

Piloting to create innovative, circular plastics solutions

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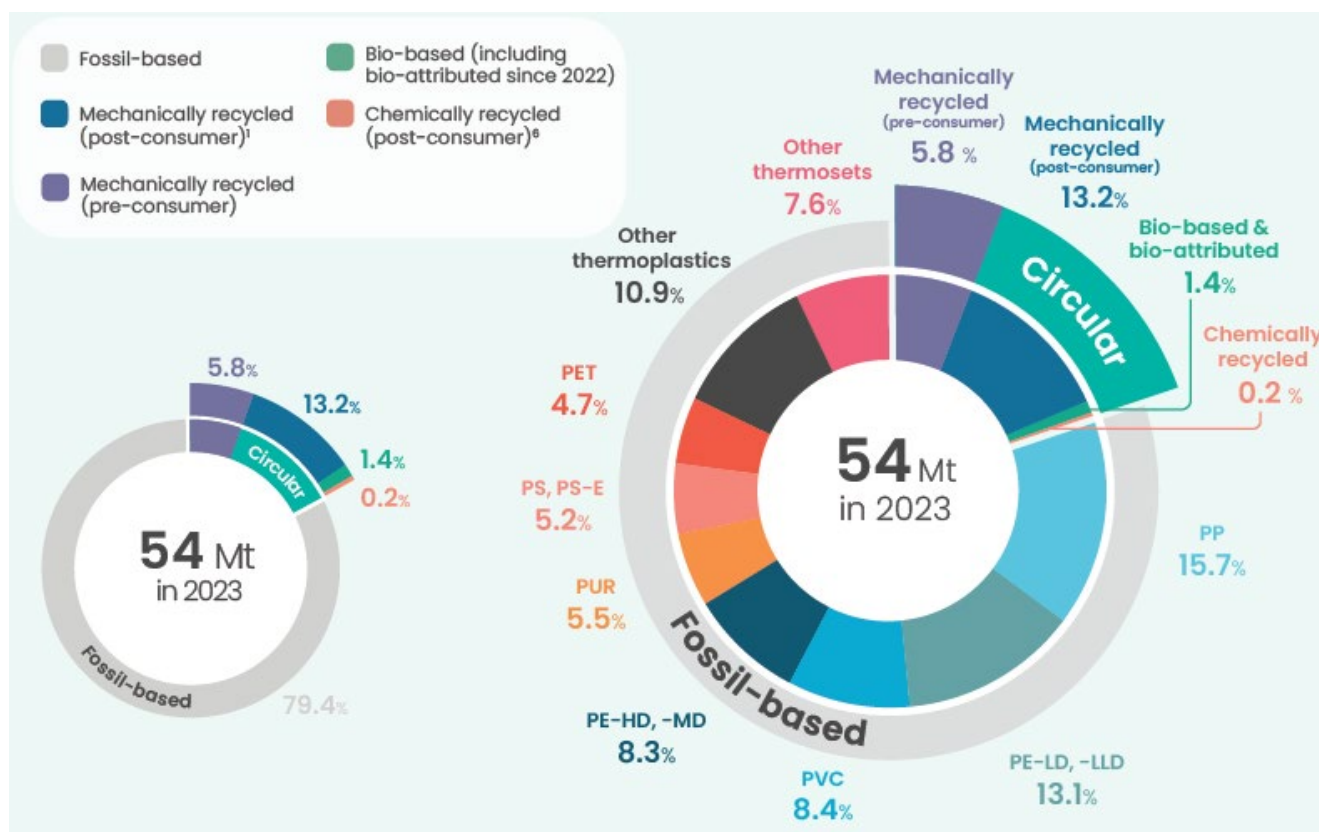
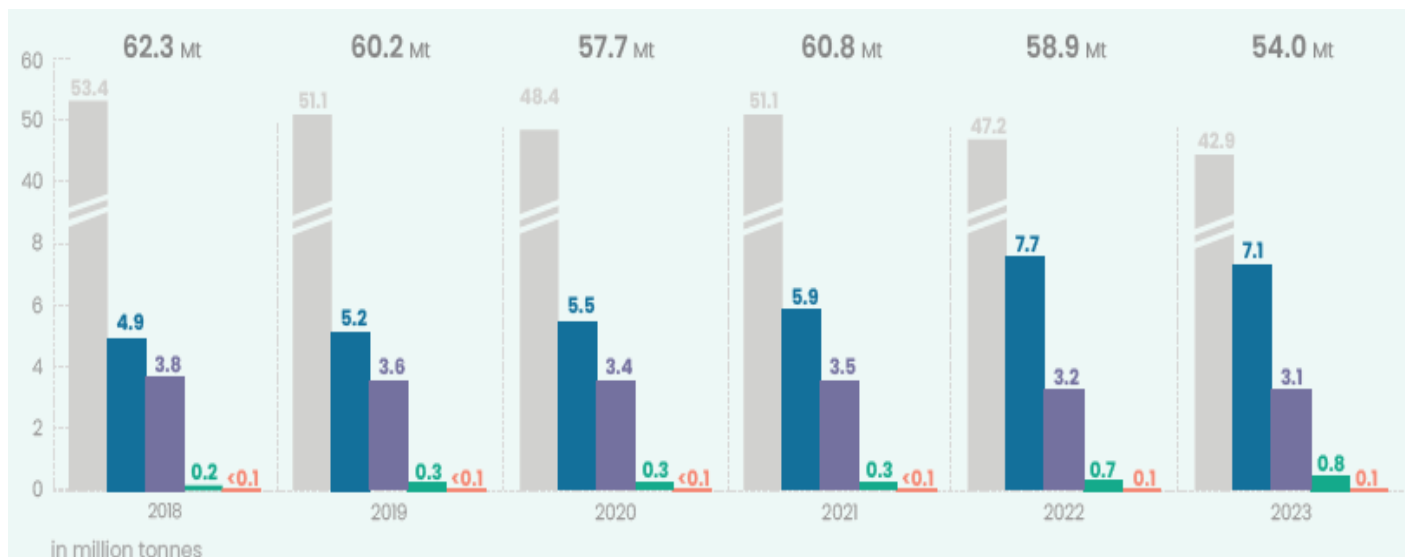
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Facts on Plastics Use IN EU27

