexible complex laminates should only include a mixture of materials where required barrier properties mean mono alternatives are unavailable

Packaging data MUST be provided to our packaging data partner, Valpak

TESCO

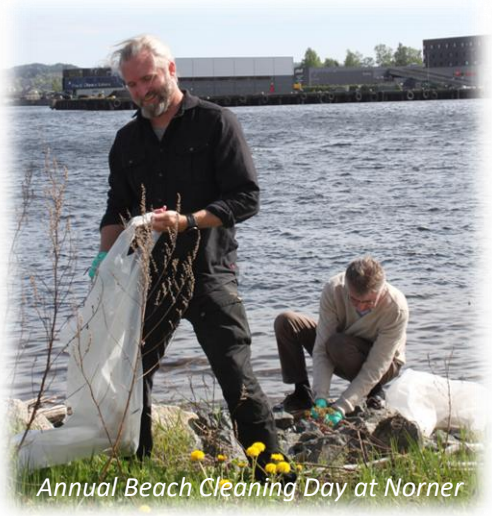
Where are we now?

Country	Virgin plastic tax/levy	Current rate	Effective/Planned date	Scope/Mechanism	DRS (status/year)	EPR eco-modulation	National recycled-content mandates (beyond SUP)	Notes for sellers
Germany	Single-Use Plastics Fund levy	Category rates (e.g., cups ≈€1.236/kg)	Law 2024; payments 2025	Cleanup levy on SUP categories	Live deposit system; €0.25 for PET bottles and cans; €0.08–0.15 for glass bottles	Yes (evolving)	None beyond SUP	Hits to-go, cups, bags; classification matters
United Kingdom	Plastic Packaging Tax if <30% recycled	£217.85/t (2024–25) £223.69/t (from 1 April 2025) £228.82/t (from 1 April 2026)	Live since 2022	Manufactured or imported packaging with <30% recycled plastic	Nation-level DRS planned for 2025+	Yes (via PRO)	None beyond PPT threshold	Clear tax saving at ≥30% PCR
France	No per-kg plastic tax; strong EPR eco-modulation			EPR bonuses for high recycled content; malus for hard-to-recycle	No national DRS; regional trials for glass & debate on plastic bottle/can deposits	Advanced	Sectoral options possible	Big fee savings at high PCR
Italy	Plastic tax on virgin plastic	€0.45/kg on virgin single-use plastic	Planned 1 Jul 2026 delayed	Tax excludes recycled & compostable plastics	Rolling out DRS elements; deposit system being developed	Yes (via CONAI)	None beyond SUP	Expect pre-compliance PCR surge
Ireland	No plastic packaging tax			Standard EPR	Live since Feb 2024; deposit 15–25 c for PET bottles and cans	Yes (via PRO)	None beyond SUP	DRS ramping; retailers push PCR

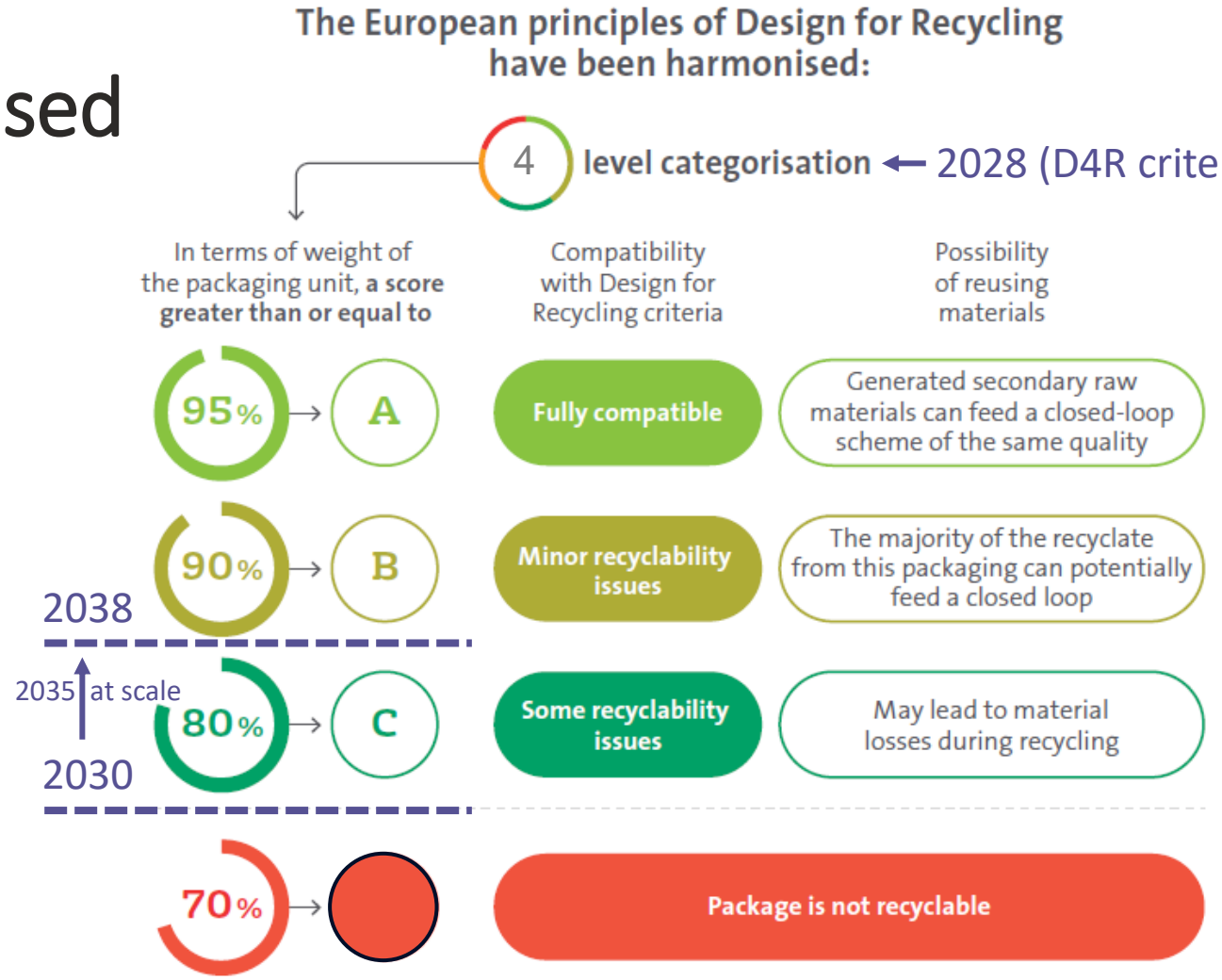
Information provided by Ultrapolymers UK

