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Achieving Circularity in Post-Consumer Plastics: The CIRCULAR FOAM Project

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13.11.24

Agenda



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Project overview

Selected approaches and results

Conclusion and Outlook





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Project overview



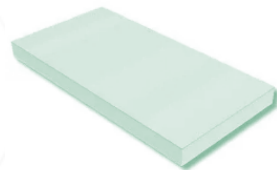
CIRCULAR FOAM - Systemic expansion of territorial CIRCULAR Ecosystems for end-of-life FOAM

- Aim: To develop and demonstrate all technological steps required to achieve circularity of plastics in post-consumer applications
- Two value chains: Rigid polyurethane foams used as insulation in refrigerators and construction

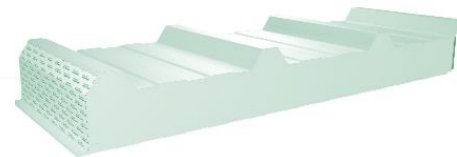
1 Refrigerators



2 Construction material



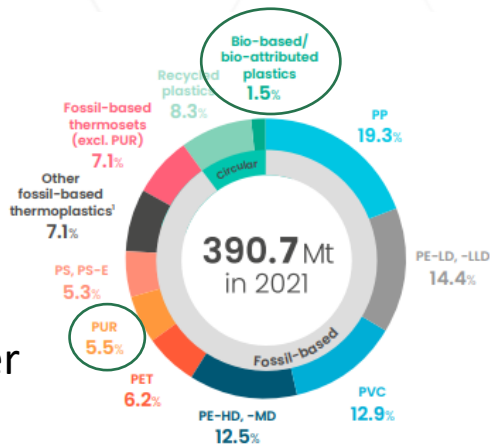
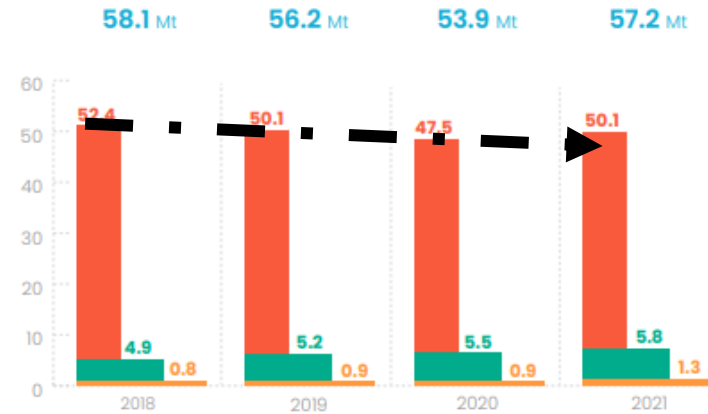
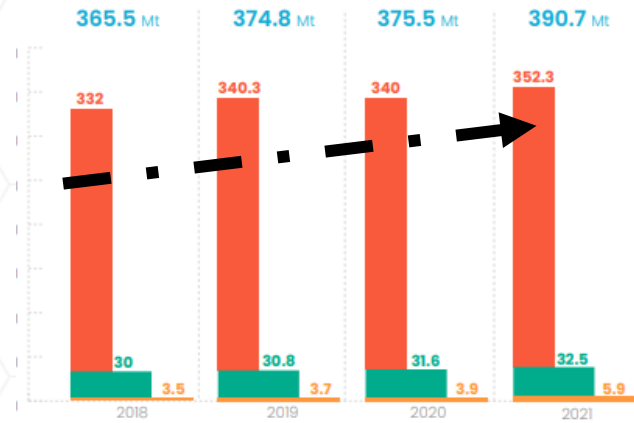
Insulation boards