2023 EU key figures – source: Plastic Europe fact sheets



Plastics production industry indexes in EU27



Production: the official Eurostat denomination is «Manufacture of plastics in primary forms».
Conversion: the official Eurostat denomination is «Manufacture of plastic products».

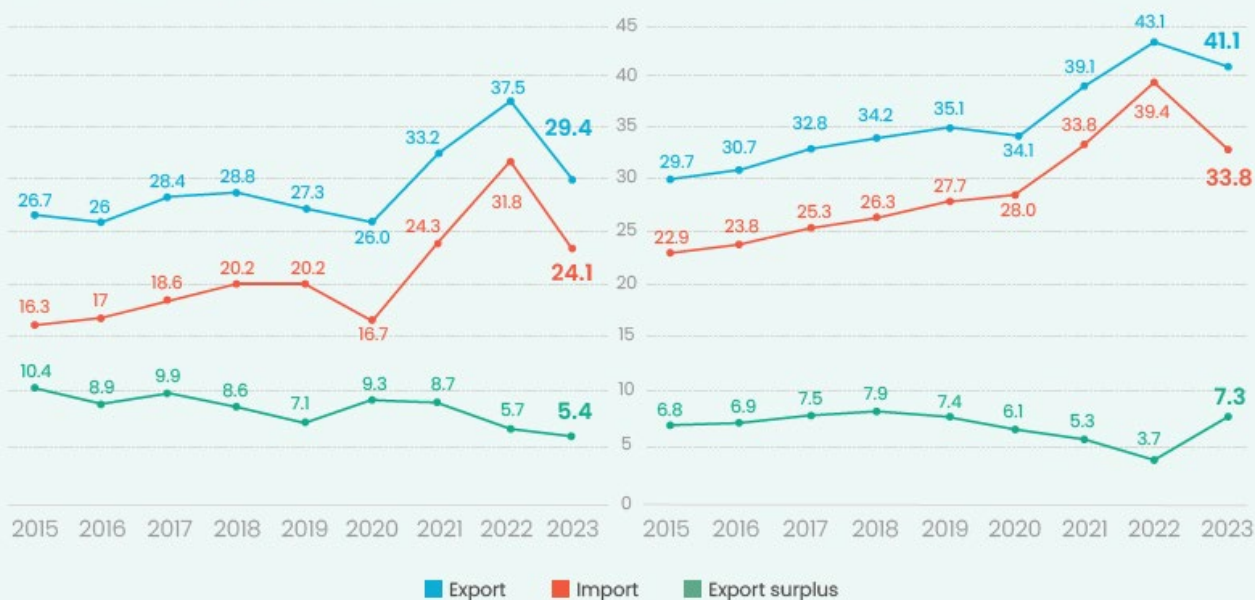
European trade balance (in value) in 2023

