



PolyUrethane Recycling Towards
a Smart Circular Economy

PUReSmart – the importance for the industry

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Virtual Workshop –Chemical recycling and plastics
May 31, 2021



This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement N° 814543



AGENDA

Challenges and Green Deal

Covestro & Recticel

Emerging Technologies and PUReSmart Solution

Results

Global Challenges – The importance of sustainable solutions



The European Green Deal

A 'new circular economy action plan' to mobilizing industry for a clean and circular economy

Include a 'sustainable products' policy:

- Ecodesign Directive & Ecodesign framework
 - Circular design of all products
- Extended producer responsibility will also be strengthened
 - According sustainability principles
 - improving product durability, reusability, upgradability and repairability
 - addressing the presence of hazardous chemicals in products
 - increasing their energy and resource efficiency
 - increasing recycled content in products, while ensuring their performance and safety
 - enabling remanufacturing and high-quality recycling
 - reducing carbon and environmental footprints
 - restricting single-use



Extended Producer Responsibility Schemes empower Producer Responsibility organizations to organize waste collection & treatment

UK

- Three potential mattress EPR models for Scotland
- Collection arrangements for mattresses
- In the UK, two EPRs are planned to be completed by 2022 and include furniture and mattresses

Netherlands

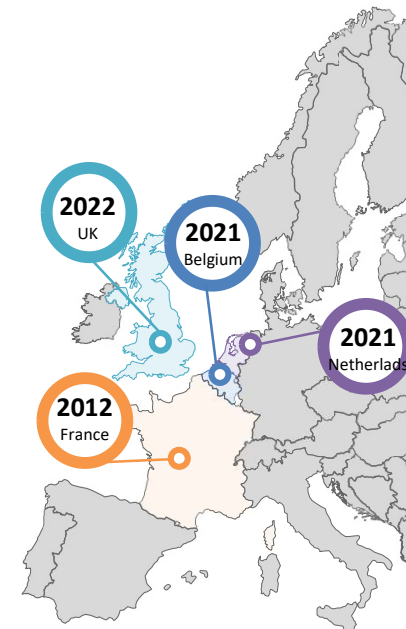
- Finalization of mandatory EPR for mattresses expected in 2020; application might be in 2021

Belgium

- EPR scheme for mattress in all started in 2021

France

- French government established most EPR schemes (21) in 1975
 - EPR for furniture and mattress was issued in 2012
 - Objectives: reduce the amount of used furniture sent to landfill by at least 20% and 45% of collected furniture waste to be recycled and reused
 - Eco fee: Producers add recycling fee to sales price which is paid by consumer and then paid back to PROs, fee is visible and calculated based on weight & dimensions of product, 1,50-13,00 Euro for standard PU mattress





Strong Vision

Covestro is focused on the Circular Economy

"We will be fully circular"

- Covestro vision underpins company purpose to make the world a brighter place



- Establish circularity throughout the company
- Become a shaping force of the Circular Economy
- Contribute to a greenhouse gas-neutral economy

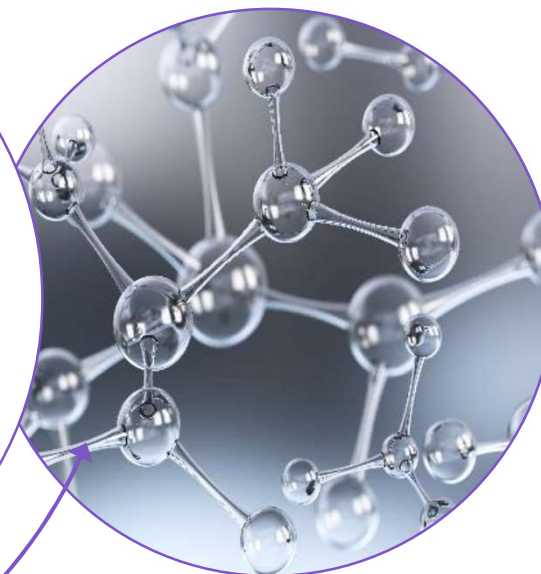
Too Valuable to be Thrown Away

Consider and use old plastics as a resource



New understanding of waste

- Consider and use end-of-life materials as a rich source of valuable molecules
- Recovery and recycling needed





Products and Research

Covestro drives forward development and use of recycled raw materials

Numerous products with recycled components on the market

- Example: Polycarbonate compounds for IT applications – up to 75 percent recycled material



More than 20 research and development projects

- Development of new, efficient technologies and methods for plastics recycling
- Broad technological approach