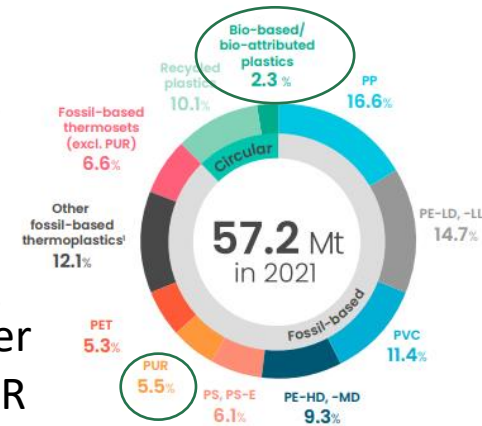
Sandwich panels

Plastic Production Evolution

World Europe



>21Mt per year PUR



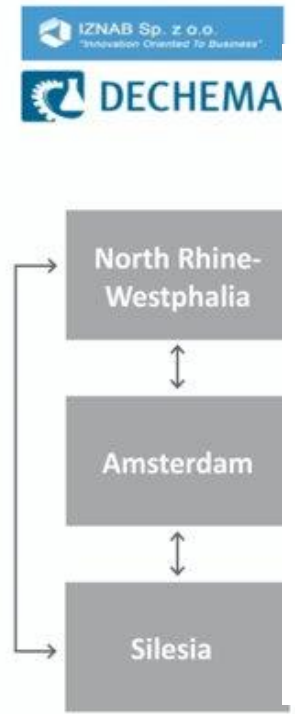
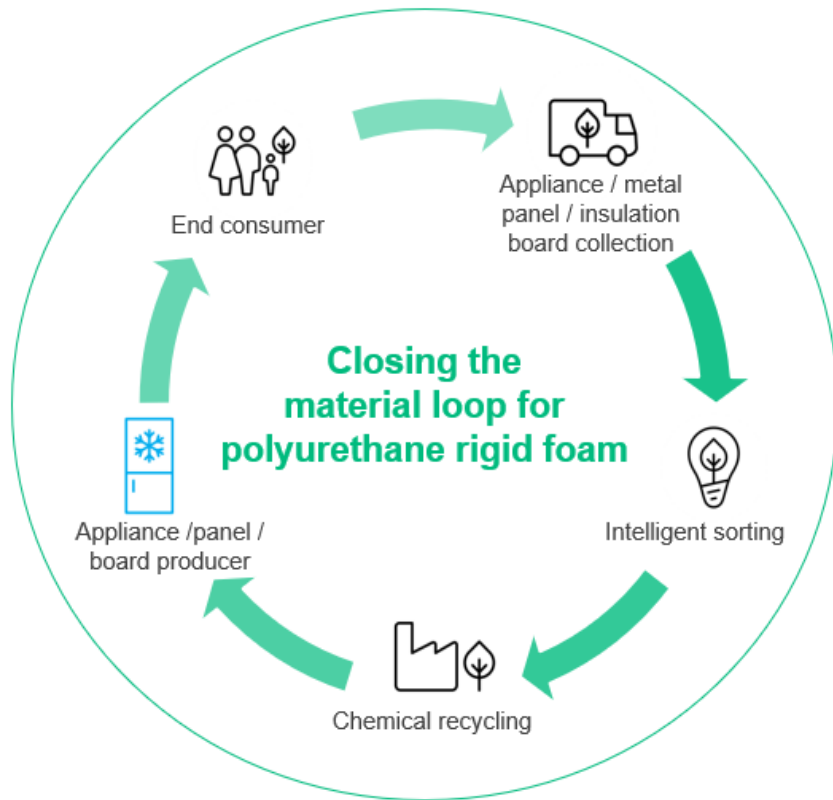
>3Mt per year PUR

