

Our journey towards becoming fully circular

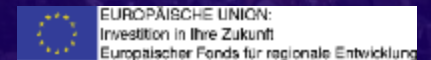
Dr. Hanno Bruemmer, Covestro
May 12th, 2022



**Process⁴
Sustainability**

**Cluster for climate-neutral
process industries in Hesse**

Supported by:





Our journey towards becoming fully circular

How we intend to close the carbon loop

Dr. Hanno Bruemmer
Head of Supply Chain & Logistics EMLA

Frankfurt, May 12th 2022

[covestro.com](https://www.covestro.com)



Forward-looking statements

This presentation may contain forward-looking statements based on current assumptions and forecasts made by Covestro AG.

Various known and unknown risks, uncertainties and other factors could lead to material differences between the actual future results, financial situation, development or performance of the company and the estimates given here. These factors include those discussed in Covestro's public reports, which are available on the Covestro website at www.covestro.com.

The company assumes no liability whatsoever to update these forward-looking statements or to adjust them to future events or developments.

Covestro – a leader in polyurethanes and plastics



Strong

- €15.9 bn in sales
- € 3.1 bn EBITDA
- 19.5% ROCE
- 17,900 employees¹



Useful

- Polyurethanes and Plastics, performance materials, solutions and specialties
- For many industries



Global

- 33 production sites globally
- Close to customers and partners



Innovative

- 1,200+ employees in research and development
- 80 years of ideas and inventions



Our vision – promote circular economy

Circular economy enables a climate neutral future

- Circular economy is the key to resource conservation, climate and environmental protection
- Plastics are a driving force for implementing circular economy



We want to become fully circular

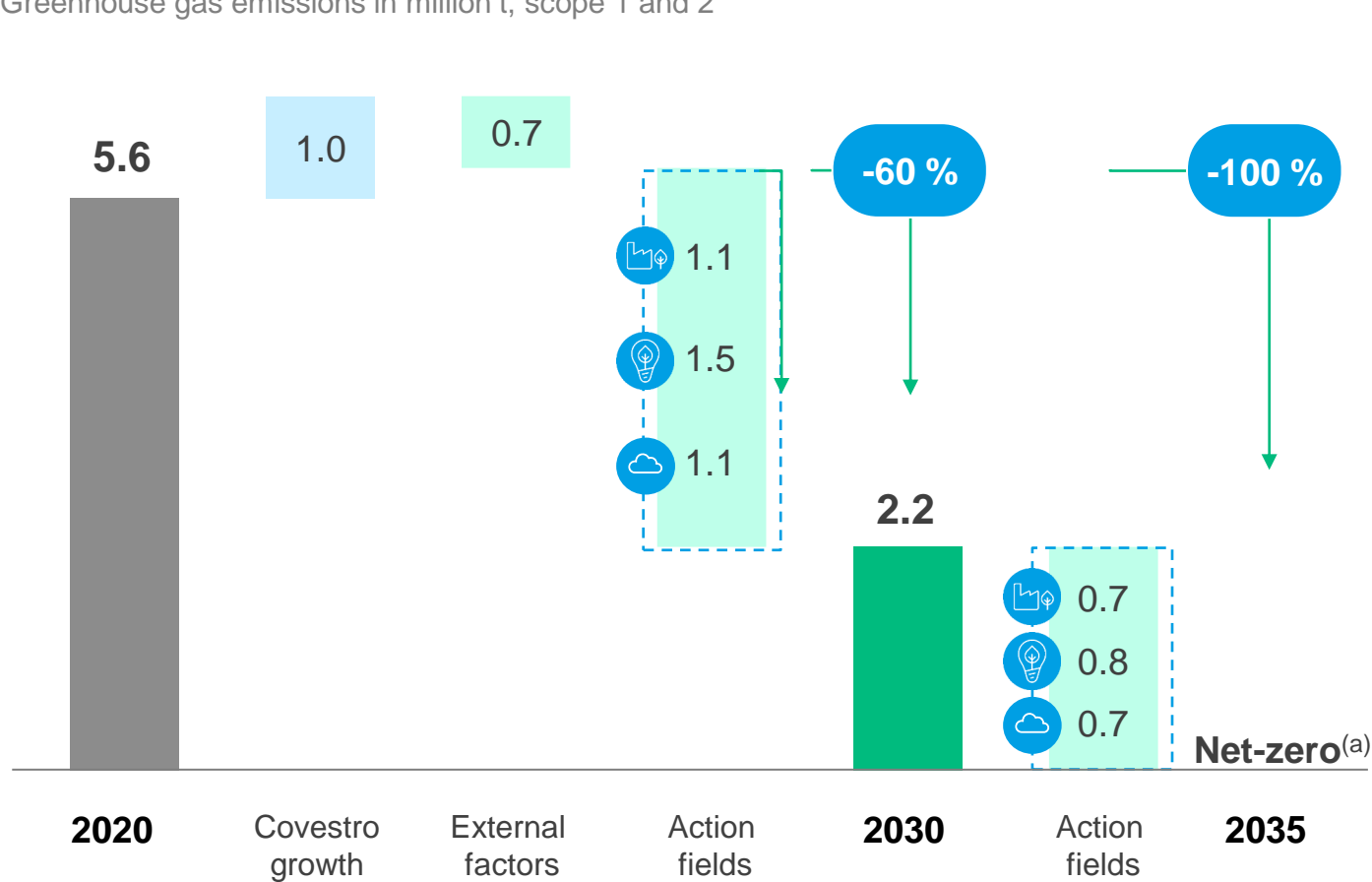
- We want to contribute to make circular economy the global guiding principle ...
- ... and anchor it across the whole company