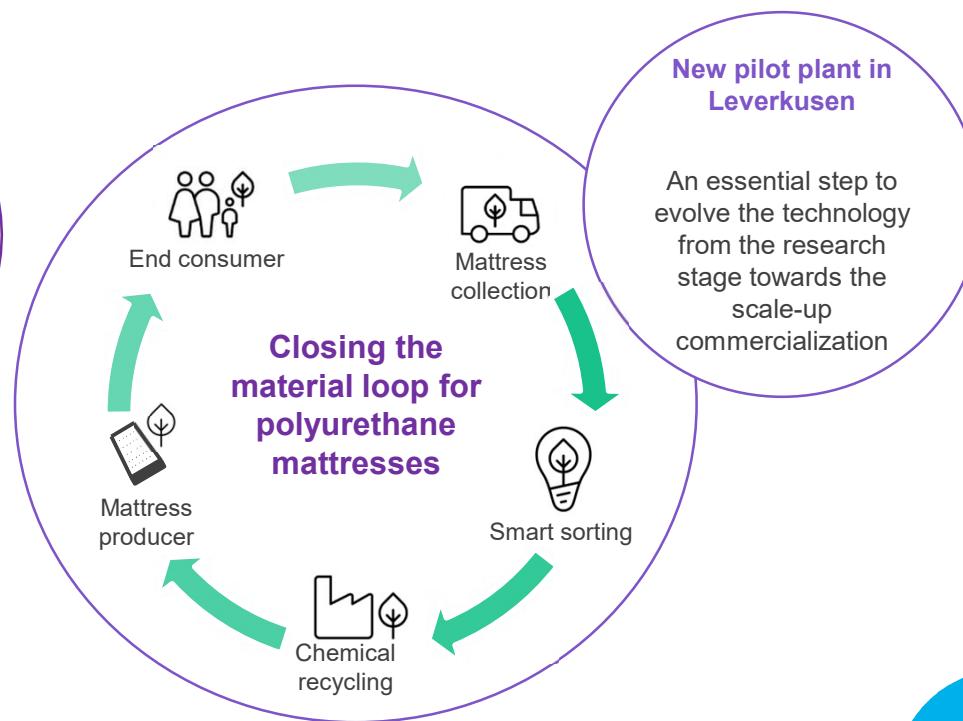


Soft Foam Chemical Recycling Program

Strategic Program to co-shape the cycle in cooperation with the value chain

Soft Foam Chemical Recycling Program

Building on the participation of the PReSmart project



Our renewed sustainability strategy



**Transformation
through
responsible
business**

Our sustainability strategy

Our renewed sustainability strategy

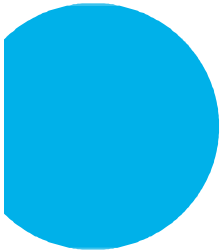


In 2020, 1,059 tonnes of PU mattress foam were recycled, representing > **50,000** foam mattresses

Following further implementation of the Green Car Policy, **80%** of company cars renewed in 2020 in Belgium were replaced with electrical or hybrid vehicles

At the end of 2020, **30,000 m²** solar panels covered the roofs of Recticel sites





Sustainability is profoundly embedded in Recticel's overall strategy



Sustainable Innovation Plan



Climate Action Plan



Transition to a circular economy



Innovation for societal needs



People Priority Plan



Sustainable partnerships

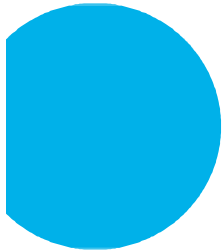
**STOP,
THINK,
ACT!**

Lower HS&E impact
(of our activities and products)



An inspiring and rewarding place to work





Our renewed sustainability strategy

Why?

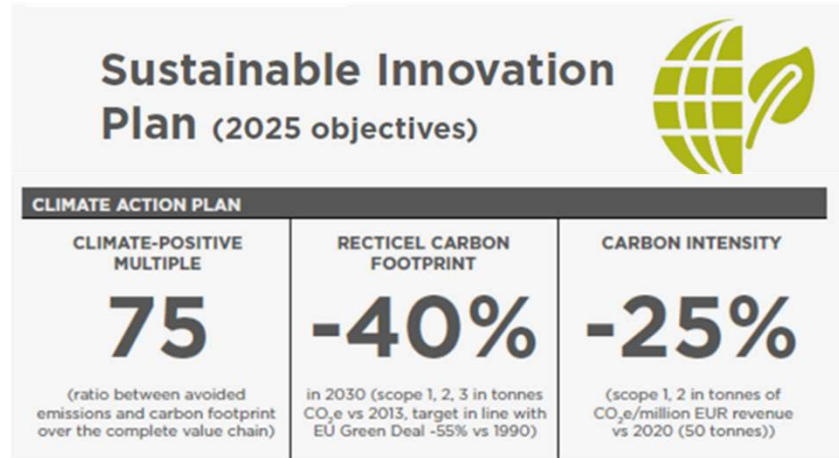
Already a **climate-positive company**, we will further **reduce our carbon footprint** and increase the positive impact of our insulation activities.