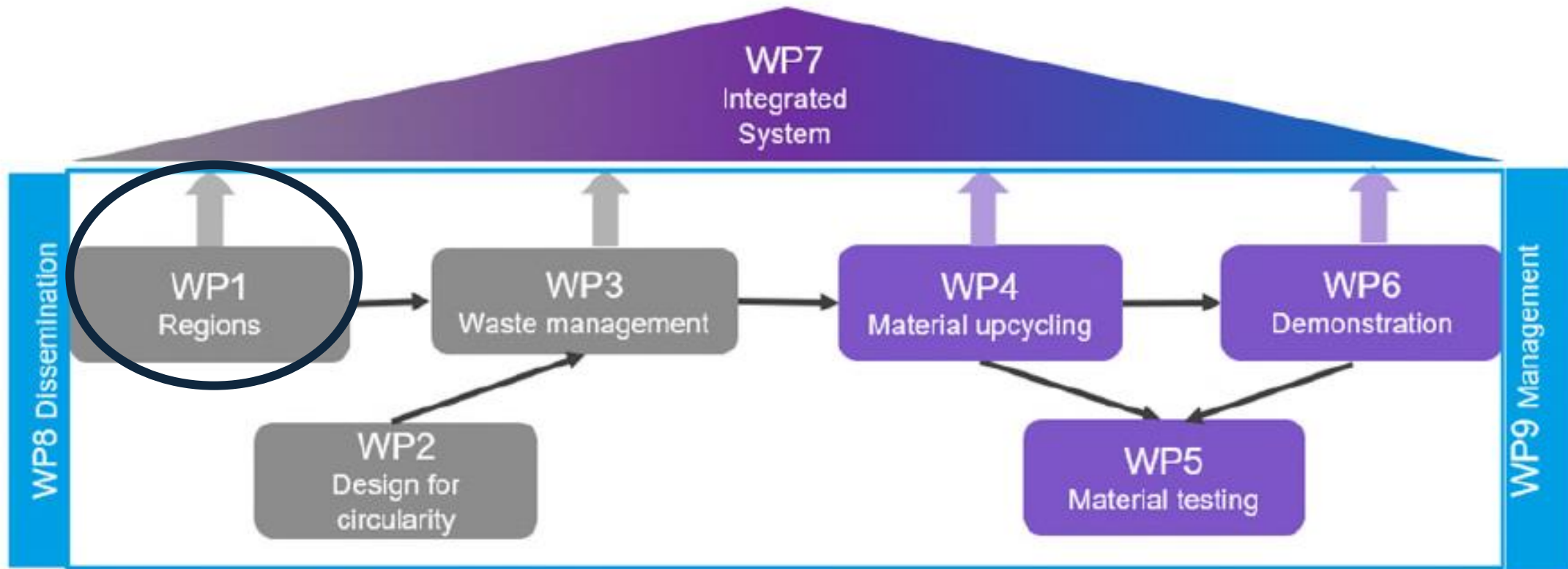
Source: [Plastics Europe • Enabling a sustainable future](#)





System development for regional application







Task 1.5: Development of a “Blueprint Model” of collaboration:

- **Not a technical blueprint**
- Build a comprehensive blueprint model integrating strategic, collaborative, and regional cultural elements for waste and recycling.
- Initial model creation in Germany, with adaptations for Poland and the Netherlands.
- The goal of work package (WP) 1 is to develop a **blueprint model** which reveals how to establish clusters of **cooperation (hubs for circularity)** in the management of PU hard-foam material flows in **different EU regions**.

Task 1.6: Regional Transfer and Application of the Blueprint Model:

- Establish a governance structure for regional cluster cooperation based on the blueprint model.
- Create a **roadmap for regional collaboration** in waste and recycling technology.
- Sets the groundwork for stakeholder cooperation and the model’s practical implementation in regional contexts.





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Selected approaches and results

Mixed method assessment of stakeholder engagement, awareness and behaviour



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Stakeholder Engagement:

Fuzzy cognitive mapping analysis

Stakeholder engagement:
Mindmapping interviews
(individual)

Consumer Behavior Research:

Qualitative and Quantitative
Customer Survey

Customers engagement in reverse logistics:
Quantitative survey
Focus group survey

Future perspectives:
Qualitative scenario development

Stakeholder engagement: Scenario workshops (group setting)

Transfer:

Roadmap:
Sustainable transformation pathways for regional circularity



Fuzzy Cognitive Mapping approach: Systemic relations and interdependencies

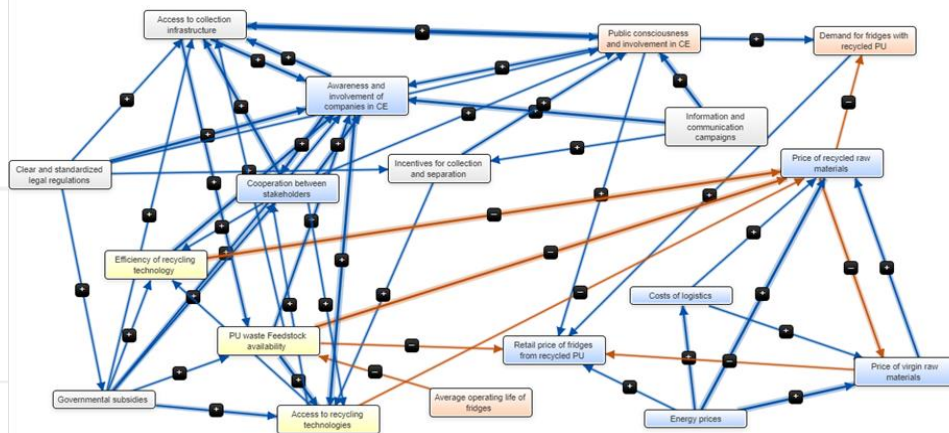


• Research questions:

- What are the main influencing factors or obstacles in the introduction of a circular (recycling) system of PU from refrigerators?
- How do these factors influence each other?
- What are the implications of possible policy scenarios?

