GREEN MANUFACTURING

Chaired by:

Myriam Tryjefaczka
Director Sustainability and Public Affairs at Tarkett

Martin Chilcott
Chairman & CEO at Manufacture 2030

Pär Larshans
Director of Sustainability at Ragn-Sells

François Laurent
Country President France / Managing Director at Covestro (France)

Peggy Zwolinski
Deputy director at G-SCOP Laboratory, University Grenoble Alpes

Ind Tech 2022

MANUFACTURE 2030

Carbon reduction to transformation in supply chains

Martin Chilcott
Manufacture 2030
June 28, 2022

Climate change is the challenge of our time. Let's solve it together.

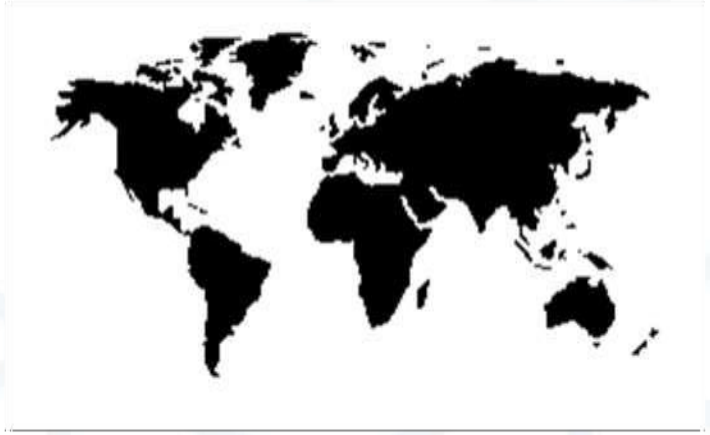
- Empower and inspire your suppliers to help you hit your carbon reduction targets by driving improvement at scale.
- Certainty for you.
- Opportunity for your suppliers.

The leading platform & service for reducing upstream Scope 3 emissions, building value for both customers and suppliers

Global Clients Include

Roche, Bayer, ASDA, Toyota, GSK, Honda, Aldi, Co-op, SC Johnson, Morrisons, Haleon, Reckitt, Sainsbury's, Lonza, Kingfisher, Ford

M2030 in 50+ Countries



Circa 4,000 supplier sites

Our Unique Approach

Creating shared value

European Commission · FRANCE22 · GOUVERNEMENT Liberté Égalité Fraternité · cea · AMIRES

Climate Action Program: Measure, Manage and Reduce

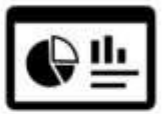
1. Engage
2. Measure
3. Manage
4. Reduce
5. Report

> Engage suppliers
> Share objectives
> Set-up & onboarding

Build supplier baseline via data capture incl.
> Supplier Scope 1, 2 &
> Upstream Scope 3
> Water & Waste
> CDP in/out transfer
> Current projects
> Site level data

> Action Planning
> Hotspot analysis
> Segment suppliers
> Gap to target analysis
> Glidepath reporting
> Incentivisation

Impact reduction via:
> Capacity building
> 450+ best practices
> Expert partners
> Supplier success team
> Recommendations
> Collaborative forums
> Behaviour change



> Dashboard reporting
> Forward visibility
> Performance analysis

Decarbonization leads to transformation

Insight. Scale. Relationships. Innovation

- Data informed, systematic approach to decarbonisation at scale
- Generates a Climate Action Plan for each supplier site
- Identifies the actions required to hit a target
- Identifies the gap to target and the 'rocks'
- Demands innovation to remove the 'rocks'
- Over time it creates a register of materials (at scale):
  - Who has what?
  - Who needs what? And
  - Where it can be found.

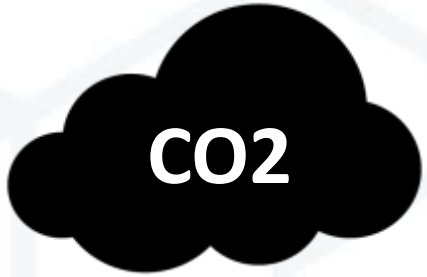
CASE STUDY: Grocery Retail (UK)

59% reduction in waste to landfill

Renewable energy usage doubled over a 3 year period

5,554 improvement projects added in 2019 alone

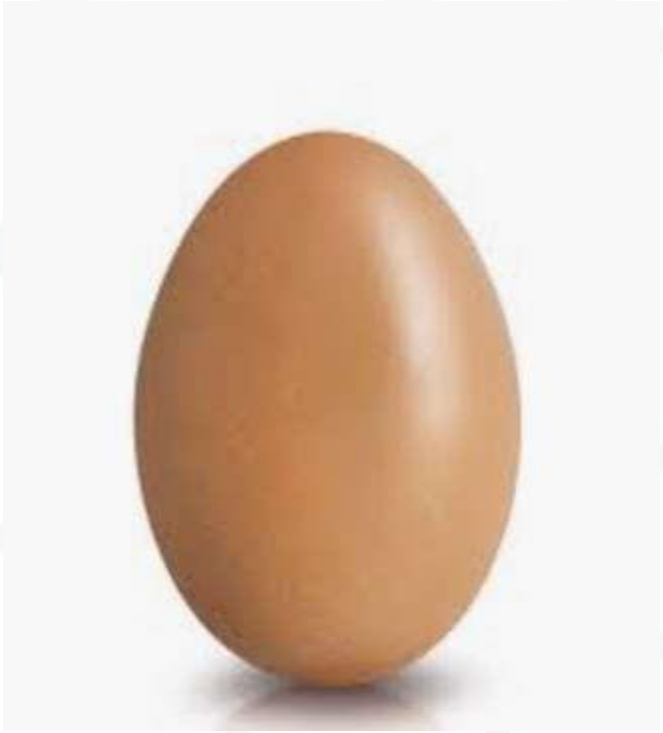
905 million tonnes of material inputs being tracked for Scope 3



17%

improvement in supplier Scope 1 & 2 CO2 per tonne of output

Two examples



Start reducing your **Scope 3** carbon emissions

- We’re committed to supporting your Scope 3 emissions reduction targets.
- Martin Chilcott
- Founder and CEO
- martinchilcott@manufacture2030.com

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Thank you!