12.7 bn €
Trade balance

Plastics PRODUCTION EXTRA EU27

€bn

Plastics CONVERSION EXTRA EU27



2023 European key figures



>1.5
million
employees



>51,700
companies



12.7
billion €
trade
balance



~365
billion €
turnover



14.8%
Share of circular
plastics in
European production⁸



54 Mt
European
plastics
production



12%
Europe's share
of global plastics
production

NOVEL CHANGES in plastics (not only) industry and use of plastics

1 EU TAXONOMY

What the EU Taxonomy is	What the EU Taxonomy is not
A classification system to establish clear definitions of what is an environmentally sustainable economic activity	It's not a mandatory list to invest in
Tool to help investors and companies to make informed investment decisions on environmentally sustainable activities for the purpose of determining the degree of sustainability of an investment	It's not a rating of the "greenness" of companies
Reflecting technological and policy developments: The Taxonomy will be updated regularly	It does not make any judgement on the financial performance of an investment
Facilitating transition of polluting sectors	What's not green is not necessarily brown. Activities that are not on the list, are not necessarily polluting activities. The focus is simply on activities that contribute substantially to environmental objectives.
Technology neutral	
Fostering Transparency by disclosures for financial market participants and large companies related to the Taxonomy	



Greenhouse gas emissions are reduced by at least 55% by 2030 (compared to 1990 levels)



There are no net emissions of greenhouse gases by 2050



The EU society is fully adapted to the unavoidable impacts of climate change by 2050



The EU's natural capital is protected, conserved and enhanced



The health and wellbeing of citizens from environment-related risks and impacts is protected



No person and no place is left behind



ECO DESIGN

[Regulation - EU - 2024/1781 - EN - EUR-Lex \(europa.eu\)](#)

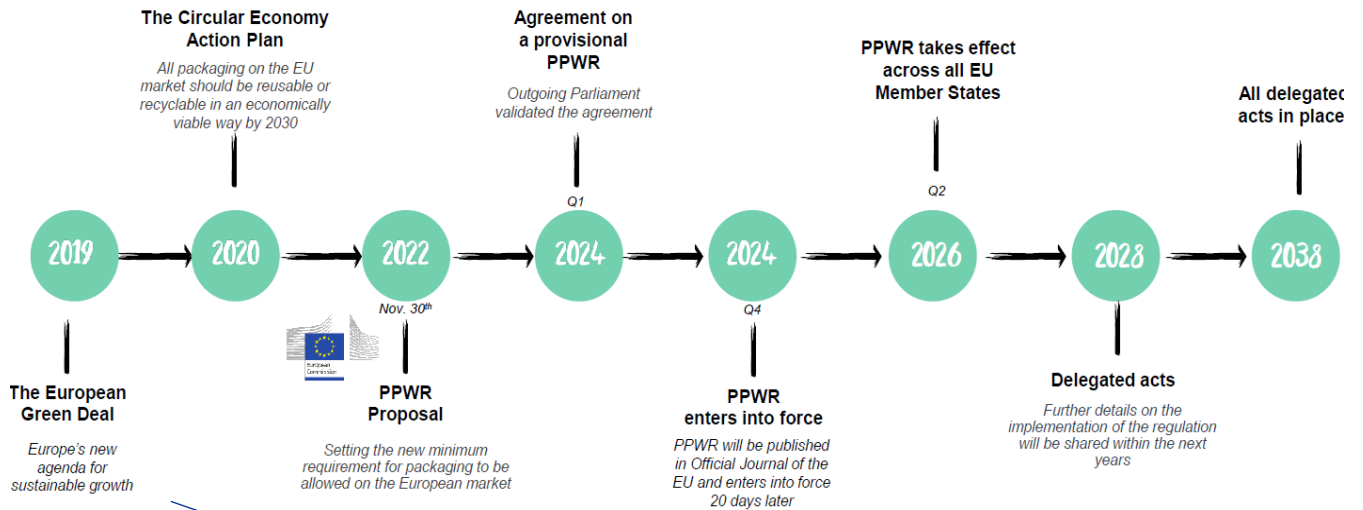
This regulation is fundamentally important for the implementation of the principles of sustainability and circularity of products of all categories. However, the principles (a) to (p) below are seamlessly applicable in the field of processing polymers and plastic products.

In order to address environmental impacts and based on the product parameters, the ecodesign requirements shall be such as to improve the following product aspects where those product aspects are relevant to the product group concerned:

- durability;
- reliability;
- reusability;
- upgradability;
- repairability;
- the possibility of maintenance and refurbishment;
- the presence of substances of concern;
- energy use and energy efficiency;
- water use and water efficiency;
- resource use and resource efficiency;
- recycled content;
- the possibility of remanufacturing;
- recyclability;
- the possibility of the recovery of materials;
- environmental impacts, including carbon footprint and environmental footprint;
- expected generation of waste.