• Stakeholder engagement:

27 semi structured interviews with interview partners in the three regions



Academia

Universities
Research
Institutes

Government

Federal state
ministries
Local authorities
State agencies
Intermediary
organizations

Industry

Recycling
companies
Waste management
companies
Producers, suppliers





Fuzzy Cognitive Mapping results

- Resulting system maps for the regions have some similarities but are significantly different
 - Different states of the recycling systems in each region
- No one-size-fits-all solution exists; each region must be treated differently based on local conditions.
- But all regions need clear regulations and stimulus programs to make large-scale PU foam recycling viable.
- The availability and quality of PU waste feedstock is a highly sensitive factor in each map.



Consumer Survey – Computer Assisted Web Interviews (CAWI) & Focus Group Interviews (FGI)



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Quantitative CAWI survey

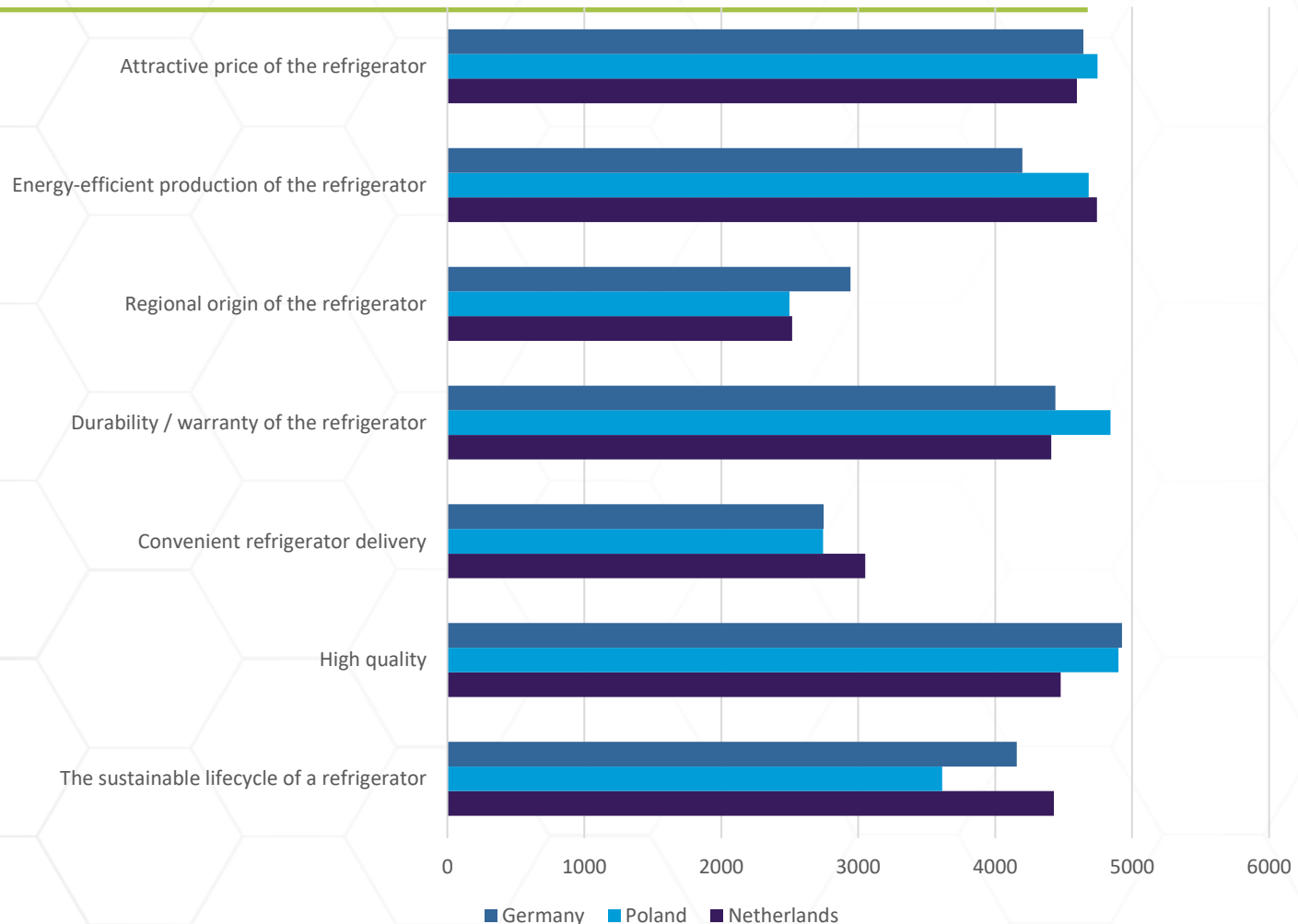
- Sample size: De: 1002, NL: 1008, PL: 1001
- Rank a set of factors from most to least important .
- For analysis the Borda Count method was used
- Sex, age, job status, education level, place of residence, household size