Innovative levers towards climate neutrality

Detailed roadmap



Greenhouse gas emissions in million t, scope 1 and 2



Our action fields:

- More sustainable manufacturing
- Renewable electricity
- Renewable steam

By 2030: capex of € 250-600m;
opex savings of around € 50-100m p.a.





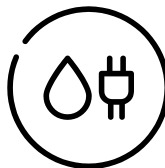
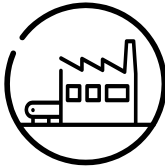

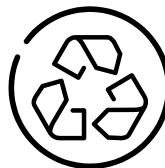
(a) Achieving net-zero greenhouse gas emissions is defined as a balance between anthropogenic emissions (from own operations and energy procurement) and anthropogenic removals of greenhouse gases.

Covestro's corporate carbon footprint 2021

~ 20% is due to energy and own operations, ~ 80 % in value chain



Covestro's Corporate Carbon Footprint (Total = 27.3 Mt CO₂e)¹

PURCHASED GOODS & SERVICES	OTHER ENERGY REL. ACTIVITIES	UPSTREAM TRANSP. & DISTR.	OTHER INDIRECT EMISSIONS ²	ENERGY (Scope 2) ³	OWN OPERATIONS (Scope 1)	DOWNSTREAM TRANSP. & DISTR.	END-OF-LIFE			
	→		→		→		→		→	
16.44 (60%)	1.02 (4%)	0.5 (2%)	0.5 (2.5%)	4.44 (16%)	0.98 (4%)	0.03 (0.1%)	3.34 (12%)			
Raw Materials represent ~ 90% of Scope 3.1 emissions	Emissions linked to the extraction and transmission of energy	Inbound and outbound freight paid by COV	Capital goods, treatment of waste from own operations, business travel and employee commuting	Use of purchased electricity and steam	N ₂ O, use of natural gas	Inbound and outbound freight paid by suppliers and customers	End-of-life treatment of sold products			

Source: Covestro Corporate Sustainability

1) Calculated in conformance to GHG Protocol and WBCSD recommendations; inkl. major RfM contributions

2) Other indirect emissions (total: 0.58): Capital Goods (0.34); Waste generated in own operations (0.16); Business travel (0.001) & Employee commuting (0.024)

3) Indirect greenhouse gas emissions calculated using the market-based method, 2021 Annual report

Our key to sustainability – focus areas

Circularity as guiding principle

Circular economy is the key to protect **climate and environment** as well as to preserve **limited resources**.