EPR-fee will be modulated based on eco-performance

- Will be modulated on level of recyclability
- May be modulated on level of recycled content
- May cover the necessary costs resulting from cleaning activities, including transport and subsequent treatment of packaging waste present in litter, as a part of the full waste management cost



Annual Beach Cleaning Day at Norner



As of 1st of January 2030 > 10% recycled content

Plastic packaging must contain a minimum amount of recycled content.

Contact sensitive plastic packaging[3]
(PET as major component)

2030	> 30%
2040	> 50%

Contact sensitive plastic packaging[3]
(All other than PET)

2030	> 10%
2040	> 25%

Single use plastic beverage bottles

2030	> 30%
2040	> 65%

For other plastic packaging

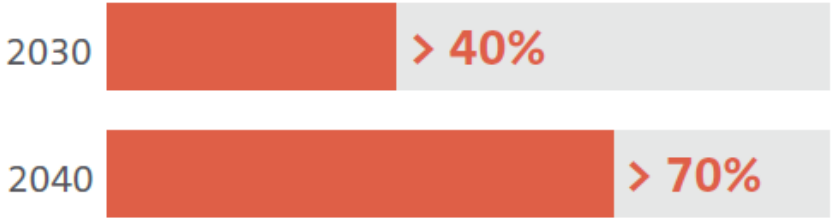
2030	> 35%
2040	> 65%

By 01/2029, the Commission shall adopt delegated acts for the calculation/verification of recycled content.

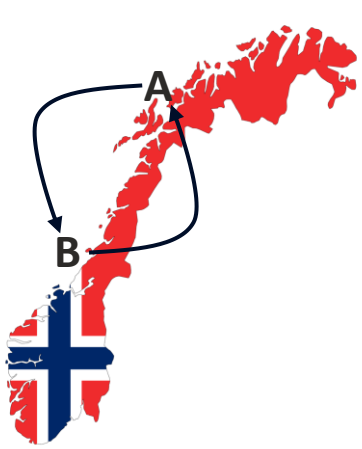
[3] This requirement excludes most medical or compostable packaging, or plastic parts representing less than 5% of total weight of a packaging format.

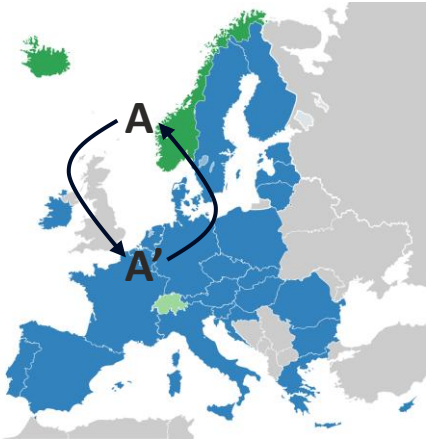
As of 1st of January 2030 > 40% reusable sales/transp. packaging

Transport and sales packaging[9] used for transporting products:



- 100% if delivery of products to another economic operator within the same Member State
- 100% if delivery between any sites on which the operator performs its activity and the sites of any other linked enterprise or partner





Transport and sales packaging:

- Pallets
- Foldable boxes
- Boxes
- Trays
- Plastic crates
- Intermediate bulk containers
- Pails
- Drums and canisters of any size or material
- Flexible formats or pallet wrappings or straps for stabilisation and protection of products put on pallets during transport

Re-use targets do not apply to:

- *Dangerous good, custom-designed large-scale equip., flexibles in direct contact with food and feed, cardboard boxes*

'transport packaging' means packaging conceived so as to facilitate the handling and transport of one or more sales units or a grouping of sales units, in order to prevent damage to the product from handling and transport."