Qualitative Focus Group Interviews

- 6-10 participants each session led by a trained moderator.
- Participants selected to reflect society make up.
- The moderator guides discussions, encouraging balanced participation and uncovering diverse viewpoints.
- Open-ended and probing questions are used to prompt participants to share thoughts and experiences.



CAWI – What factors would convince you to purchase a refrigerator with reclaimed (recycled) polyurethane?



- Price, quality, and energy-efficient production are top priorities in all countries
- Poland - durability, warranty, and sustainability (less trust).
- Convenient delivery matters most in the Netherlands but ranks low overall compared to product performance.
- Regional origin is the least important factor across all countries, reflecting trust in the global supply chain.

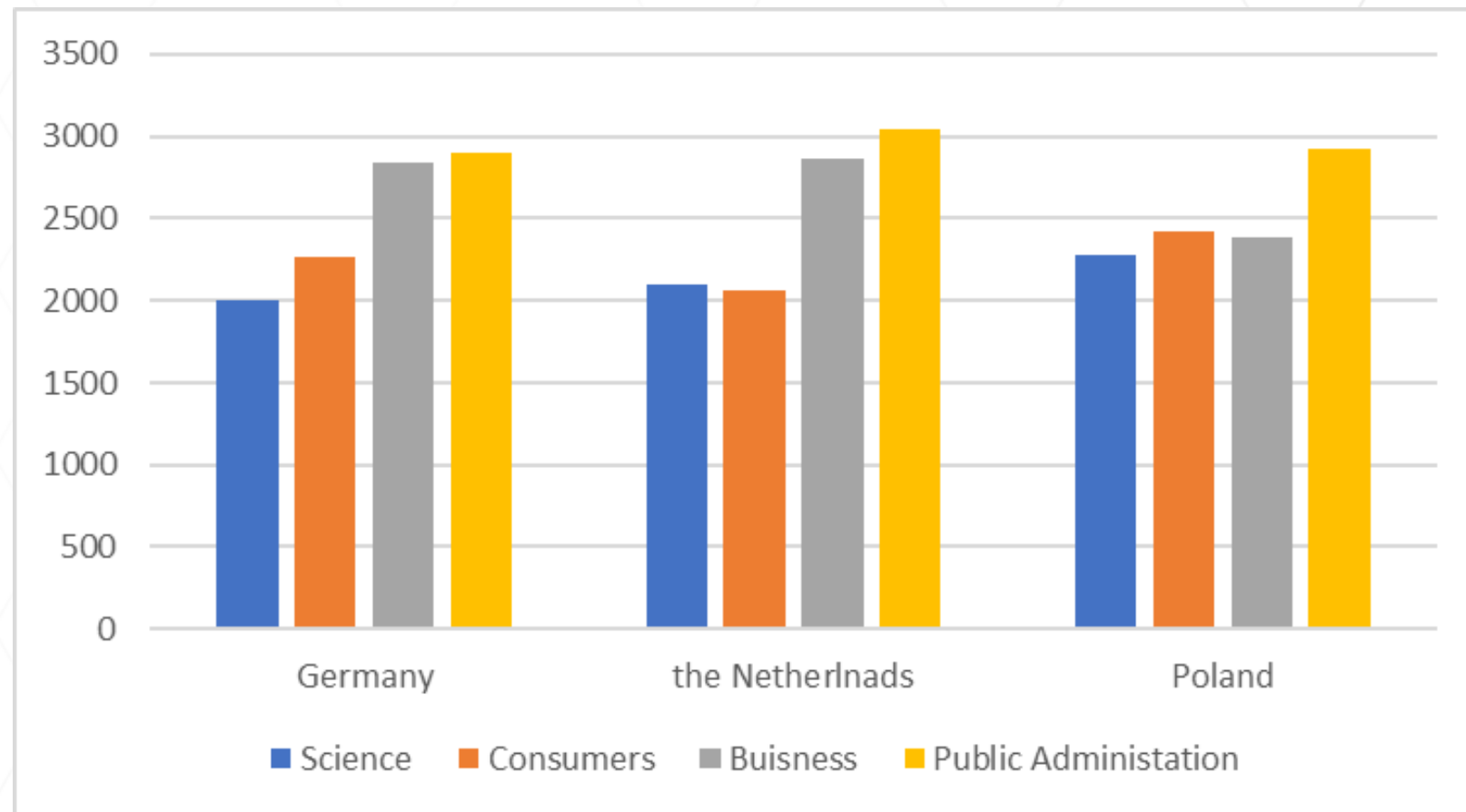


CAWI – who should be responsible for the development of solutions in the field of recycling plastic waste?



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- Germany and the Netherlands: Public Administration most, followed by Business. Science and Consumers less.
- Poland: Public Administration most, with Business, Science, and Consumers playing smaller roles.
- Science and Consumers consistently rank lower in responsibility across all three countries.