3

PPWR



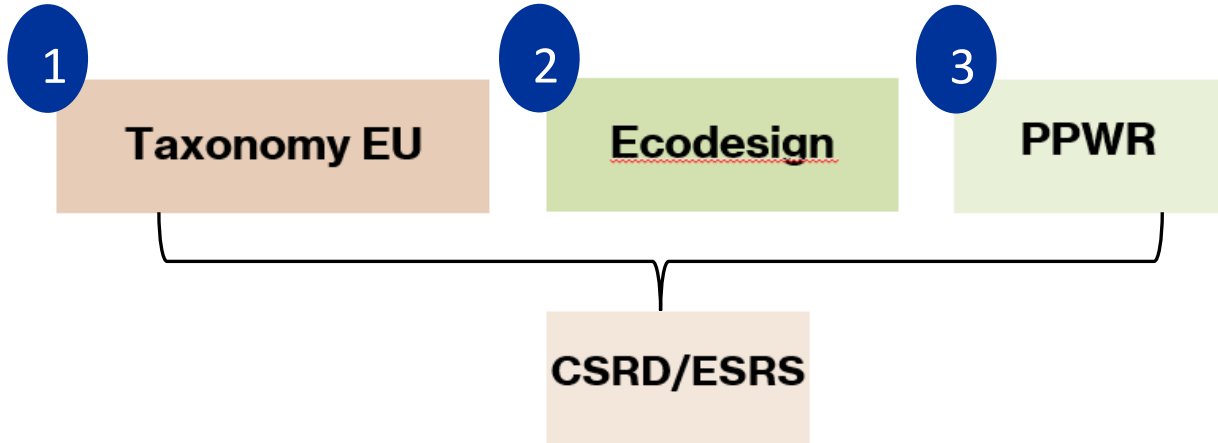
Design for Recycling

as

INTEGRAL PART



„Holy Trinity“



Design Thinking Workshop – understanding

The goal is to assess selected product solutions (applications) in the context of both product requirements, but also from the perspective of creative thinking/assessment with a focus on human needs while simultaneously respecting scientific knowledge about sustainability.

Motto: Design thinking is a mindset and approach to problem-solving and innovation anchored around human-centered design.

PREMISES :

1. User-Centered Approach (Empathy Phase)
2. Problem Definition (Define Phase)
3. Ideation (Idea Generation Phase)
4. Prototyping
5. Testing
6. Iteration and Refinement
7. Collaboration and Multidisciplinary
8. Iterative Process
9. Focus on Sustainability
10. Design Thinking for the Future of the Plastics Industry

Plan-C participating countries – national DTWs





DTW in Germany

The TOPIC of DTW in Germany – „problem to be solved“ ?!

Application Field : Plastic waste sorting rate improvement - specifically, it is about finding suitable measures in terms of materials and technologies that aim to increase the proportion of correctly sorted plastic waste already in the first phase.

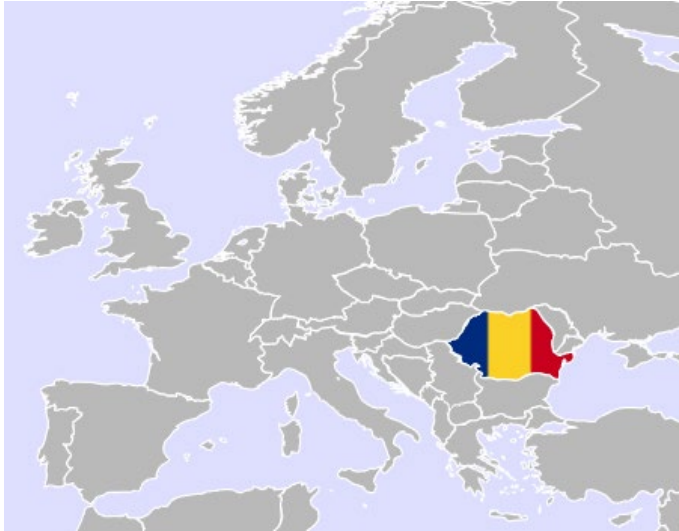
- How would you rate the recycling process in Germany? What is going well, and what could be better?
- How could the process be improved to recycle more materials from the Yellow Bag?
- What do you understand by the concept of the circular economy?
- What innovations in recycling or waste management are you aware of, or do you think are promising?
- How could machines be developed to respond more flexibly to different types of plastic waste, especially from the Yellow Bag?
- How can the machinery industry, as part of Plan C, contribute to promoting climate-neutral and resource-efficient production processes?
- What role does the machinery industry play in reducing emissions within the circular economy, particularly in plastic recycling?
- What challenges does the machinery industry currently face in processing fully circular materials, and how could these be overcome?

The TOPIC of DTW in Germany – OUTCOMES:

The combination of theoretical knowledge, practical insights, and real-world applications made the workshop a memorable and impactful experience. It not only informed participants but also encouraged them to actively think about and contribute to the future of recycling and sustainability.