'sales packaging' means packaging conceived so as to constitute a sales unit consisting of products and packaging to the end user at the point of sale

Plastic Packaging

Plastic packaging means all plastic-containing materials which can be used for **the containment**, **protection**, **handling**, **delivery** and **presentation** of other products, from raw materials to processed goods, from the producer to the user or the consumer

Picture: ASTRO Italy

Picture: Umoe Norway

Picture: Leafield UK

Picture: Vectus India

ESPR: Ecodesign for Sustainable Products Regulations

Status

Adopted in 2024 Implementation starting 2026–2028, depending on product category

Why it matters for plastics

While PPWR focuses on packaging, ESPR targets products themselves, including plastic products used in:

- Construction
- Infrastructure
- Transport
- Industrial and technical applications

ESPR enables the EU to introduce binding requirements for:

- minimum recycled content
- design for recyclability
- restrictions on problematic additives
- durability, repairability, and material efficiency

In practice, this means many plastic products beyond packaging will be regulated for the first time at EU level.

Digital Product Passport (DPP)

The Digital Product Passport is introduced under ESPR and will be one of the most impactful changes for the plastics value chain.

What DPP will require (for plastics)

Polymer composition and blends

Share of post-consumer recycled (PCR) content

Presence of regulated substances

Recyclability and end-of-life guidance

Traceability across the value chain

Key implication:

No data → no market access

1. What it's made of
    1. Type of plastic (e.g. PP, PE, PET, ABS)
    2. Additives (colours, flame retardants, fillers)
    3. Percentage of recycled content
    4. Whether it contains hazardous substances
2. How it was made
    1. Manufacturer and production site
    2. Compliance with EU rules (like REACH, RoHS)
    3. Sustainability information (e.g. carbon footprint – if required)
3. How to use and care for it
    1. Intended use
    2. Safety information
    3. Cleaning or maintenance advice
4. How to end its life
    1. Can it be recycled?
    2. Into what streams?
    3. Dismantling instructions (important for complex plastic products)
    4. Reuse or repair options

Microplastics restriction (REACH Annex XVII)

Already adopted, but practical impact is increasing now.

<u>Impacts include:</u>

- intentionally added microplastics
- fragmentation and wear
- pellet, powder, and masterbatch handling