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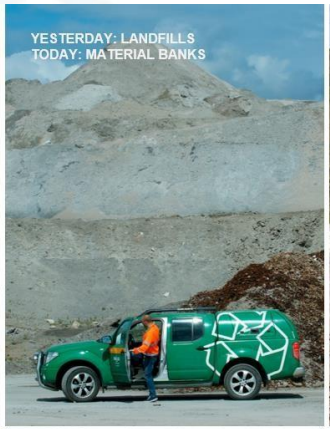
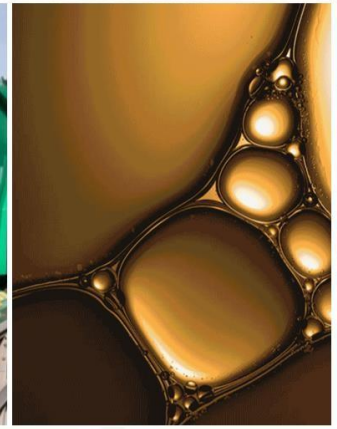
Circular material flows will reduce the risk to overshoot any of the planetary boundaries

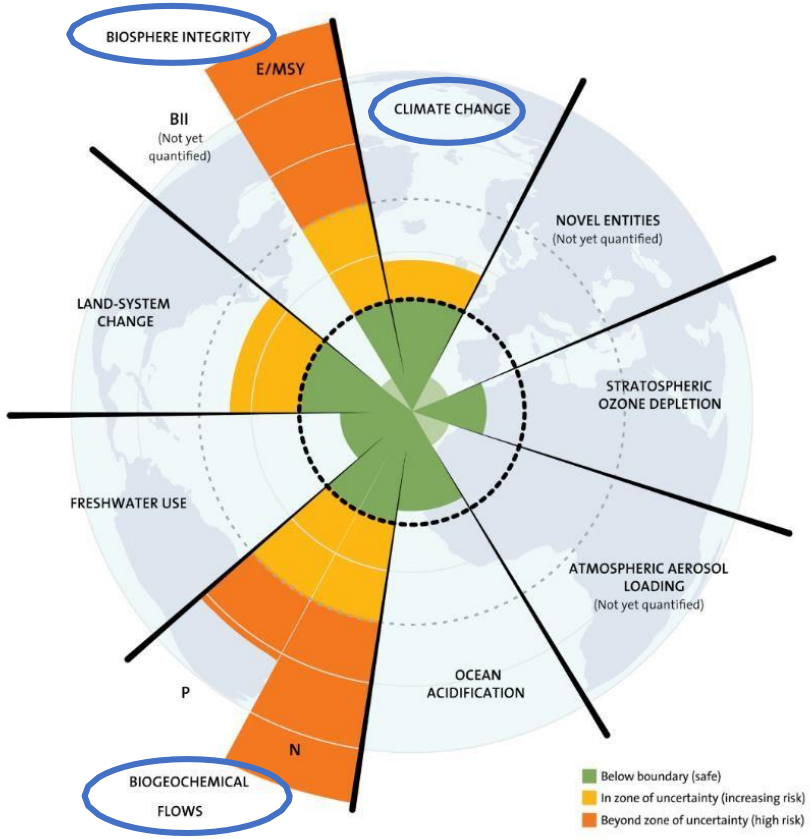
Pär Larshans
Ragn-Sells
28th of June 2022, Grenoble

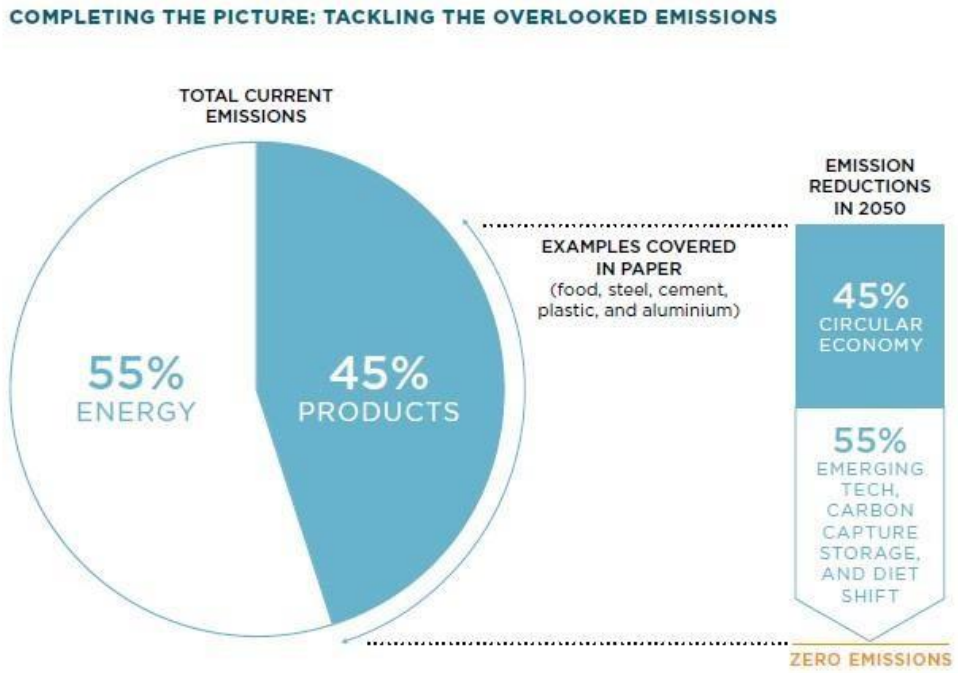
Originating from 1881





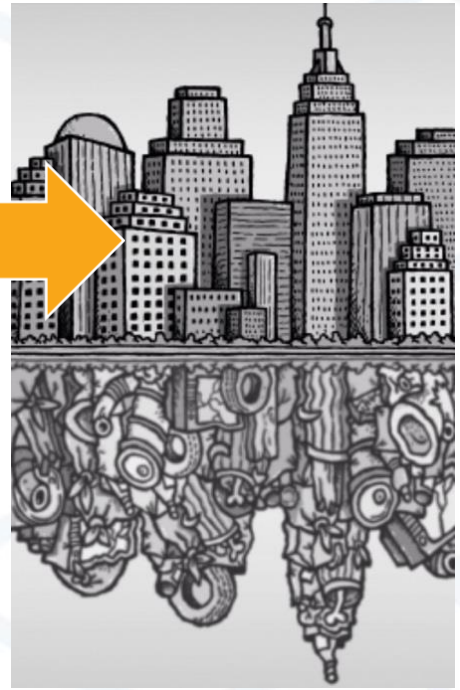
Ragn-Sells focus, Climate NEEDS circularity