We drive circularity with a **strategic program** and anchor it in the whole organization.

By switching to green electricity and alternative raw materials we want to achieve a fossil-free production.

With innovative technologies we aim to **improve recycling processes**.

*Alternative raw materials:
make use of biomass, CO₂
and end-of-life products*



*Innovative recycling:
develop new technologies*



*Renewable energies:
convert sites to green
electricity*

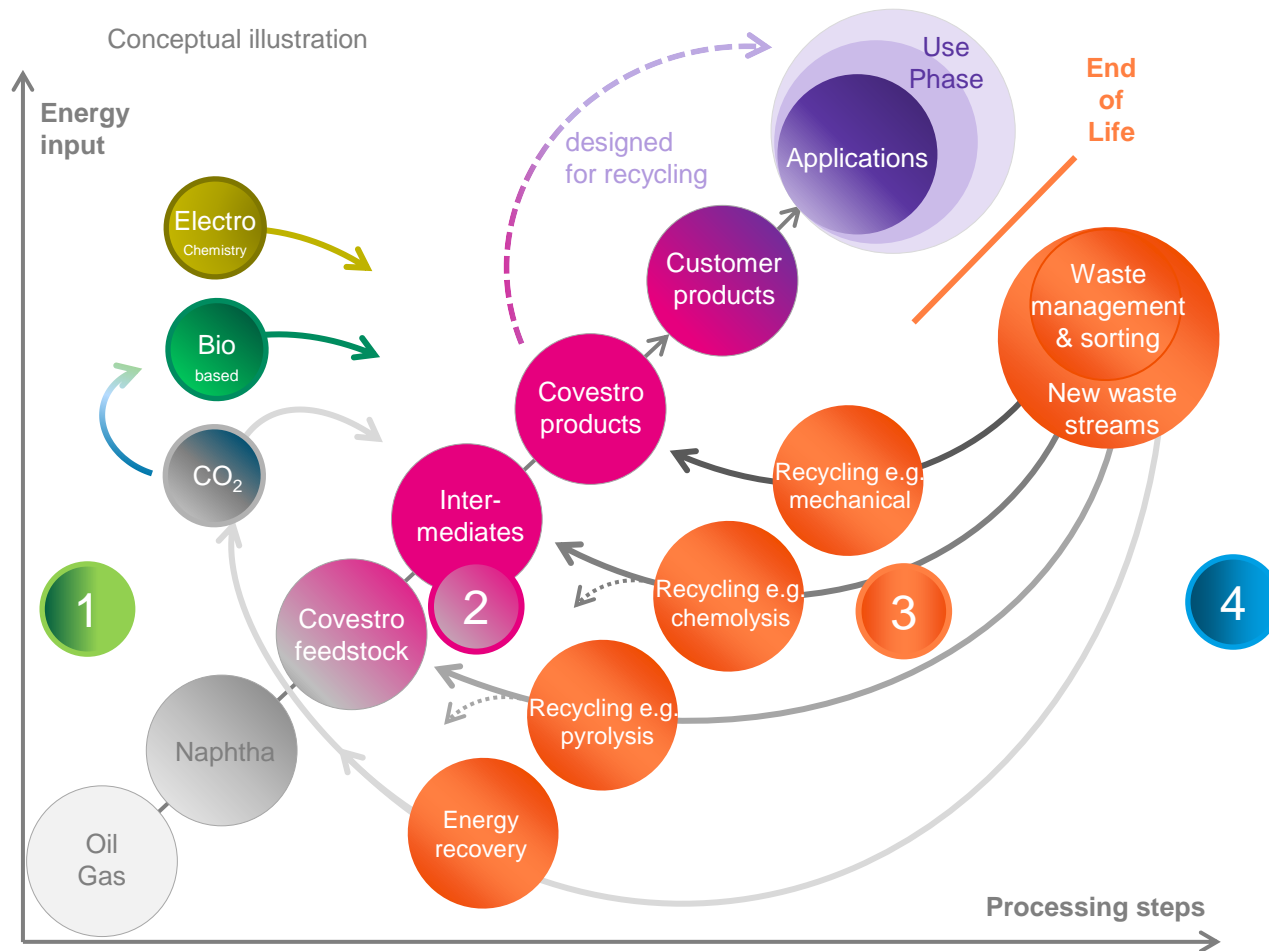


*Joint solutions:
find new ways to
create value*



Closing material and carbon loops

Circular and climate neutral economy



COVESTRO APPROACH TO CIRCULARITY

- 1 Renewable energy
- 2 Alternative raw materials
- 3 Innovative recycling for end-of-life solutions
- 4 Cross-industry collaborations



Goal to obtain 100% of our electricity from renewable sources long-term

Renewable energy



ONSHORE WIND



OFFSHORE WIND



SOLAR



- PPA with ENGIE signed in 2021, covering a capacity of 39 MW from 15 newly constructed wind turbines since April 2021
- About 45% of our site's electricity demand in Antwerp, Belgium, covered by renewable energy, saving about 39kt of CO₂e emissions annually

- PPA with Ørsted signed in 2019 for offshore wind energy, to be newly built in the North Sea
- Starting in 2025, Ørsted to provide 100 MW of electricity for 10 years, covering c. 10% of electricity consumed by Covestro in Germany

- PPA with Datang Wuzhong New Energy Co. signed in 2021 for power from solar farms in China's northwest region Ningxia
- Agreement covers 100 MW capacity, equivalent to c. 10% of our site's annual electricity demand in Shanghai, PRC

Green Hydrogen / Green Ammonia

Memorandum of Understanding

**FORTESCUE
FUTURE
INDUSTRIES**



- MoU **signed in January 2022** between Fortescue Future Industries and Covestro
- Up to **100 kt/y of green hydrogen globally**, first deliveries **in 2024**
- Equivalent to approx. **500 kt/y of green ammonia** (current Covestro global demand 450 kt/y)
- **Ammonia is the initial focus**, as the supply chain is existing and Covestro can use the product immediately
- Covestro's ammonia demand in **Shanghai, Houston** and **Cologne**
- Volumes will be **ramping up over time**, in line with market acceptance
- Covestro continues interest in **blue hydrogen and blue ammonia**