<u>This introduces new requirements for:</u>

- production practices
- loss prevention
- documentation and compliance

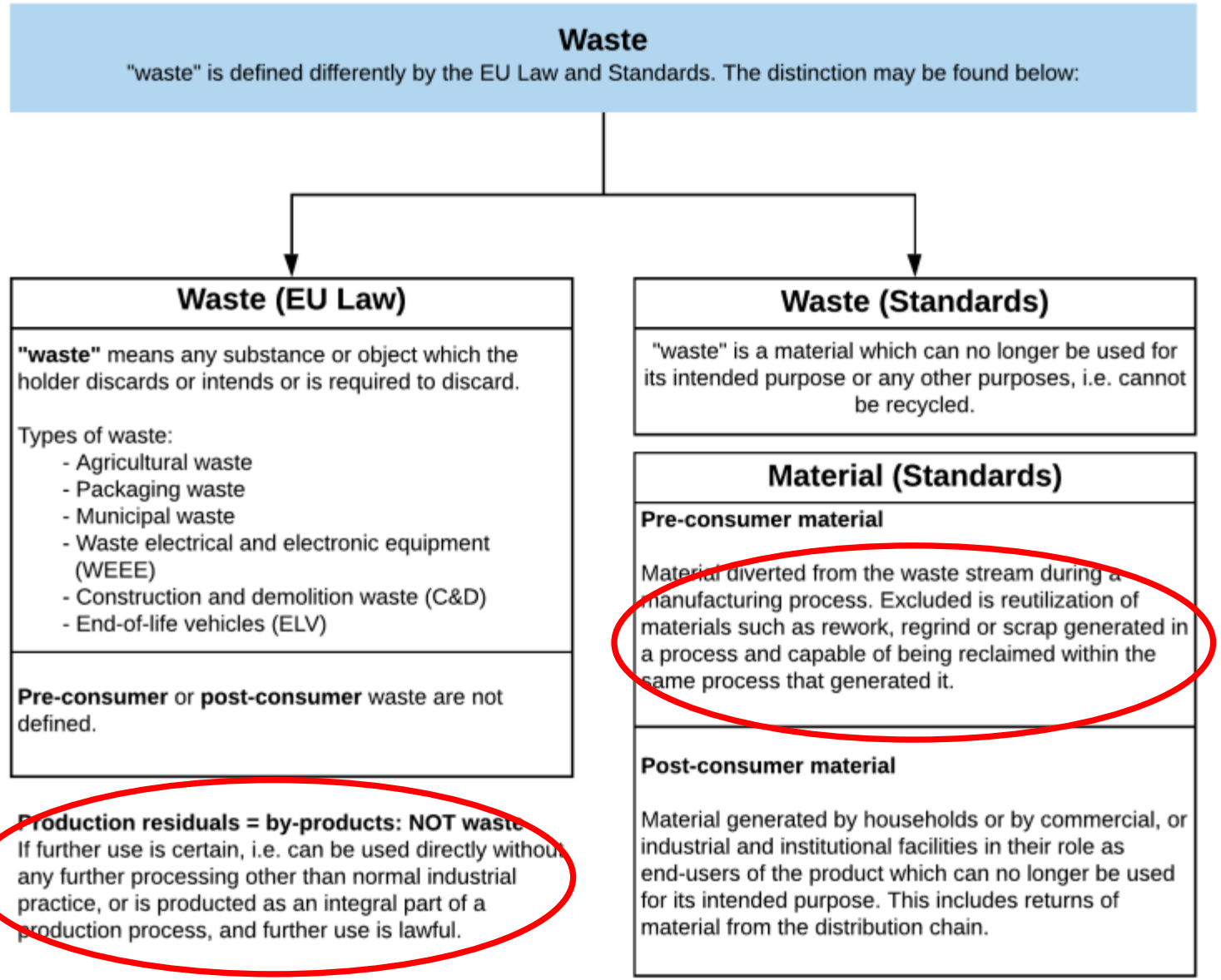


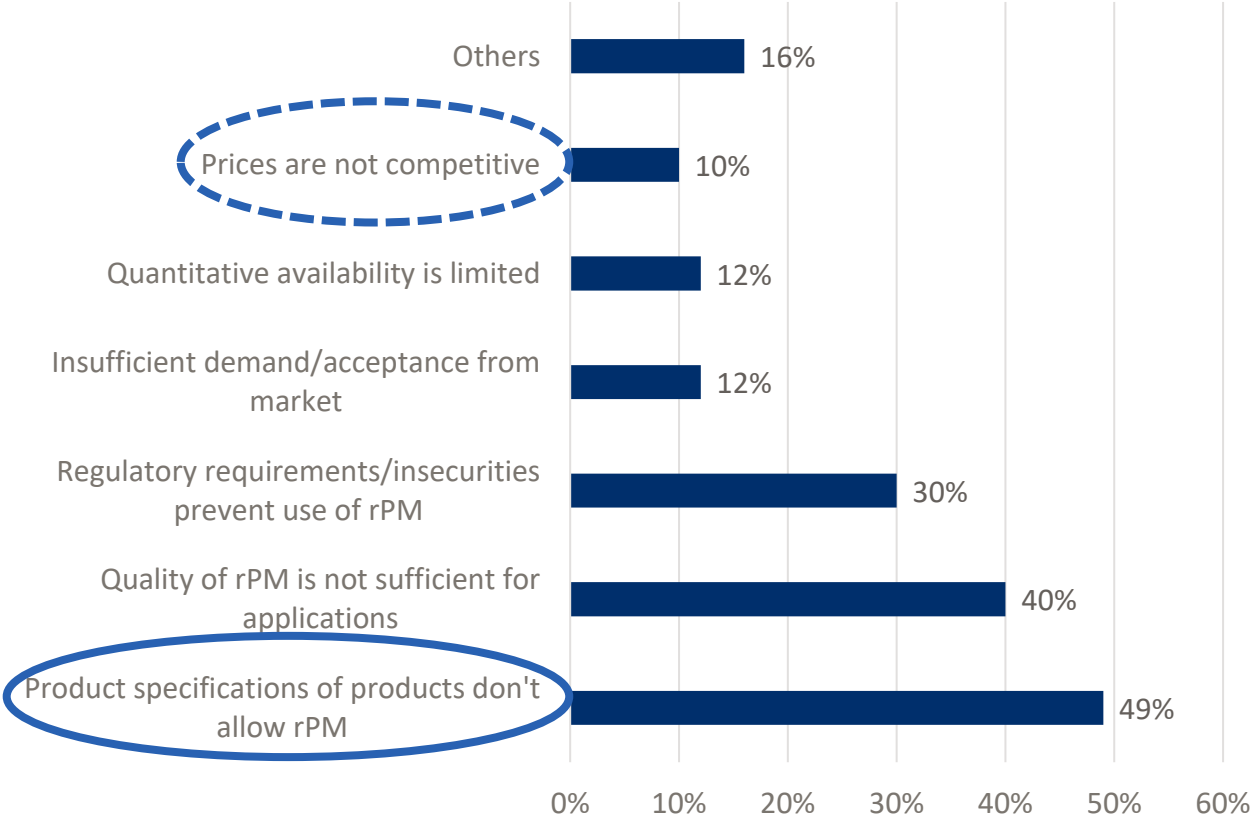
Figure 2. Waste and material definitions according to EU law and Standards