Resource focus vs. waste focus

60 TONNES
PER CAPITA
& YEAR



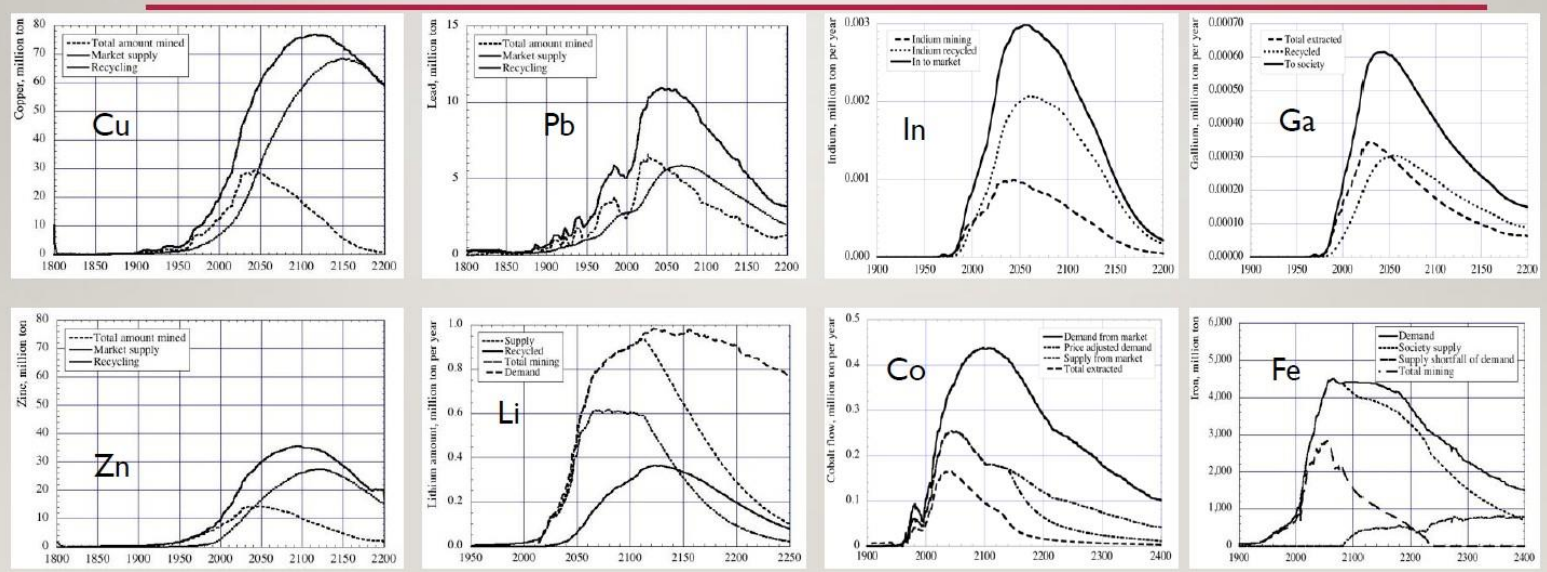
3.8 TONNES
PER CAPITA
& YEAR

But should be here!

Todays' focus is here…

MORE RESOURCES are NEEDED = material banks needed!

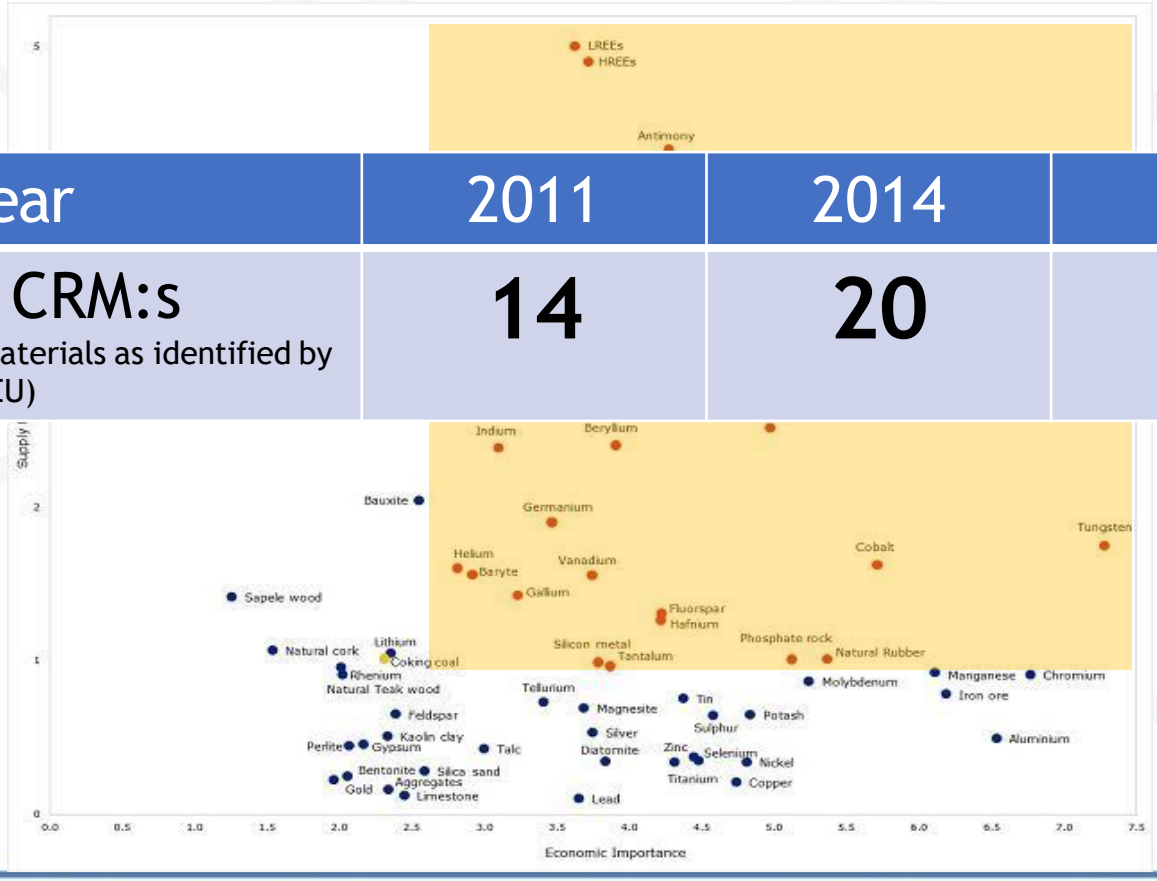
EXTRACTION, SUPPLY, RECYCLING AND DEMAND FOR DIFFERENT IMPORTANT METALS



Source: Sverdrup, U. *et al.* 2016, On the integrated climate impact of resources and energy extractiion and use in society, Berlin 8 nov 2016, https://www.umweltbundesamt.de/en/conference-decarbonisation-ressource-efficiency-0

Increased shortage of resources, specific resources more needed

Year	2011	2014	2017	2020
No of CRM:s (CRM = Critical Raw Materials as identified by EU)	**14**	**20**	**27**	**30!**