- Plan C's vision of a Europe-wide recycling infrastructure that conserves resources and minimizes waste perfectly aligns with Vogt Plastic's ongoing efforts. Already responsible for recycling 10% of the entire Yellow Bag collection in Germany, Vogt Plastic shows the industry that a climate-neutral, sustainable future in plastics and machines processing is not just theoretical—it's already a reality.
- While many European industries are still transitioning toward widespread adoption of circular economy principles, Vogt Plastic is demonstrating what the future could look like. Its cutting-edge technologies and deep commitment to the circular economy actively contribute to reducing emissions and conserving vital resources. These practices embody the long-term goals of Plan C, which seeks to elevate recycling and reuse across Europe while reducing dependence on primary raw materials.



DTW in Romania

The TOPIC of DTW in Romania – „problem to be solved“ ?!

Application Field: Support for recycling technologies and a plastic waste collection system - DTW took place on the basis of an effort to define the connection between research, state support, information exchange and the implementation of specific projects.

The workshop aimed to foster innovation through academic research. Participants were introduced to the Design Thinking methodology, encouraged to develop circular solutions for plastics, and engaged in collaboration among experts, stakeholders, and regional decision-makers from academia, the chemical industry, environmental agencies, resource management companies, and innovation-focused clusters open to new digital products and services.

The TOPIC of DTW in Romania – OUTCOMES:

Proposed solutions identification (Team 1):

- Awareness Campaigns for Selective Collection
- Expansion of the Deposit-Return System (DRS) for plastics
- Fiscal Incentives for Recycled
- Support for Recyclers
- Reusable Plastic Products
- Redesign for Extended Reusability
- Research and Innovation for Biodegradable Plastics

Proposed solution identification (Team 2):

- R&D for New Recycled Plastic Products
- Investment in Plastic Recycling Facilities
- Integrated Business Model (Collection + Recycling or Recycling + Production)
- Legislative Change for Recycled Content Products
- Establish Technology Transfer Centers (CTTs)
- Stimulate Market for Recycled Products
- Simplified procedures for Circular Economy Projects funds



DTW in Austria

The TOPIC of DTW in Austria – „problem to be solved“ ?!

Application Field: Reuse of specific components for the same or similar applications

1. Remote control for B2B customers (hotel industry):

- Remote control as a service model
- Alternative energy source
- Modular Design
- Different surface

2. Reuse of the internal scrap/punching grid from the production of Vehicle interior. Two main ideas were proposed:

- including custom car keys or enclosures for the electronics or cosmetic industry in the usually scrapped parts
- Recycling the production scraps to manufacture customizable plastic films to cover electronic or cosmetic enclosures

The TOPIC of DTW in Austria – OUTCOMES:

Instead of selling the remote control, the group proposed a service model, where the companies (Hotels, IPTV-Provider, Hospitals, etc.) rent the remote control. From the customer side, there would be no change of batteries necessary, no repair or hygiene needs, because everything would have been taken care of by the company. For that the surface, especially the buttons would be coated with a bacteria resistant material. Furthermore, the remote control would be designed as a modular Prototype (Screws or click mechanism with release button) with an alternative battery (accumulator). Therefore, the reuse of all or specific parts would be possible and recycling of not reusable parts accessible. The company does use recycled plastic as base material. The energy is generated by wind turbines. The different option is an attached crank on the remote control, with which the user can generate energy.

Instead of throwing away the internal scrap/punching grid from the production of Vehicle interior, the group proposed to include custom car keys or enclosures for the electronics or cosmetic industry in the usually scrapped parts. This provides a good solution and readily available business model instead of throwing the scrapped parts/punching grid away.

Another way of reusing these parts would be to recycle the production waste/punching grid and reuse the plastic for customizable films to cover electronic or cosmetic enclosures. This could be implemented with limited editions and/or collaboration with popular brands and/or sport clubs.





DTW in Moldova

The TOPIC of DTW in Moldova – „problem to be solved” ?!

Application Field: development of modular and reusable plastic components for construction

The workshop was structured around an agenda that prioritized interactive discussions and practical activities, aiming to explore ways to transition from traditional plastic use to sustainable and circular models. Through a series of guided exercises and collaborative brainstorming sessions, participants examined core issues related to the life cycle of plastics, including durability, reusability, recyclability, and environmental impact.

The thematic questionnaire distributed before the workshop helped attendees identify and focus on specific challenges and opportunities within each sector represented, encouraging a cross-disciplinary approach to problem-solving.

During the sessions, experts shared valuable insights from their respective fields, each contributing a unique perspective to the dialogue. Environmental experts discussed the pressing need for plastic solutions that minimize carbon footprints and overall environmental impact.