FGI: Are people willing to pay more for appliances made with recycled materials, and why or why not?



"The purchase of a refrigerator is so rare I achieve much more from my purchase decisions"

"Recycled material should not be more expensive than original"

"5 refrigerators are already expensive
3-4% is just one part of the refrigerator, so it shouldn't have a significant impact on the price."



FGI: Do country of origin or age impact people's attitudes toward recycling?



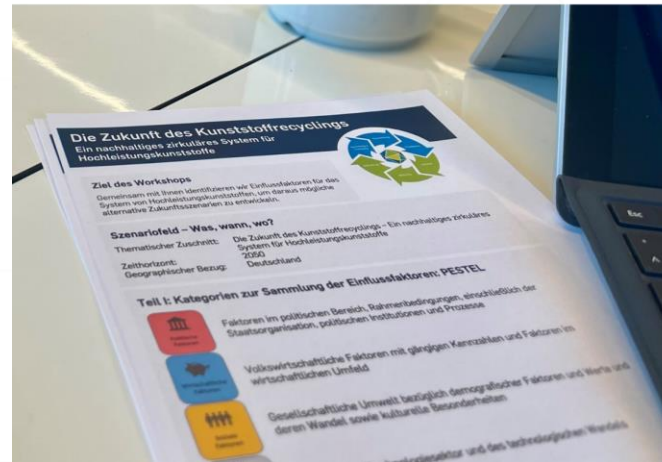
- **Germany and Netherlands:** Strong recycling infrastructure and environmental education lead younger consumers to embrace sustainability (*"If it is EXACTLY the same as from virgin materials I would choose the recycled one. It feels good if it is recycled but the price is more important"*), but older consumers prioritize cost savings over environmental benefits (*"The energy label is the first thing I look at"*).
- **Poland:** Consumers focus more on everyday environmental issues like plastic waste rather than appliances (*"Instead of spending money and time on refrigerator, lets invest in water faucet to buy less bottled water"*).
- **Generational divide:** Younger generations are more proactive in supporting sustainable products, while older consumers prioritize functionality and expect manufacturers to absorb the costs of sustainability.