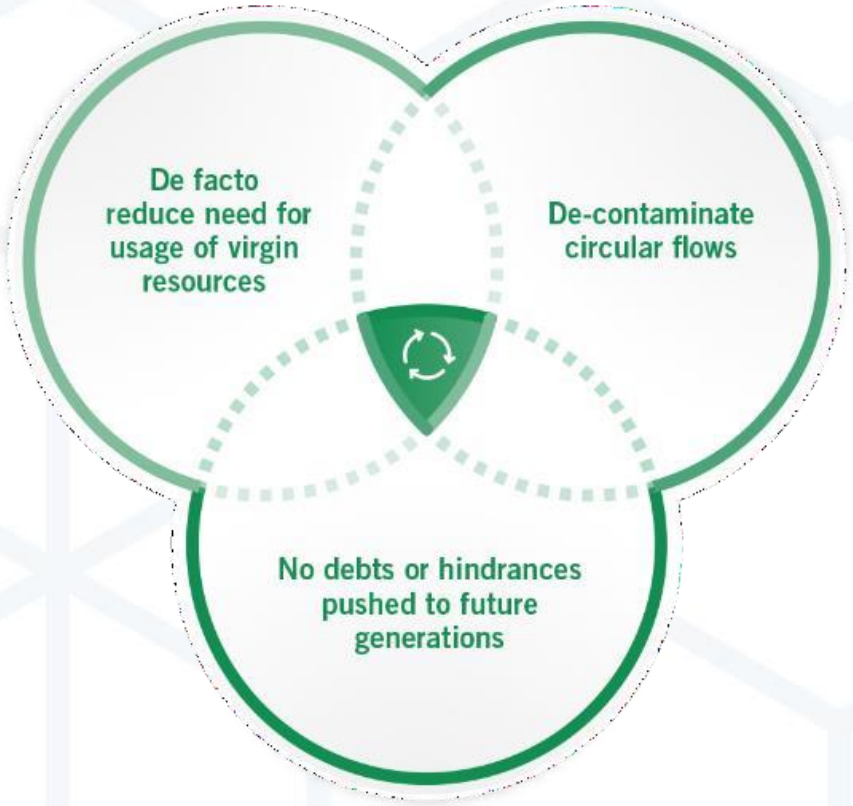


Macro nutrients shortage (N+P+K)

- Production of food a new high priority
- Global supply chain not reliable
- Shortage of phosphorus already a problem
- Developing countries has already been hit

Guiding principles for achieving CIRCULAR solutions

- Circular material flows must never cause harm to future generations
- Will reduce the need to usage of virgin resources
- Must include a decontamination step



First potassium factory that extract resources from urban flows – fly ash from waste incineration is the source

Media release, 15 April 2020

Extracting the Best from the Rest:
Ragn-Sells and Hitachi Zosen Inova Build Facilit
Processing Flue Gas Treatment Residues in Swe

Hitachi Zosen INOVA

Swedish recycling company Ragn-Sells and Swiss cleantech company Hitachi Zosen Inova are to build a facility for processing flue gas treatment residues at Högbytorp, Sweden. The process enables salts to be extracted from the waste product which can then be reused in industrial and chemical processes.

The flue gas treatment residue processing facility being built at the Högbytorp site of the Swedish recycling company Ragn-Sells will collect and wash residues from industrial processes, enabling the recovery of various commercial salts. Following a joint project development phase, the client, Ragn-Sells Treatment & Detox AB, has commissioned the Swiss cleantech company Hitachi Zosen Inova (HZI) to supply and integrate the entire process technology.

"HZI is a well-known name in plant construction and has many years of process technology experience. These were crucial factors in our choice of partner for this project," says Ragn-Sells project head Ulrik Améen.

Making a Sustainable Circular Economy Reality
With the objective of creating a sustainable circular solution, once commissioned the installation will extract useful materials such as various salts such as potassium chloride, sodium chloride and calcium chloride as well as ammonium sulphate from the residue. These materials can then be reused for industrial or chemical purposes.

For HZI this project marks a return to familiar territory: in the past the company has successfully developed and installed diverse fly ash washing systems at thermal waste treatment plants. "Given the various interpretations of the European legislation on treatment and landfilling fly ash and residues in different countries, the Ragn-Sells facility marks the way forward," says Ruedi Frey, Senior Engineer at HZI. "We're proud to be able to contribute our know-how and experience to this prestigious project."

Vision drawing by Sweco

Feb 24, 2020 15:22 UTC

Ragn-Sells invests 50 million EUR on resource extraction from fly ash

The environmental company Ragn-Sells is investing more than 50 million EUR in a new plant for the treatment of fly ash from waste incineration using its patented technology Ash2Salt. The new method extracts potassium and other valuable substances from the ash, while large amounts

[Read more: Ash2Salt (easymining.se)]

Resource plants replacing wastewater treatment plants in the future

- Summary: 69th Session of UNECE (ragnsells.com)
- From Wastewater Treatment Plants to Resource Plants (ragnsells.com) – UNECE 2021
- ”We need international agreements based on the quality, not origin” (ragnsells.com) – WTO May 2022

Macro nutrients in focus

- A “mine” that the more you use it, the better for the…
  - Environment
  - Peoples health
  - Future generations ability to live on the planet

50% of Europe's need of phosphorous is available in the urban environment

- Sewage treatment plants
- Fish farms
- Biogas industry
- Slaughter houses
- Etc

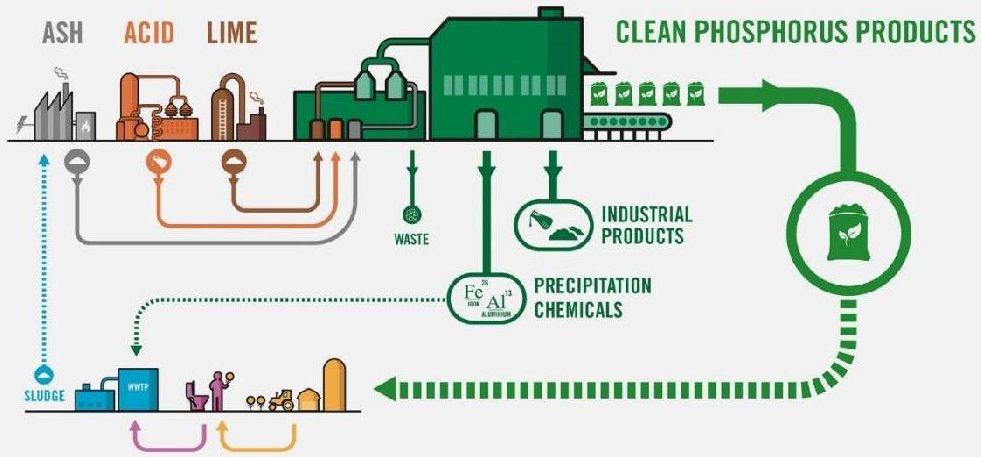
ASH2®PHOS – products from the process

Products from the process = 99,7 % can be used

- Phosphorus
  - Ammonium phosphate – Fertilizer
  - Calcium phosphate – Feed phosphates
- Precipitation chemicals – Iron chloride and aluminium hydroxide and /or sodium aluminate
- Silica sand – Foundry sand, fill, proppant etc.