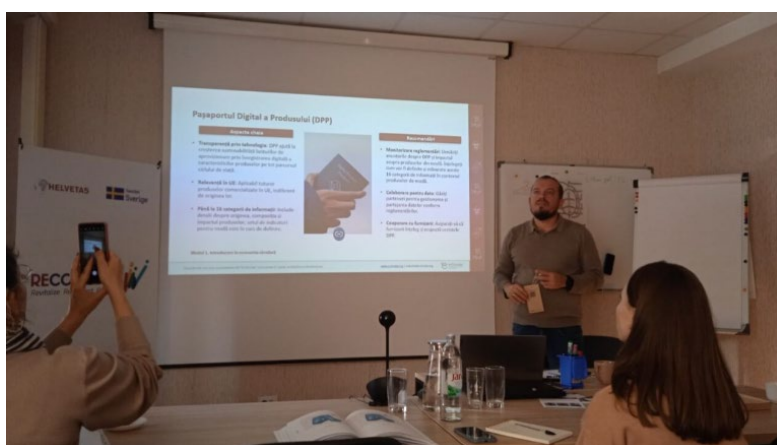
Construction industry representatives highlighted the importance of durable and reliable materials in sustainable building projects, while those from the textiles sector explored how plastic waste could be repurposed and reintegrated into textile manufacturing.

The TOPIC of DTW in Moldova – OUTCOMES :

By the end of the workshop, participants had collaboratively generated a series of actionable ideas aimed at advancing circular practices within their industries. Notable concepts included the development of modular and reusable plastic components for construction, and the creation of textile products made from recycled plastic, both of which align with the circular economy's goals of minimizing waste and maximizing resource efficiency.

The event not only encouraged cross-industry collaboration but also demonstrated the effectiveness of design thinking as a method for tackling complex environmental challenges. SORINTEX, as an advocate for innovative and sustainable solutions in Moldova, will continue to support initiatives that promote circular economy practices and contribute to the broader objectives of the Plan C project.

This workshop represents a significant step forward in the journey towards a circular plastics economy in Moldova, and SORINTEX remains committed to advancing these discussions and projects in collaboration with both local and international partners.





DTW in Slovakia

The TOPIC of DTW in Slovakia – „problem to be solved“ ?!

Application Field:

1. Industrial problem area: PACKAGING

Bioplastics are expensive. In addition to the price aspect, the participants were tasked with how the packaging could be lightened without burdening the environment. At the same time, the suitability of use for food must be taken into account.

The use of biodegradable plastics would be a solution, but it is also a very expensive solution.

2. industrial problem area: AGRICULTURE

Traditional mulching films made from non-biodegradable materials can contribute to plastic pollution if not properly disposed of or recycled. However, biodegradable mulching films made from materials such as polylactic acid (PLA) or other bio-based polymers are becoming increasingly popular and offer a more sustainable alternative to traditional plastic mulching films.

Non-woven fabrics are suitable as a base for mulching. They prevent the growth of weeds, saving a lot of work on mechanical cleaning of the vegetable beds/green fields. That is why they are becoming more and more popular among gardeners.

3. industrial problem area: CONSTRUCTION INDUSTRY

The basic problem is also the increasing amount of construction of new houses and the increasing share of construction waste, which is sometimes hazardous waste (including insulation with construction polystyrene).

At the same time, there is an increasing proportion of old houses that do not meet either the energy requirements or the requirements of functionality and modernity.

There is also a return to natural materials such as straw, wood, etc. Wood as a raw material could only be an additional, not a basic building element.

There is also a visible requirement when selling a property to modify the property according to oneself and one's requirements.

All these requirements need to be incorporated into the requirements for building elements, building materials that could form interior wall cladding, or even basic building modules or floor elements.



The TOPIC of DTW in Slovakia – OUTCOMES:

1. The solution was that the packaging, for example, of food products (yogurts or other types of food products) would also be used for another purpose – for example, storing screws, nails, sorting certain small materials – storage trays, etc. Adjusting the packaging – adjust the round cups to square ones so that more of them can be placed on the pallet, which would ensure that more of them can be transferred/transported, or packages can be used.

In this proposal of the solution, it was also said that they could be made of two layers – one biodegradable plastic and the other degradable, for example, paper made of biomaterial. This solution was also reflected in the production of the prototype – see photos. The third solution proposed that the packaging could be eaten together with the inside – that it should be made not only as organic - but it should really be made of a material that is possible to eat

2. Biodegradable film, which itself can be expensive. Therefore, a composite was designed where natural plant-based fibers would be used, and instead of chemical fibers, fibers based on biodegradable materials would be used. It would therefore be a composite of bioplastic and plant fibers. This solution was chosen as the most suitable. Design an AI robot that will eliminate weeds. However, this may be problematic from a technological point of view for the time being. Another problem could be that the robot would also collect plant seedlings and would not maintain moisture in the plants as mulch films do.

3. The first solution was to use recycled materials and build the house in such a way that it is possible to replace any element in the house with a new one or another or to dismantle part of the house and use the material to reimagine the house.

Panels, blocks, or tiles made of biodegradable material could be used for this solution. For its better properties and lower costs of such material, it would be appropriate to use a composite solution that would consist of biodegradable material + waste resources from agricultural crop production. The workshop participants agreed on this solution.