Electrochemistry for small molecules

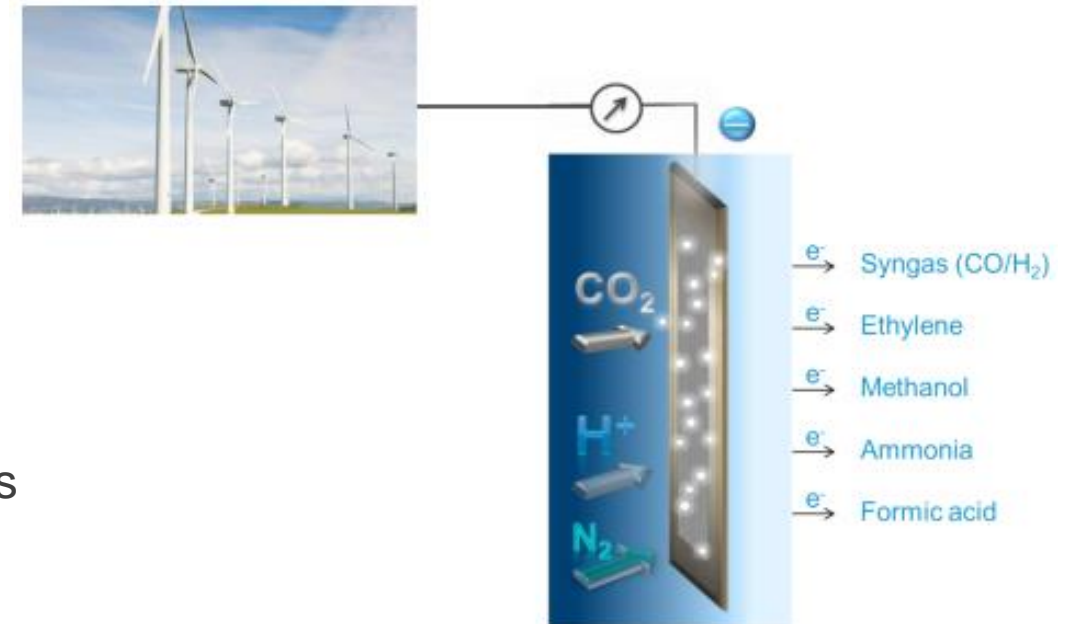


Technical challenges

- Selectivity & stability of the gas diffusion electrodes
- Processing of product mixture in needed specification
- Scale-up: electrodes and cells in industrial scale

Partnering

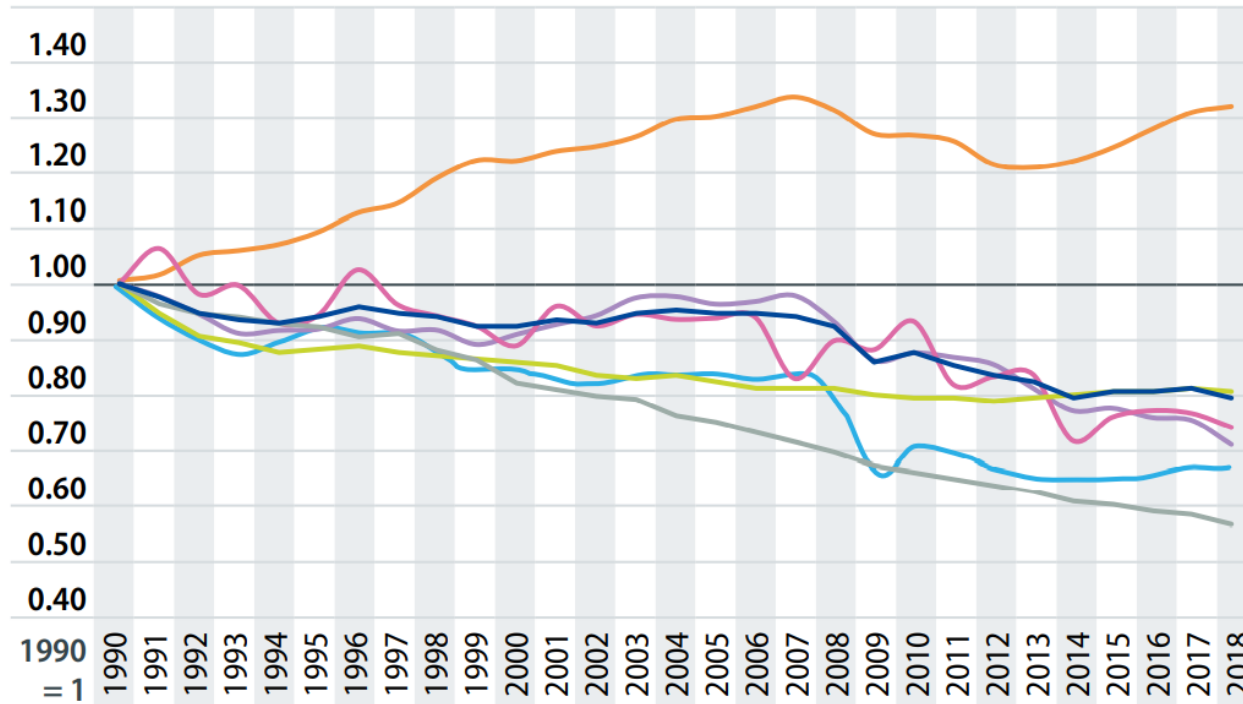
- Process development with academic and industrial partners
- Several public funded projects (focus “Power2X”)
- Key academic cooperation partner: JARA = Jülich Aachen Research Alliance (RWTH Aachen + FZ Jülich)



Covestro will also contribute to reducing GHG emissions from transport



Energy industries · Industry (***) · Transport (**) · Residential and commercial
· Agriculture, forestry, fisheries (****) · Other (*****) · Total



The issue

- The transport sector is the only sector where GHG-emissions continue to rise.
- In 2018 GHG-emissions from transport were 32% higher than in 1990.
- Failure to reverse this trend has potential to undermine the European climate goals.