Rotomoulders Nordic + Baltic

Total PE consumption	Recycled PE	Rework PE	Biobased PE
	4 %	1 %	0
20 000	800	200	0

volume 2023	10 %	20 %	30 %	40 %	50 %
20 000	2 000	4 000	6 000	8 000	10 000
Volume rPE	800	800	800	800	800
Missing rPE	**1 200**	**3 200**	**5 200**	**7 200**	**9 200**

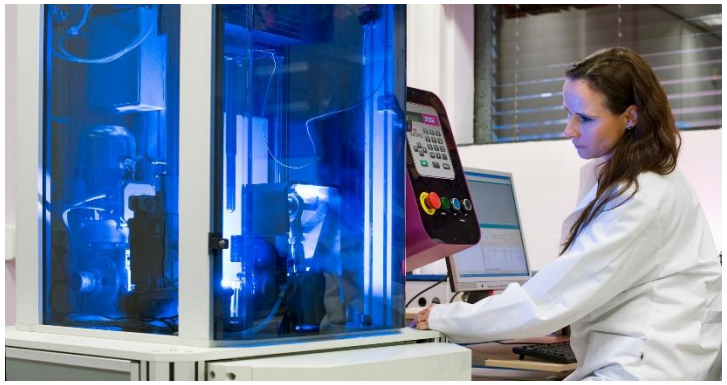
What are the main reasons preventing you from using recycled plastic materials?



What qualitative problems prevent your company from using (more) recycled plastics materials?

Source: EuPC Recycled Plastic Materials Usage by Plastics Converters in Europe - 2019

Mechanical properties



Processing

Colour

Gels & impurities

Traceability

Picture source: tempoautomation.com

Odour

Picture source:www.biositecleanup.com.au

Control of the waste raw material is a key to success, - but it does not solve everything !

Replast has developed several rLLDPEs for Rotational Moulding

Certified according to ISO 9001:2015
Cert.No. 51764-2009-AQ-NOR-NA

Certificate of Analysis

Producer :	Nordic Plastic Recycling
Reference number	Recyclene 1218

Norner AS is maintained by ISO 9001:2008 and administrated by certification body "Det Norske Veritas".
The certification of ISO9001 is valid from 2009.04.16

PROPERTIES	UNIT	TEST METHOD	TEST VALUE	St.Dev
MFR 190°C / 2,16kg	g/10min	ISO 1133	4,1	
Density	Kg/m³	ISO 1183-1/A	939	0,2
Tensile modulus @ 23°C 1mm/min	MPa	ISO 527-2	652	17,0
Stress at yield @ 23°C, 50mm/min	MPa	ISO 527-2	18	0,2
Strain at yield @ 23°C,50mm/min	%	ISO 527-2	11	0,1
Tensile strength @ 23°C,50mm/min	MPa	ISO 527-2	18	0,2
Stress at break, @ 23°C,50mm/min	MPa	ISO 527-2	8,2	1,7
Strain at break, @ 23°C,50mm/min	%	ISO 527-2	170	31,1
ESCR, 10% Arkopal	h	ASTM D1693	>500	
HDT, Method B (0.45MPa)	°C	ISO 75-2	59	
ARM Impact	J/mm	ARM std	21	

Date : 9-Dec-22

Heidi Nornes Bryntesen
Senior Consultant

Ronny Ervik
Senior Consultant

Norner AS
Dokkveien 20
3920 Porsgrunn
Norway

Org.nr: NO898736 032MVA
Web: www.norner.no
post@norner.no

Change or be changed?

Rotostøp as

Manufacturer of River Boats

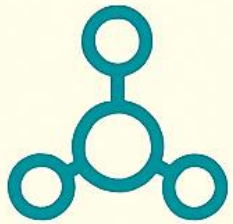
3 main goals of circular economy

a) **To eliminate waste**
b) **Make things last longer**
c) **Regenerate natural systems**

Plastic Value Chain

Raw Material Production	Conversion and product manufacturing	Distribution	Use	Recycling