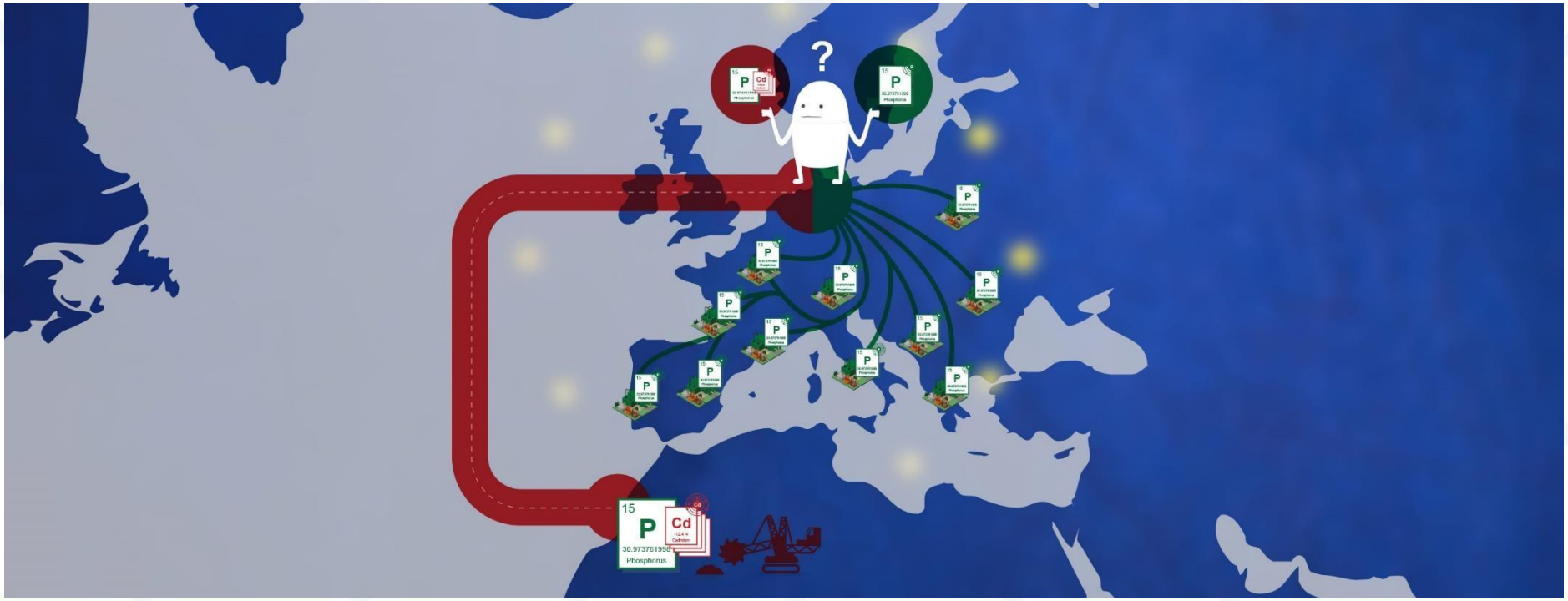
Recovery of heavy metals

- Heavy metals that should be recovered (Cu etc)
- Heavy metals that should be taken care of (Cd)



A Circular resource - IS NOT WASTE

There is a need to shift from today's ORIGIN perspective to a QUALITY perspective by our policymakers when dealing with resources to enable a circular transition in society.

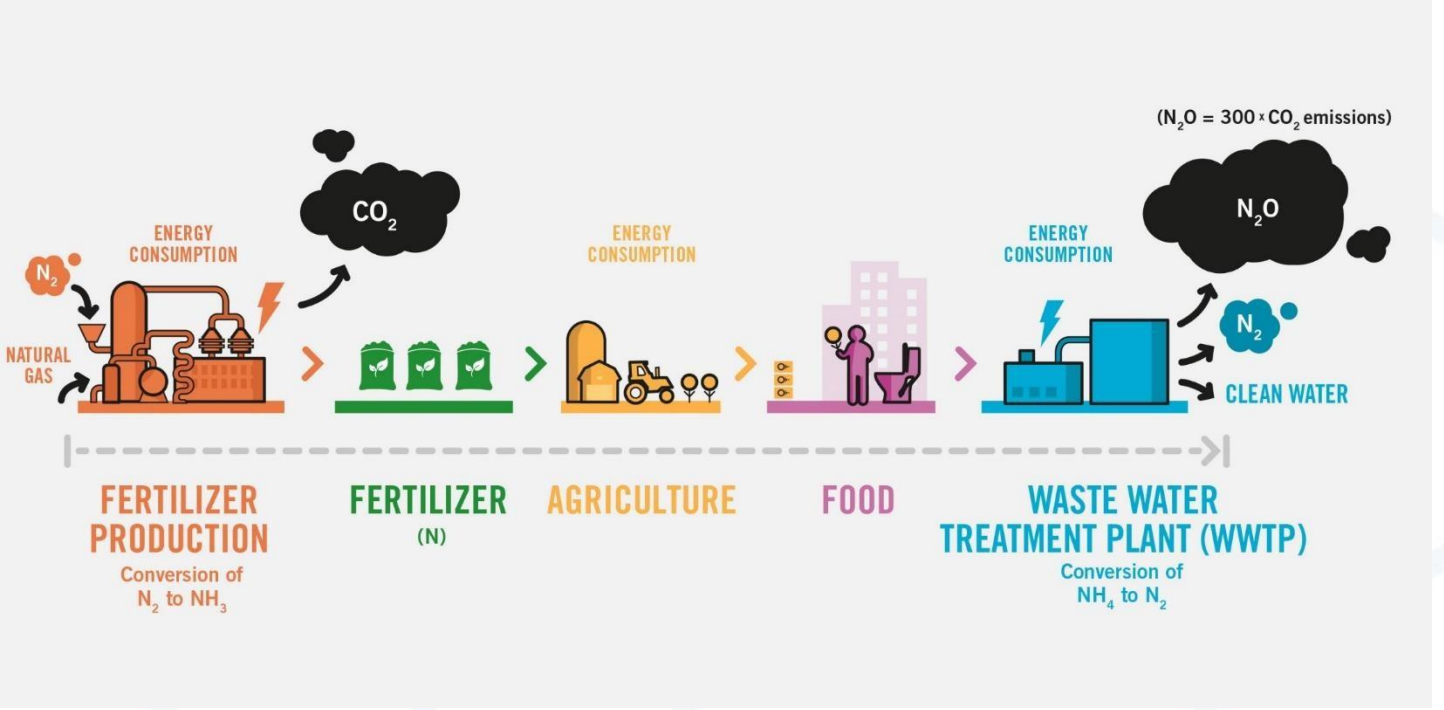


From a huge challenge to a possible resource

Each an every wastewater treatment plant will soon, start to become a producer of nitrogen fertilizers