There is a need for all stakeholders to act, collectively.

NB: (*) Excluding LULUCF (land use, land-use change and forestry) emissions and international maritime, including international aviation and indirect CO₂.
(**) Excluding international maritime (international traffic departing from the EU), including international aviation.

Source: European Environment Agency (EEA)

Covestro and NPRC plan to power salt barge fleet with H₂

First sustainable logistics lighthouse project, as a contribution to Covestro's circular economy ambition



4 February 2021

Salt fleet to be powered by hydrogen

In a joint project, Covestro and the logistics service provider NPRC plan to convert the salt transport fleet on the Rhine to emission-free hydrogen-powered ships. The first two zero-emission ships are scheduled to operate between the Netherlands and Covestro's three Lower Rhine sites as early as 2024.

▶ [Read more](#)



Read more: [Covestro and NPRC plan to use hydrogen-powered barges](#)

Goal to produce 100% of products from alternative raw materials long-term

Alternative raw materials



CO₂-BASED

- 11 products commercialized
- 14 running R&D projects



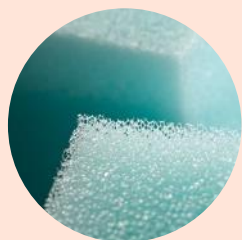
WASTE-BASED

- 21 products commercialized
- 46 running R&D projects



BIO-BASED

- 13 products commercialized
- 28 running R&D projects



Example Performance Materials CO₂ as raw material

- CO₂ replaces up to 20% of crude oil-based feedstock of polyols
- Demo plant of 5kt p.a. at Dormagen site and product brand cardyon® launched in 2016
- Recticel promotes foam mattresses with portions of oil content replaced by CO₂-based chemicals
- Sports flooring producer Polytan installed first elastic subfloor using cardyon® as binder



Example Engineering Plastics Recycled polycarbonates

- New polycarbonate grades from post-consumer recycled (PCR) content, e.g. water bottles or auto-motive lighting
- Open loop recycling system to collect, sort, shred and clean material
- PCR grades contain up to 75% of recycled content with up to 50% reduced carbon footprint
- PCR grades are used in various consumer electronics applications for a second life



Example Coatings and Adhesives Bio-based car top coat

- Enabling customers to optimize the CO₂ footprint of their products
- New hardener for automotive coatings with carbon basis up to 70% from renewable raw materials
- No compromises with regards to protective functions and appearance
- Collaboration with automotive group Audi and the coating experts at BASF Coatings