Circular Design for Plastics



Systems Thinking

Understand the interconnectedness of materlals, process, a□peple

Value Creation

Generate long-term economic, social, and environmental benefits

Resource Management

Use resources efficiently, prioritizing renewable and recycled inputs

Value Sharing

Enable collaborative models and platforms

Resource Tracking

Resource Tracking

Ecosystem Resilience

Design for adaptabillty and robustness in changing environments

Systems Thinking

What can you do to eliminate waste being sent to incineration or landfill

Biological and technical cycles

Increased lifespan
Waste reduction
Material circularity

Module based design

Value creation

Create long term economic, social and environmental benefits

Reduced CO_2 emission
Recycle materials (PET)
Market differentiation

River 420 eco

100 % recycled

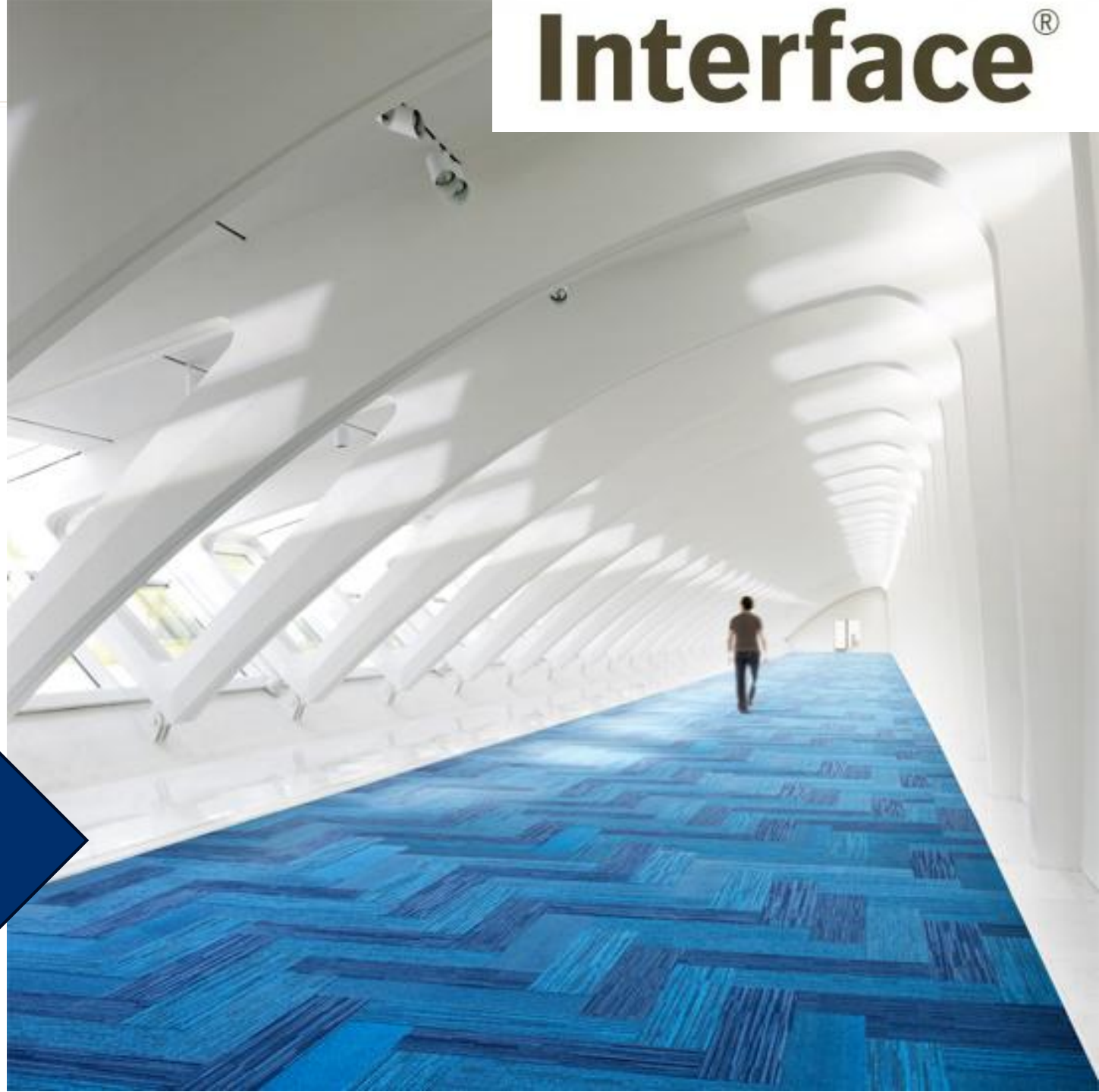
Rotostøp as

Manufacturer of River Boats

Value Sharing

Enable collaborative models and platforms

Local communities earn income
Interface gains high quality polyamide
Reduced plastics in the ocean