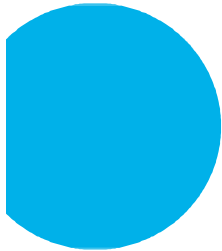
By **focusing** on:

- ▶ Selection lower-carbon raw materials (low-GWP, renewable and recycled)
- ▶ Processes (more green energy & better energy efficiency)
- ▶ Products (more sustainable)



Climate Action Plan





Our renewed sustainability strategy



Transition to a circular economy

Why?

We support a **sustainable** economic model built on **preservation of natural resources, eco-design, responsible production and end-of-life solutions.**

How?

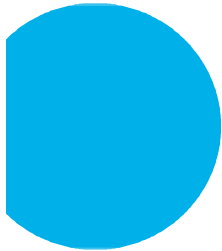
By **leading the way:**

- ▶ In implementing **new chemical recycling solutions** for flexible PU
- ▶ In eco-design of our products, and in mechanical recycling of post-consumer foam as an interim step to full circularity



In our ambition to increase the use of lower-carbon raw materials





Our renewed sustainability strategy



Innovation for societal needs

Why?

Sustainability **adds value** and **drives success** for all stakeholders.

How?

By **innovating** to:

- ▶ Support healthy, sustainable lifestyles
- ▶ Reduce carbon emissions
- ▶ Maximise resource efficiency

Sustainable Innovation Plan (2025 objectives)



INNOVATION FOR SOCIETAL NEEDS

80%

OF R&D PROJECTS CLASSIFIED AS SUSTAINABLE

≥3

SUSTAINABLE R&D PROJECTS BROUGHT TO MARKET EACH YEAR



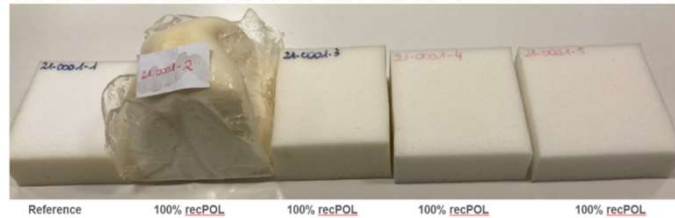
Emerging technologies for EoL flexible foam recycling

First industrial plants will be operable by end of 2021

- **H&S technology** of flexible PU foam recycling is based on optimized acidolysis method where PU residues are being dissolved in a mixture of carboxylic acids and basic polyol
 - **DOW RENUVA™** Mattress project to bring the value chain actors into a new ecosystem, cooperation with **Eco Mobiler, Orrion Orgaform Chemicals and Vita**, plan to market RENUVA™ polyols in first half of 2021
 - **RetourMatras** is building an industrial scale plant, schedule to be commissioned by the end of 2021
- **BASF** “wet chemolysis” process to close the loop with the recycling of mattresses
- **Rampf Eco Solutions** tailored polyols are manufactured from PU waste materials or PET using solvolysis
 - Repsol polyurethane-to-polyol plant able to recycle more than 2kt/a, to be operable in 2022
- **PUReSmart Solution** – exploring new methods, technologies and approaches to transform polyurethane into a circular material
 - Design new molecules to make PU re-processable (thermoplastic characters)
 - Smart sorting technology to gain clean material inputs for the subsequent recycling process
 - Convert EoL mattresses back into PUR raw materials – a recycled polyol and an TDI from recycled TDA – enabling a high level of recycled raw material content in the targeted application

Results: recovered raw materials from lab scale trials

- At small and intermediate pilot scale different types of foams were recycled resulting in high purity and yield polyether polyol
- The recovered toluene diamine (TDA) was further processed to toluene diisocyanate, a high yield recycled TDI was obtained at small scale
- Foaming trials with the recovered polyol were performed allowing the replacement of 100% virgin polyol with recycled polyol in a conventional polyurethane foam formulation retaining good foam properties



- The installation of the pilot plant progressed significantly. Mechanical completion of the polyol train was directly followed by the start-up process and the installation of the work-up step for the amine fraction started and is expected to be completed mid of 2021

Thank you

Any question?