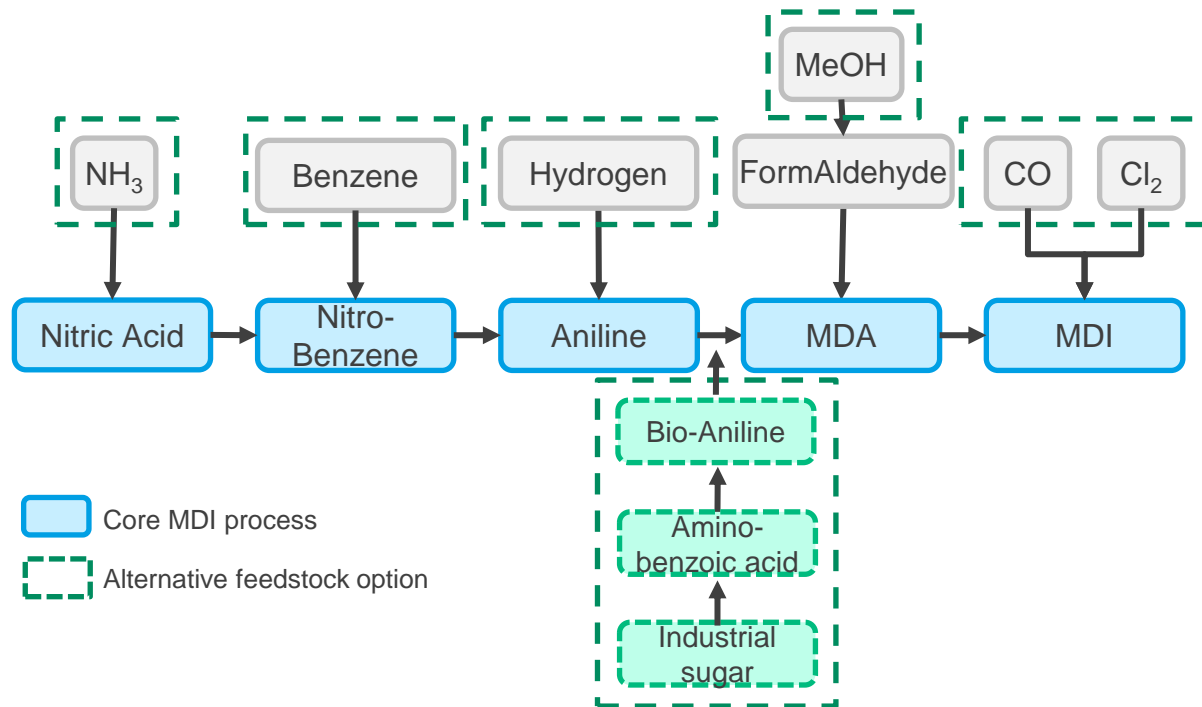
Certified alternative MDI possible with current technology and assets

Potential drop-in solutions to MDI production



MDI PRODUCTION PROCESS

Conceptual illustration



OPTIONS TO PRODUCE ALTERNATIVE MDI

Alternative raw materials as potential drop-in solutions

- Certified alternative benzene via mass balance
- Hydrogen (H₂) from chlor-alkali electrolysis or water electrolysis based on renewable energy (green H₂)
- Ammonia (NH₃) from conventional process based on green H₂
- Methanol (MeOH) from industrial waste CO₂ plus green H₂ with mass balance approach
- CO from waste or biogas-fed steam-methane-reformer incl. CO₂ recycling

Commercial

Commercial

Commercial

Pre-Commercial

Commercial

Alternative energy

- Energy from renewable sources, e.g. wind

Commercial

Alternative precursor

- Bio-aniline based on industrial sugar in development, using proprietary technology

Early R&D

Global availability of drop-in solutions for alternative MDI raw materials results in low risk for future stranded assets