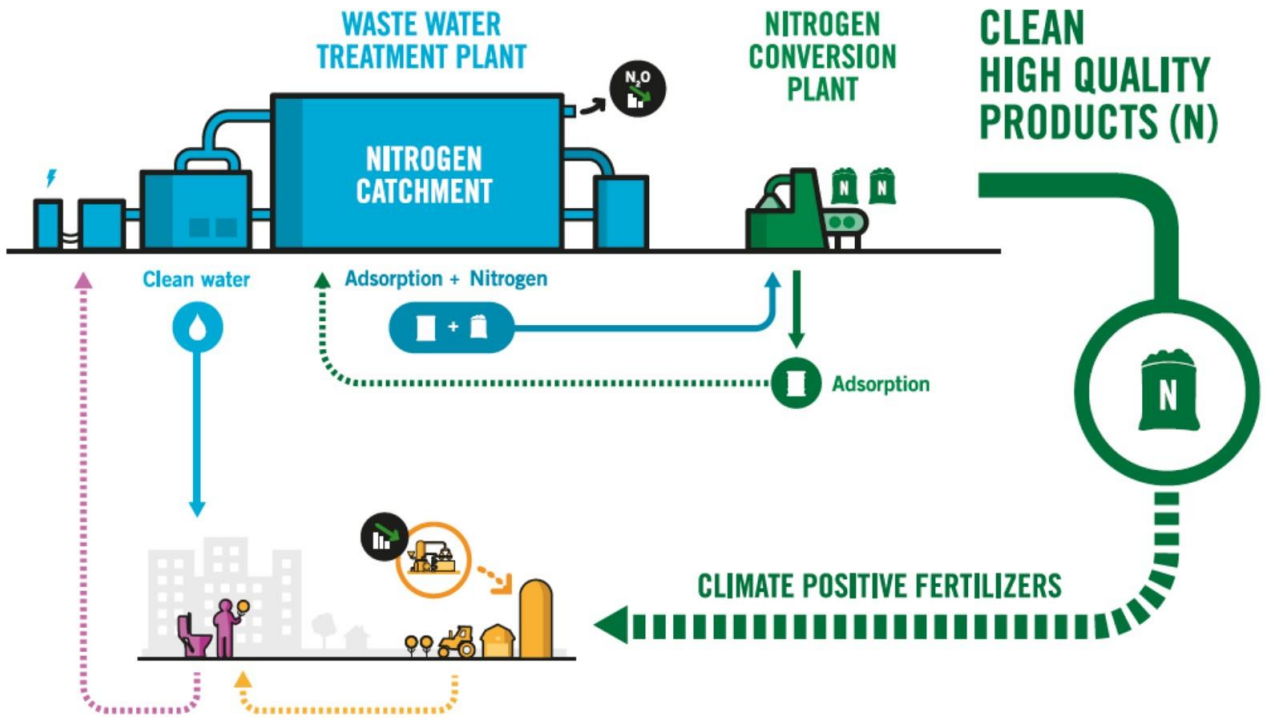
Our linear system is outdated, lets reboot the system

Haber-Bausch process did receive the Nobel prize in 1918



Robust and stable method for nitrogen removal and recovery

- Converts the captured nitrogen to e.g. ammonium sulphate without being returned to the atmosphere
- Application areas in focus
  - Reject water in Wastewater Treatment Plants
  - Landfill leachate
- Other areas of applications – biogas, fishing industry, animal farming
- Additional pros…
  - Low energy consumption
  - No release of greenhouse gases



Coordinator: EasyMining

Partners: Lantmännen, BIOFOS, RAGN-SELLS

Financed by:

Disclaimer: This information reflects the project partners' view. The EU Agency is not responsible for any use that may be made of the information it contains.

From ash mountains to a future raw material production with a CCU+S project

- Precipitated Calcium Carbonate with a negative CO2 value will be the output
- The first factory might also produce 30% of Europe's need of Magnesium

Partnerships needed in a future circular economy

- New circular material flows will change new ways to source
- Circular material flows will be in partnership
- French, Estonian, Swedish, German industrial CCU+S project

Tarkett

Press Release

Tarkett Group

Estonian ash piles turned into carbon negative raw material for flooring: Tarkett and Ragn-Sells partner to fight climate change

Paris, France, 12 October 2021 - Tarkett, a worldwide leader in innovative and sustainable flooring and sports surface solutions, and the Swedish environmental company Ragn-Sells, have announced today a collaboration aiming at developing carbon negative mineral fillers for vinyl flooring by 2025. The calcium is extracted from ash piles in Estonia and the calcium carbonate is produced using carbon capture technology.

Estonian ash piles disposed in nature. Tarkett and Ragn-Sells aim at transforming the ash into carbon negative raw material for vinyl flooring by 2025. The picture is Ragn-Sells property

The calcium carbonate to be produced by Ragn-Sells could be used as mineral fillers for Tarkett vinyl flooring. Several hundred thousand tons of mineral fillers are used by Tarkett every year. Photo credits: Philip Gatward

Support from EU on its way

One of the biggest obstacles is the possibility to source CO_2

Lack of carbon dioxide – a threat to the transition to a circular economy

Vice President of the European Commission, Frans Timmermans met with Ragn-Sells during his visit to Estonia.

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RAGN SELLS

European Commission

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An ambitious path to Circular Economy

François LAURENT
Covestro (France)
June 28th, 2022 - Grenoble

Covestro, leading in the world of plastics

Strong

- €15.9 bn in sales
- ~17,900 employees[1]

Useful

- Long-lasting plastics, pre-products and solutions
- (with very long-life cycle)
- For many industries

Global

- 50 production sites globally (thereof 18 in Europe)
- Close to customers and partners

Innovative

- ~1,500 employees in research and development
- 80 years of ideas and inventions

Information is based on financial results for 2021, except amount of employees and amount of global production sites. Those are as of June 30, 2021.
[1]calculated as full-time equivalent (FTE)

Strong vision

Covestro has fully embraced Circular Economy

“We will be fully circular”

The new vision substantiates our **purpose:** to make the world a brighter place

It reinforces our **mission:** to drive innovation and growth through profitable products and technologies that benefit society and reduce environmental impact

Key goals:

Embed circularity throughout the company

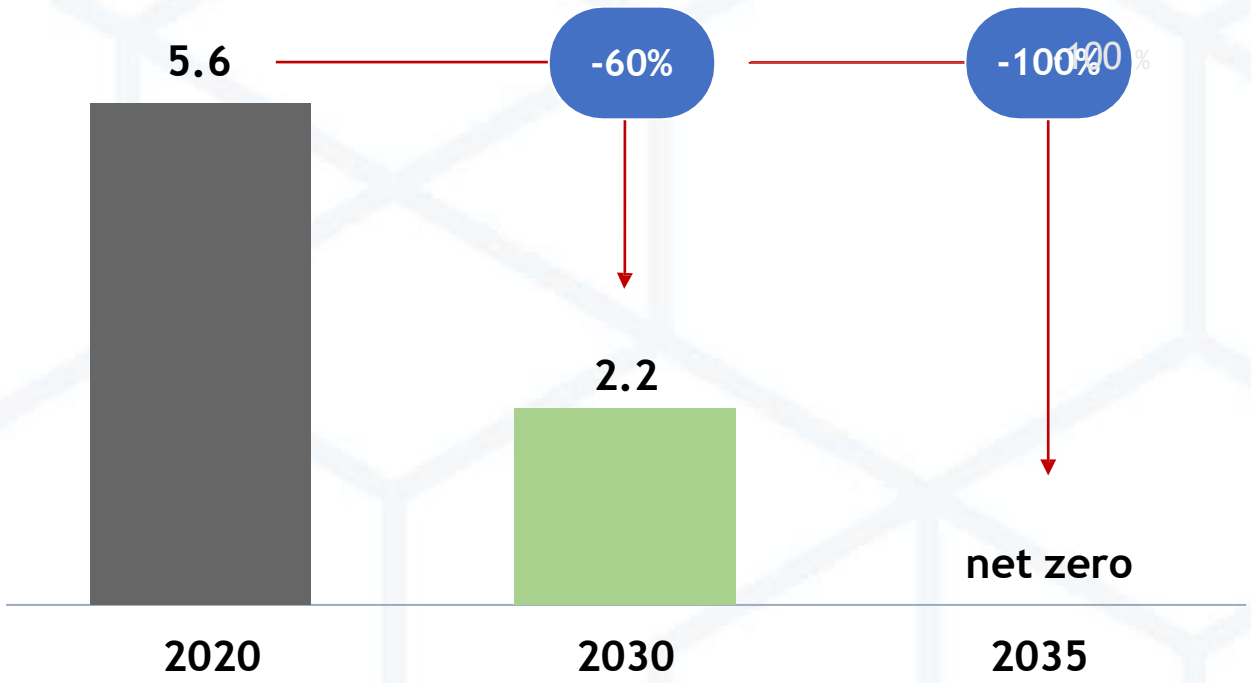
Become shaping force for Circular Economy

Contribute to greenhouse gas neutral economy

Pioneering with ambitious goals

Net zero[(a)] emissions by 2035 on the way to climate neutrality

Greenhouse gas emissions in million tons, scope 1 and 2



- By 2035: Net zero scope 1 and 2 emissions
- Interim target 2030: Reduction by 60 % to 2.2 m t
- Commitment to the 1.5°-goal of the Paris Climate agreement

(a) Net zero includes all direct and indirect greenhouse gas emissions (scope 1 and 2) and their reduction to a level compatible with the 1.5 degree target of the Paris Climate Agreement..

Clear focus

Four main areas to help realize resource-efficient Circular Economy

Long-term strategic program

Focus on
four key areas

Develop concrete goals
and KPIs to measure
progress step by step

Alternative raw materials

Innovative recycling

Joint solutions

Renewable energy

Focus area: Alternative raw materials

Revolutionize plastics production

Using carbon from alternative sources

Close the carbon loop

Abandon fossil fuels

Reduce GHG emissions

Biomass

13 products commercialized
28 running R&D projects

CO_2

11 products commercialized
46 running R&D projects

End-of-life materials/ waste

Driving, running, wearing…

More and more bio-based plastics

Increasing amount of products made from plant biomass

Example:
Coating components for cars – up to 70% carbon from plants

Scientific breakthrough

Important chemical only from plants

Major success in promising R&D pipeline: bio-based aniline

New process to produce important basic chemical from plants

Combination of biocatalysis and chemocatalysis – could set new industrial standards