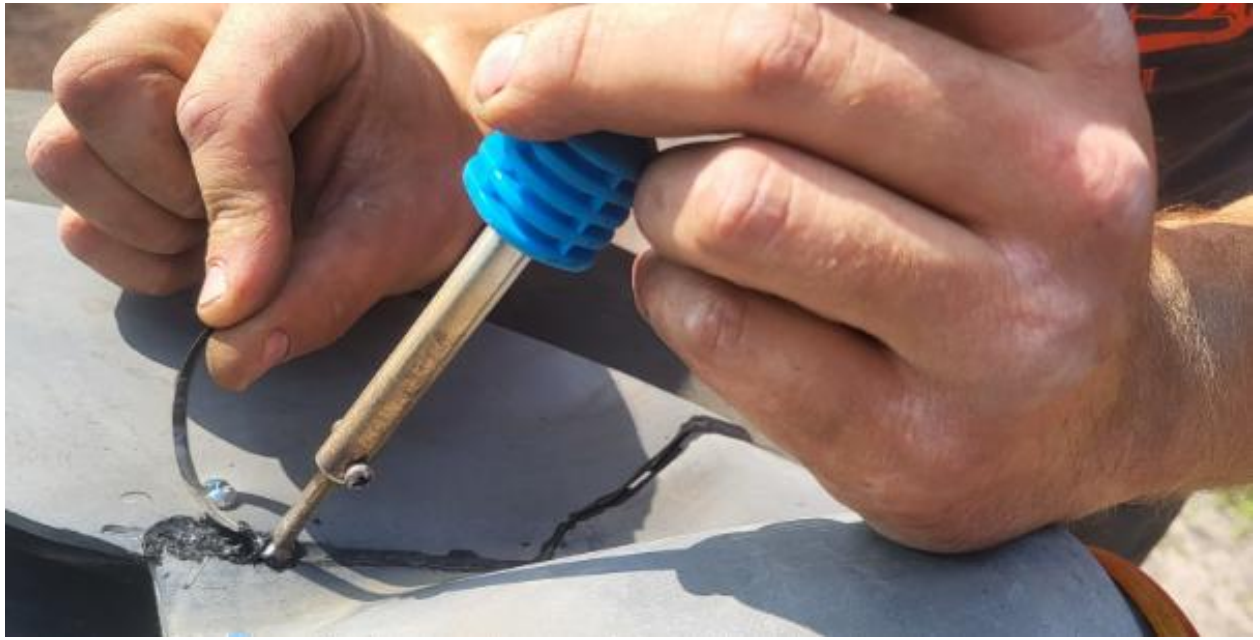
Design for rental and shared use

Resource Management

Use resources efficiently, prioritizing renewable and recycled inputs

Increased garment lifespan
Efficient recovery of textiles
Reduction in virgin material use