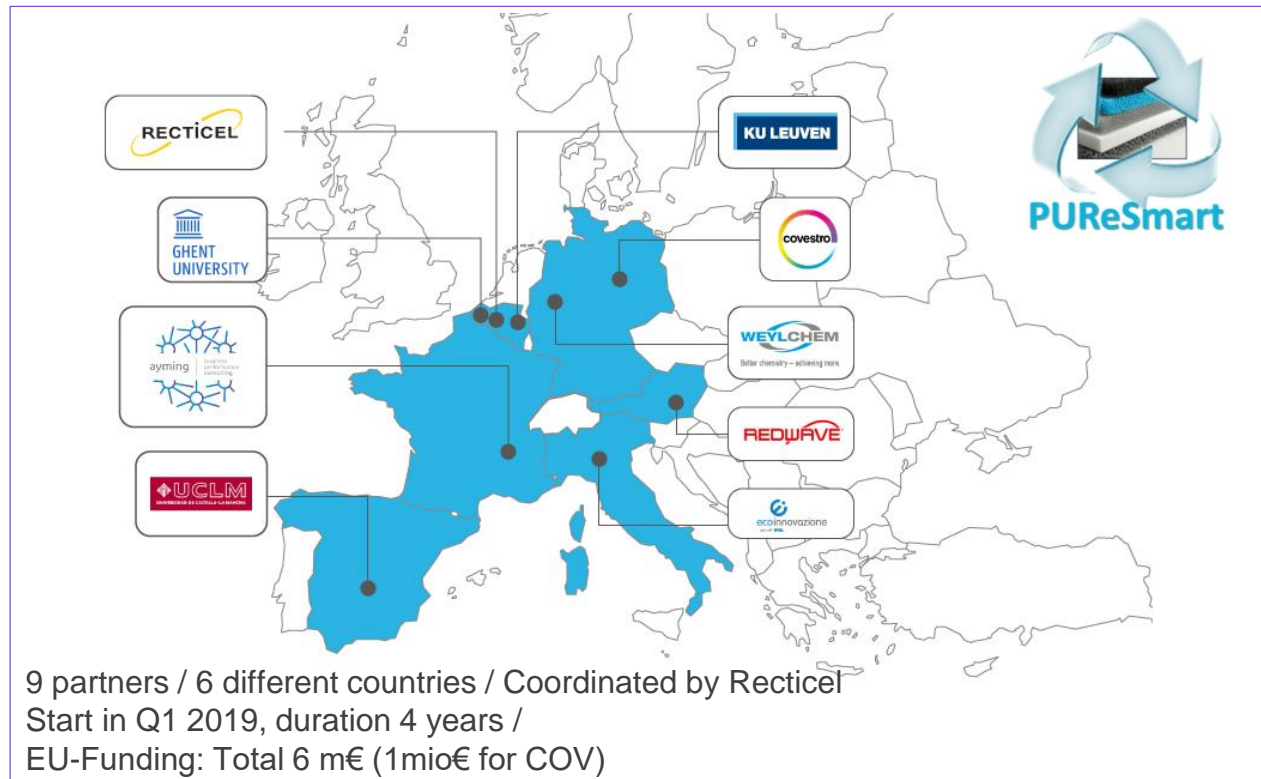
PUReSmart - Chemical recycling of flexible foams

Call: H2020-NMBP-ST-IND-2018

TOPIC : Smart plastic materials with intrinsic recycling properties by design (RIA)



Polyurethane Recycling towards a Smart Circular Economy



Three main pillars

- I **Smart Design** Design new molecules to make PU re-processable (thermoplastic characters)
- II **Smart Sorting** Improve sorting abilities to gain clean material inputs for PU recycling
- III **Smart Chemolysis** Modify chemolytic process to increase quality & quantity of recycled products



This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement no. 814543

The next step: Industrialization of Soft Foam Chemical Recycling



REALLY closing the material loop

Building on the participation of the PReSmart project



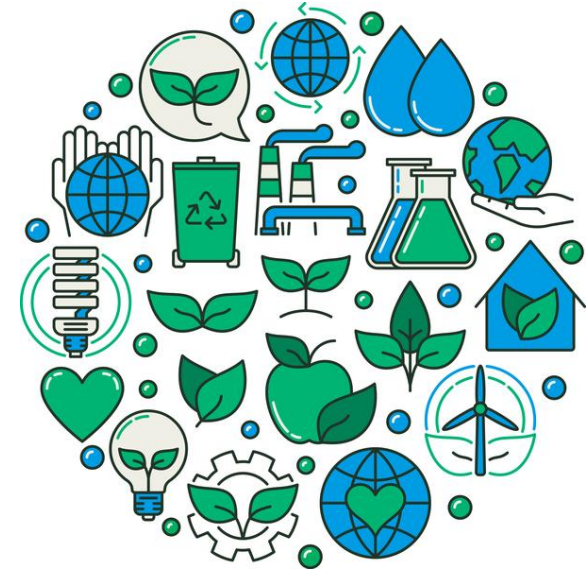
<https://www.covestro.in/en/sustainability/circular-economy/innovative-recycling>

Summary and outlook

- Circular Economy is key to achieve a sustainable chemical industry.
- Making it a reality requires multiple activities along the value chain.
- Partnerships to combine expertise and competencies are a key success factor.
- Business logic and political frameworks need to evolve.
- Circular Economy will be part of job profiles for Chemical Engineers.

A strong vision guides our journey:

Covestro – we will be fully circular





Thank you very much for your attention!

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