The third solution talks about the implementation of a 3D house that would be created through a 3D printer – this solution already exists, but it is more of a construction method.



DTW in Hungary

The TOPIC of DTW in Hungary – „problem to be solved“ ?!

Application Field: food packaging design for recyclability, material and energy saving as well as minimizing the waste at the end of use.

The workshop centered on streamlining food packaging to align with the principles of a circular economy. The workshop brought together participants from diverse backgrounds, including:

- academia (Budapest University of Technology and Economics),
- professional association (Hungarian Plastics Association),
- SMEs (UgrinPack Kft, PolymerOn Kft, New Energy Kft, Bio-Refinery Kft, DBH InnoHub Kft),
- large corporations (MOL Group / MOHU).

Participants tackled key challenges, such as the complexity of materials, contamination risks, and the need for user-friendly designs emphasizing the recyclability challenges arising from diverse material properties (e.g., melt flow index and molecular weight distribution) in the waste stream.

Prototypes showcased multifunctional packaging that serves as storage or transport solutions, promoting reuse before recycling. The team proposed scalable strategies to enhance resource efficiency, minimize waste, and adhere to circular economy principles, ensuring a cleaner and more sustainable lifecycle for food packaging.

Additional recommendations included developing packaging standards to reduce material overuse and streamline printing processes. Raising public awareness emerged as another critical focus, with calls for educational initiatives and better information dissemination to empower consumers in adopting sustainable practices. These measures, detailed below, aim to create a holistic approach to improving the sustainability of food packaging systems.

The TOPIC of DTW in Hungary – OUTCOMES :

Redesigning food packaging in the context of a circular economy

Redesigning food packaging is an innovative approach aimed at optimizing packaging systems to align with the principles of sustainability and circularity. This involves reevaluating the material composition, functionality, and lifecycle of packaging to minimize environmental impact while maintaining or improving usability and protection of the product.

Benefits of Redesigning Packaging:

- **Environmental Impact Reduction:** Less waste and reduced reliance on virgin materials.
- **Cost Savings:** Lower production, transportation, and disposal costs.
- **Consumer Appeal:** Eco-friendly packaging can enhance brand reputation and consumer loyalty.
- **Regulatory Compliance:** Aligning with global sustainability goals and policies.

By addressing these aspects, redesigned packaging can seamlessly integrate into a circular economy, reduce waste, and encourage responsible consumption and production practices.



DTW in Serbia

The TOPIC of DTW in Serbia – „problem to be solved“ ?!

Application Field: Using of natural bio-based sustainable sources that replace fossil resources as a part of plastic product content.

Natural composite materials from industrial hemp

Given that industrial hemp is a crop with very high potential and application possibilities and represents a species suitable for growing on the territory of the Republic of Serbia (especially in Vojvodina), the workshop participants focused on the process of processing different plant parts with the aim of obtaining the final products that can replace plastic and plastic parts in certain industries.

The final conceptual solution of the workshop is natural composite materials created by processing natural resin and natural fibers of industrial hemp, which can potentially replace plastic parts and plastic products, primarily in the automotive and packaging industries. So the idea is that instead of traditional plastic parts and plastic packaging, a process of transformation towards a more sustainable model will take place, including parts and packaging containing the highest percentage of industrial hemp.

The TOPIC of DTW in Serbia – OUTCOMES :

Industrial hemp-based natural composite materials are known for their high tensile strength and resilience, comparable to certain plastics. These properties make them suitable for use in the automotive and packaging industries, where durability is crucial. By leveraging the natural fibers and resin from industrial hemp, the resulting composite materials exhibit robustness against wear and tear, extending the lifespan of products.

Durability is essential for the proposed solution. The targeted industries, such as automotive and packaging, require materials that can withstand mechanical stresses and environmental factors. Ensuring the durability of hemp-based composites is key to gaining acceptance as a viable alternative to traditional plastic components.

The proposed solution promotes reuse and upgradeability by offering materials that can be molded and reprocessed. Hemp-based composites can be designed for modular applications, allowing components to be disassembled, repaired, or upgraded as needed. This approach aligns with circular principles by reducing waste and extending the product lifecycle.

The proposed solution positively impacts efficiency by reducing resource demand.

Industrial hemp cultivation requires less water, pesticides, and fertilizers compared to other crops. Additionally, the production of hemp-based composites typically involves lower energy consumption than conventional plastic manufacturing processes, leading to reduced environmental strain. Reducing the demand for water, energy, and chemicals not only supports sustainability goals but also makes the solution economically competitive with traditional plastic production.



DTW in Bosna i Hercegovina

The TOPIC of DTW in Bosna i Hercegovina – „problem to be solved“ ?!