Future perspectives: Scenario workshops

- Method: Qualitative participative scenario analysis in each region
- (broader) Thematic focus: The future of plastics recycling in the year 2050 - A sustainable circular system for high-performance plastics
- Goal: The workshops serve to identify possible future developments that could help or hinder the project goals
- Participants: Small group of around 20 people from different backgrounds (academia, municipality, industry, associations)





Early results and next steps (after 3 workshops)

Germany:

- The willingness of companies to cooperate is considered to be very high.
- Invention of new materials and innovative substances could jeopardise recycling strategies.
- Solutions should be socially acceptable

Netherlands:

- Cross-border recycling and waste handling is seen as a very important factor (regulations)
- Shift in Business Models is needed: e.g. companies may eventually want to reclaim products directly due to the value of materials

Two more workshops will take place on 18 November in Amsterdam and on 22 January in Upper Silesia

→ Regional comparison: similarities and differences in the results





Scenario Transfer: Evaluation

- Evaluation and assessment of scenarios according to **desirability** or positive and negative aspects (Is this what we want?)
- **Impact analyses** (What opportunities and risks are associated with the situation depicted in the scenario?)
- **Actor analyses** (What do these possible developments mean for individual actors and actor constellations?)
- Development of **options for action/strategy derivation** (What can we do? Which levers are decisive?)

→ Impact assessment and development of strategies





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Conclusion and Outlook



Conclusion and Outlook

- Overall, the focus on the three different regions and the stakeholder engagement resulted in valuable results on different aspects of the circularity of plastics in post-consumer applications.
- The results are a fitting counterpart to the more technical approaches and results of the other work packages of the project.
- Next step will be the fusion with all previous results from WP1 (not mentioned in this presentation) and the other work packages to develop a **blueprint model** which reveals how to establish clusters of **cooperation (hubs for circularity)**
- Building on this, a **roadmap for regional collaboration** in waste and recycling technology will provide the basis for stakeholders to work together in regional contexts.
- Step by step approach: First in the pilot region -> then in follower regions -> then in other EU regions
- The goal is also to provide lessons for other circularity challenges, polymers or materials in general!





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Thank you!

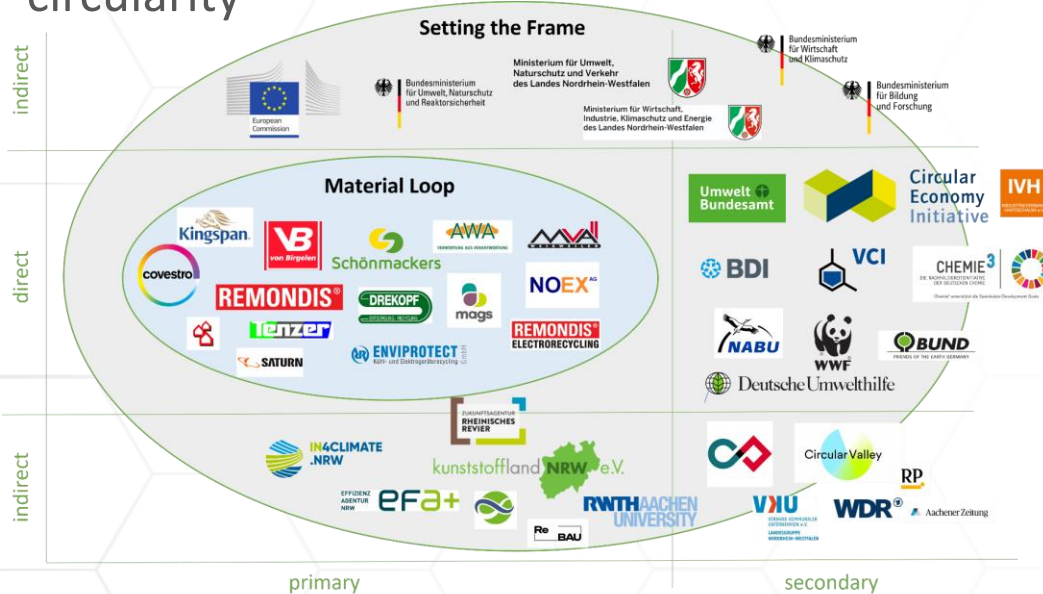


www.circular-foam.eu

Regional Analysis & Stakeholder Analysis

- Assessment of the **readiness of regions** to introduce PU circular solutions
- Identification of **regional stakeholders** that are important for establishing hubs for circularity

- Stakeholder engagement: Qualitative field interviews & site visit at a disposal center



Core-Periphery-Map of stakeholders in Rheinisches Revier/ NRW



Circular material use rate, by country,
(% of material input for domestic use)