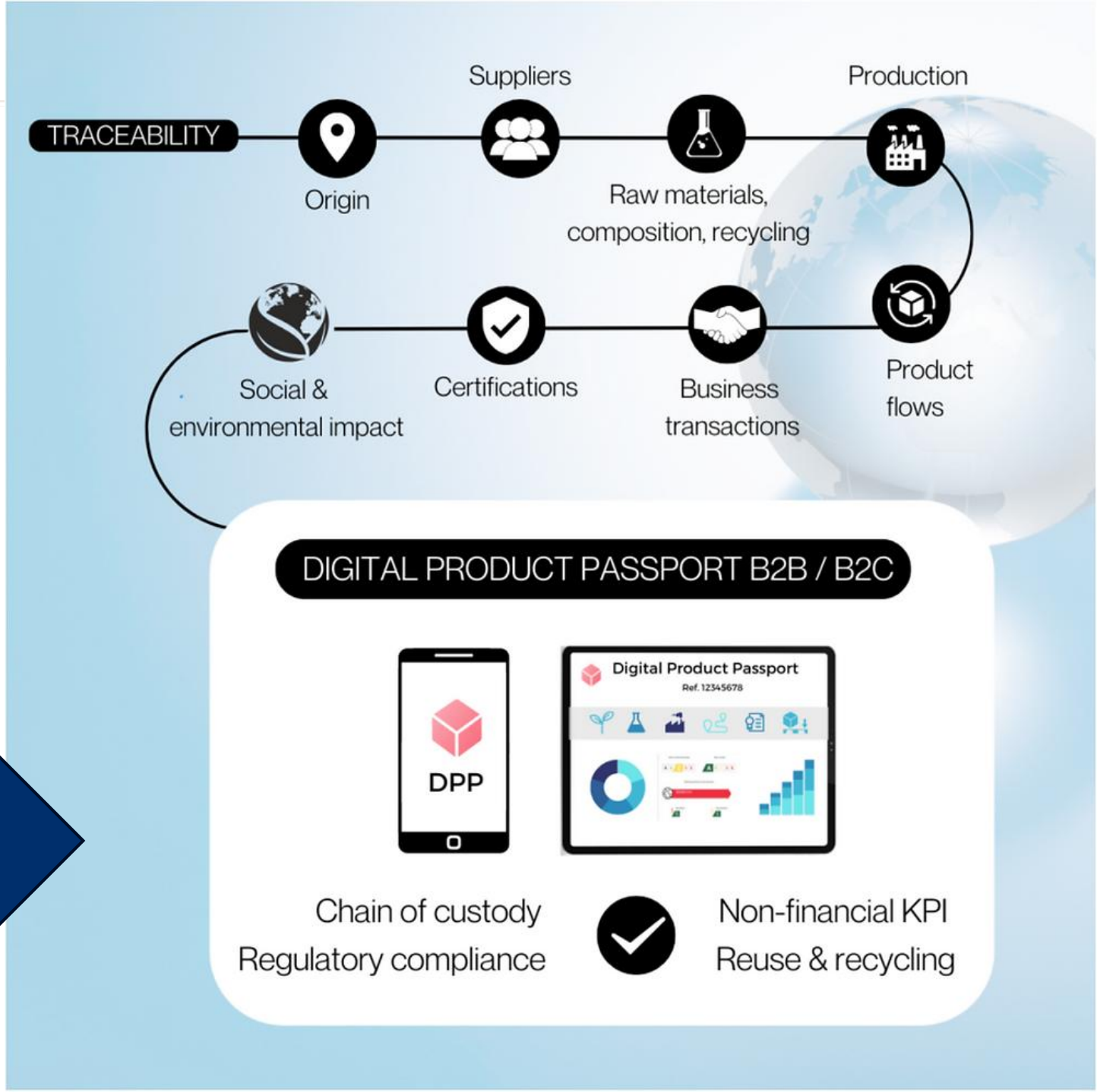
Design for easy repairing



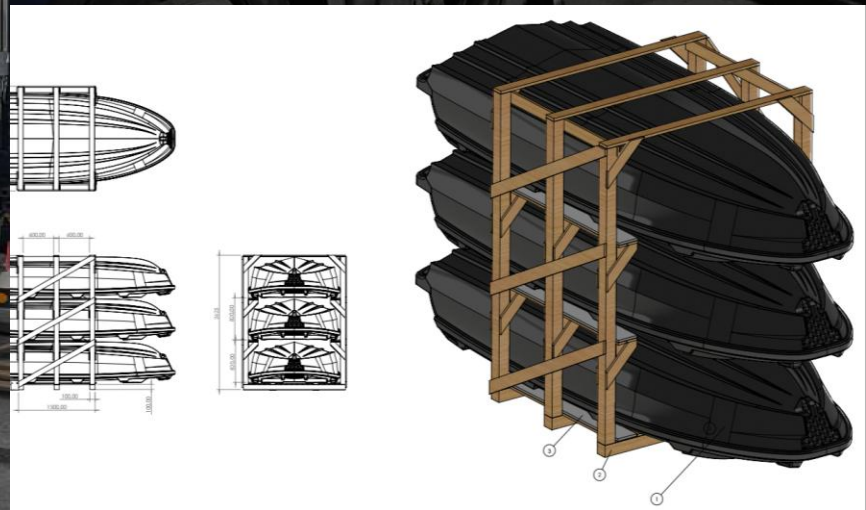
Resource Tracking

Tracking of materials and products

Easier recycling
Consumers get transparency
Supports resale and refurbishment systems



Design for transportation



Ecosystem Resilience

Design for adaptability and robustness in changing environments

Restores soil health & increases biodiversity
Improves water retention
Reduces dependency on chemical fertilizers

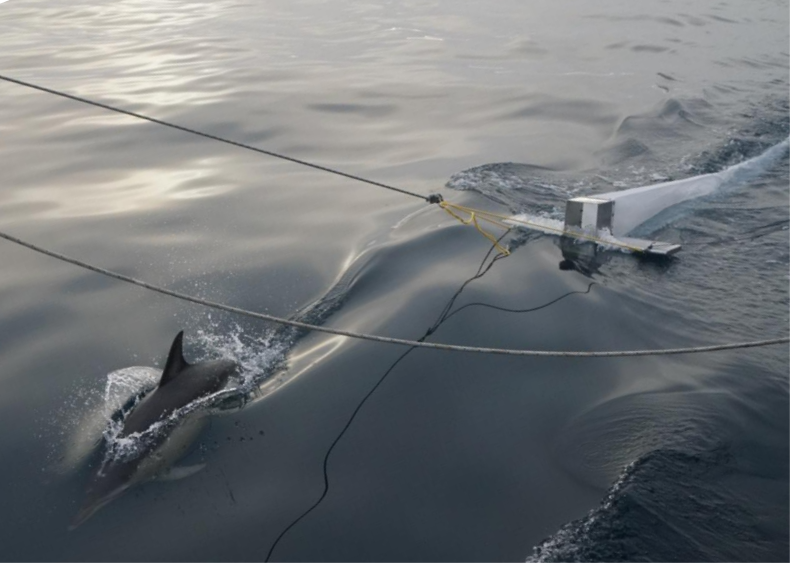
Local sourced materials

Båt	110	kg	LLDPE
Strøm	260	kw/t pr.ovn	Støpetid
Nettleie	260	kw/t pr.ovn	Støpetid
Arbeidstimer	5,5	timer	
Emballasje	1	Strekkfilm/rull	LLDPE
Logoer	2	stk	Selvkl. Folier
Primer logoer	0,05	boks	3M på boks
Akterspeil innvendig	1	stk	4mm aluminium
Akterspeil utvendig	1	stk	6mm aluminium
Baugluke	1	Stk	HDPE
Lenseplugg sort	2	Stk	Plast
Ekspansionsplugg	1	Stk	Plast/gummi

Summary

- Use Circular Design on all new products
- Implement in your organization:
  - System Thinking
  - Value Creation
  - Resource Management
  - Value Sharing
  - Resource Tracking
  - Ecosystem Resilience
- Circular Design will not only benefit the environment, but also the society and your shareholders

You will boost profit, reputation and help the environment by implementing Circular Design



We are all in the same boat

ARE EVERYONE ON-BOARD?

CHANGE OR BE CHANGED!
What is your strategy?

LICENCE TO OPERATE

norner
The Polymer Explorers