Application field:

- new types of plastics can replace heavier materials in cars, such as
 - bioplastic or nano plastics that are lightweight;
 - bioplastic in 3D printing;
- use plastic in construction for end-of-life waste management;
- using plastic grippers to lower the tool weight in grippers;
- using AI and computer vision for waste detection.

Solution for lightweight car parts using bioplastics was analysed first and participants came up with the prototype for using bioplastics to replace traditional, heavier materials like metal. The materials considered included bioplastics such as PLA, PHA, and biocomposites with natural fibers, prototypes can be made using 3D printing or injection molding techniques to produce car parts like panels, handles, or trim pieces, and lightweight car door panels.

Using Arduino and AI for waste sorting, participants suggested that simple prototypes of ideas from the Ideate phase could be built using simple microcontroller such as Arduino, which would serve as an accessible starting point before progressing to more advanced processing units.

This prototype combines lightweight plastic grippers with an Arduino-based system to detect and sort waste automatically.

An AI model, running on Arduino-compatible vision module, analyses the photos to classify waste types. Based on the classification, the Arduino commands the grippers to sort waste into specific bins.

The TOPIC of DTW in Bosna i Hercegovina – OUTCOMES :

We suggested bioplastic for 3D printers and AI for sorting waste. Although bioplastics have good compatibility with many 3D printers, they are not always suitable for all types of projects, especially when high mechanical properties are required. Bioplastics like PLA are not necessarily the strongest option, especially compared to traditional plastics such as ABS or PETG. It may be less resistant to high temperatures or physical impacts, which can limit its use-case in industrial applications.

Dependence on storage conditions Bioplastics can be more sensitive to moisture and temperature, so it is important to store the filament properly (in dry conditions) to avoid problems during printing. Unlike bioplastics, which may have limited uses, recycled plastics in the automotive industry are becoming more and more widely used thanks to their reliability and durability. We concluded that the use of plastics in construction as part of a circular process can be a key strategy for reducing waste and achieving sustainability.





DTW in Czech Republic

The TOPIC of DTW in Czech Republic – „problem to be solved“ ?!

Application Field: 2G plastic waste reusage - second-generation waste is also generated during recycling, for which solutions need to be designed.

During the processing and recycling of waste plastics, a large amount of waste sludge is generated, which contains plastic parts and various contaminants. Currently, these sludges are specified as hazardous waste, and disposal represents a cost for recycling line operators. This sludge would be dewatered in the project on a sludge dewatering line, which would have to be optimized in terms of drainage treatment and due to the high content of various paper labels, adhesives and other impurities that cannot be dewatered on commonly available equipment. Another necessary optimization is the chemical management for sludge dewatering so that it does not affect the recycled material and its subsequent transformation into a raw material for the production of components from recycled plastic.

The aim of DTW was to specify and propose the solution how to design, test and optimise a suitable technology for the separation of sludge and plastics. Processing of plastics into a form usable for further processing, or production of a product from this recycled material. (E.g. grass gratings or various building elements are envisaged). It will also include an analysis of products and intermediate products resulting from sludge treatment with proposals for possible subsequent use or disposal methods with regard to LCA.



The TOPIC of DTW in Czech – OUTCOMES:

- **Recycled water** – returns to the recycling technology
- **Primary sludge** – separated plastic material (content approx. 90% plastic + paper pulp, ash) from mechanical pre-treatment using an SFT filter with dewatering
- **Secondary sludge** – final sludge from the flotation unit

Proposed solution :

- Polymer granulate based on plastic sludge with optimized values of migrating components.
- Utilization of secondary sludge – total and specific migration mechanical tests, HS-GC analysis (volatile substances), recipe, use of scavengers4 final recipes
- Elimination of odor and hazardous substances into the environment





Conclusion

Observation:

The conceptual evaluation of the approach of individual PPs to defining and proposing a solution shows us that the approach may differ in terms of systemicity or, conversely, specificity. Both variants of the approach to the solution are correct and their combination is appropriate: a specific solution must always meet industry assumptions and requirements - on the contrary, a systemic solution must respect the technical and design possibilities of specific applications and products.

What is the same & important:

All the proposals defined and investigated by PPs in participating countries were used well and under the principles of Circular Design Thinking – it means the results of the reworking of various design tools and techniques, combining strategic design and regenerative design into a unique, flexible, and holistic methodology aimed at identifying new opportunities for circularity and creating sustainable outcomes.

Policy context :

The Ecodesign for Sustainable Products Regulation (ESPR) recently entered into force as Regulation (EU) 2024/1781 with the aim of creating a strong and coherent policy framework to make sustainable products the norm in the EU. This JRC report assesses a number of product groups and horizontal requirements that may be suitable priorities under ESPR. Together with other elements – such as the requirements and priority list of products set out in the ESPR, considerations relating to availability of resources and the political priorities of the new GreenDeal Plan.