Oil savings & better carbon footprint

Focus area:
Innovative recycling

Too good to be thrown away

Used plastics are a valuable resource

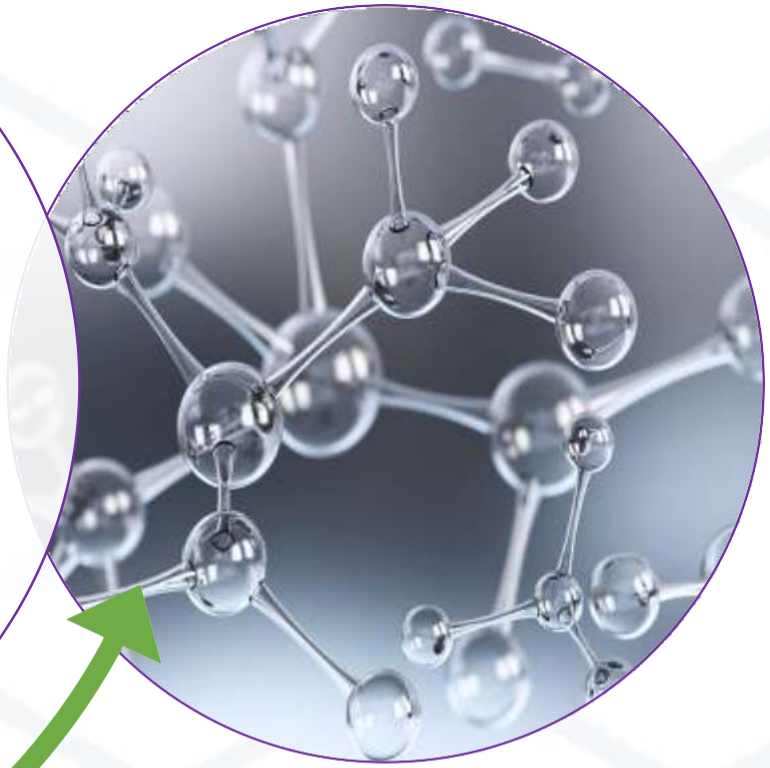
Towards a new concept of waste

End-of-life materials: rich source of valuable molecules

Must be reclaimed and reused

21 products commercialized

46 running R&D projects



Chemical competence

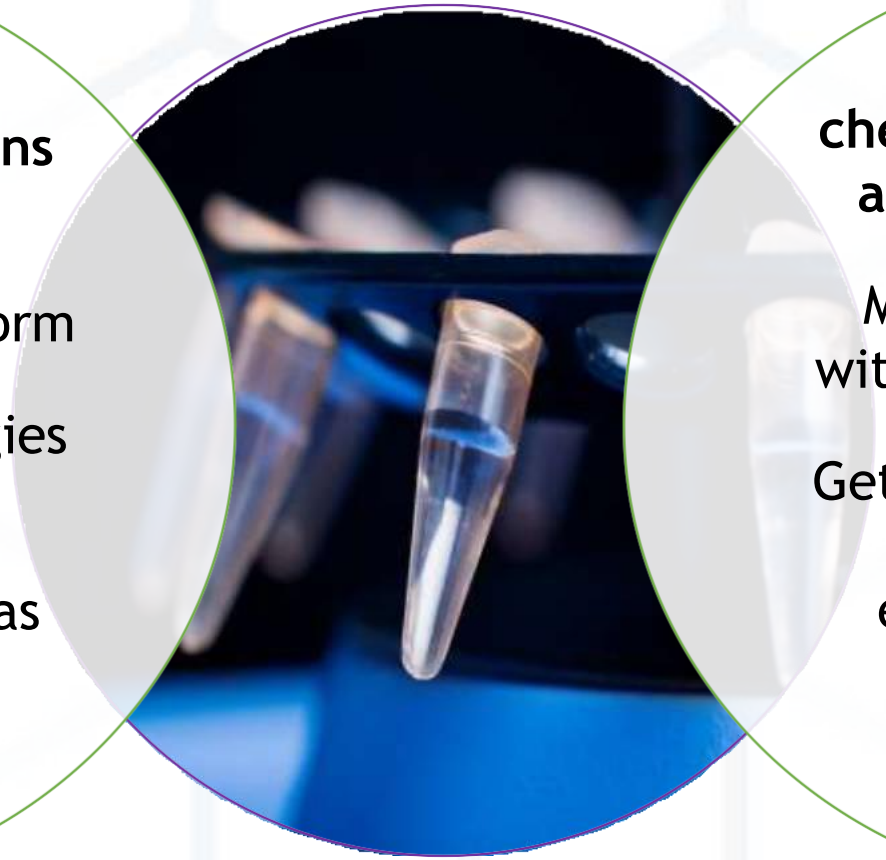
Researching new recycling technologies

Work on developing new solutions for plastics recycling

Expand technology platform

Bring required technologies quickly to market

Technological diversity as prerequisite



Bring in chemical competence to advance technologies

Maintain the polymer with mechanical recycling

Get back to the molecules with chemolysis, enzymatic recycling, smart pyrolysis

Intensive research

Active in numerous R&D projects

More than 20 research and development projects

Develop new, efficient technologies and methods to recycle plastic

Example:

Recycling polyurethane foam

EU-wide project PUReSmart

Recover 90% of used polyurethane to create building blocks

Focus area:
Joint solutions

Broad cooperation

Partnerships for most efficient solutions

Globally active

Engagement in international initiatives

Fight pollution

Covestro member of Alliance to End Plastic Waste

Worldwide network for infrastructure development, innovation, education & engagement, clean-up

Better recycling

Covestro participating in EU Circular Plastics Alliance

Broad initiative to promote recycling of plastics in Europe

Focus area:
Renewable energy

Numerous measures effectively reduce GHG emissions

Main levers to achieve climate target will define our Covestro specific roadmap

MORE SUSTAINABLE MANUFACTURING

- Reducing nitrous oxide emissions by installation of highly efficient catalysts
- Optimizing production processes to increase energy efficiency
- Need for development: A waste reduction program

RENEWABLE ELECTRICITY

- Onshore wind energy, e.g. PPA with ENGIE since 2021 for 45% of site's electricity in Antwerp
- Offshore wind energy, e.g. PPA with Ørsted starting 2025 for 10% of sites' electricity in Germany
- Solar energy, e.g. PPA with Datang since 2021 for 10% of site's electricity in Shanghai

RENEWABLE STEAM

- Converting steam generation from fossil to renewable energy sources
- Evaluating options to electrify steam generation based on renewable energies
- Evaluating e.g. biogas or green hydrogen as energy source to generate steam

Notes: PPA: Power purchase agreement
Datang: Datang Wuzhong New Energy Co.

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Thank you!

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G-SCOP

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UGA Université Grenoble Alpes

Challenges for more sustainable Circular Industrial Systems

Peggy ZWOLINSKI
G-SCOP Laboratory
June 28, 2022

Context : G-SCOP Laboratory

A multidisciplinary research laboratory answering the challenges of design, optimisation and management of products and production systems

- The ecological transition

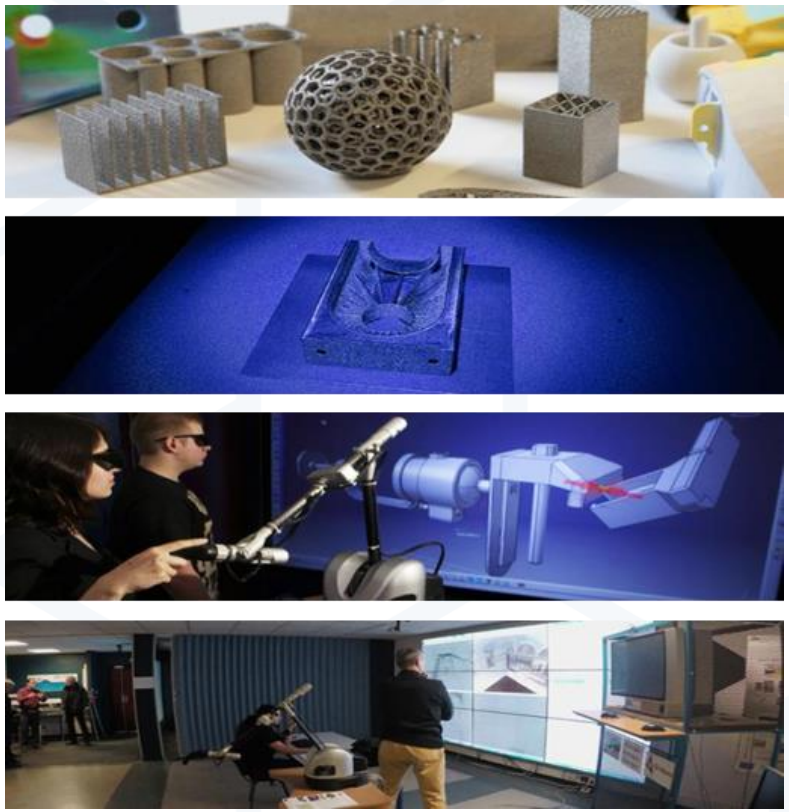
Circular economy, sobriety, the energy transition and low resource consumption systems, etc.

- The digital transition

Virtual and augmented reality, analysis and use of massive data, etc.

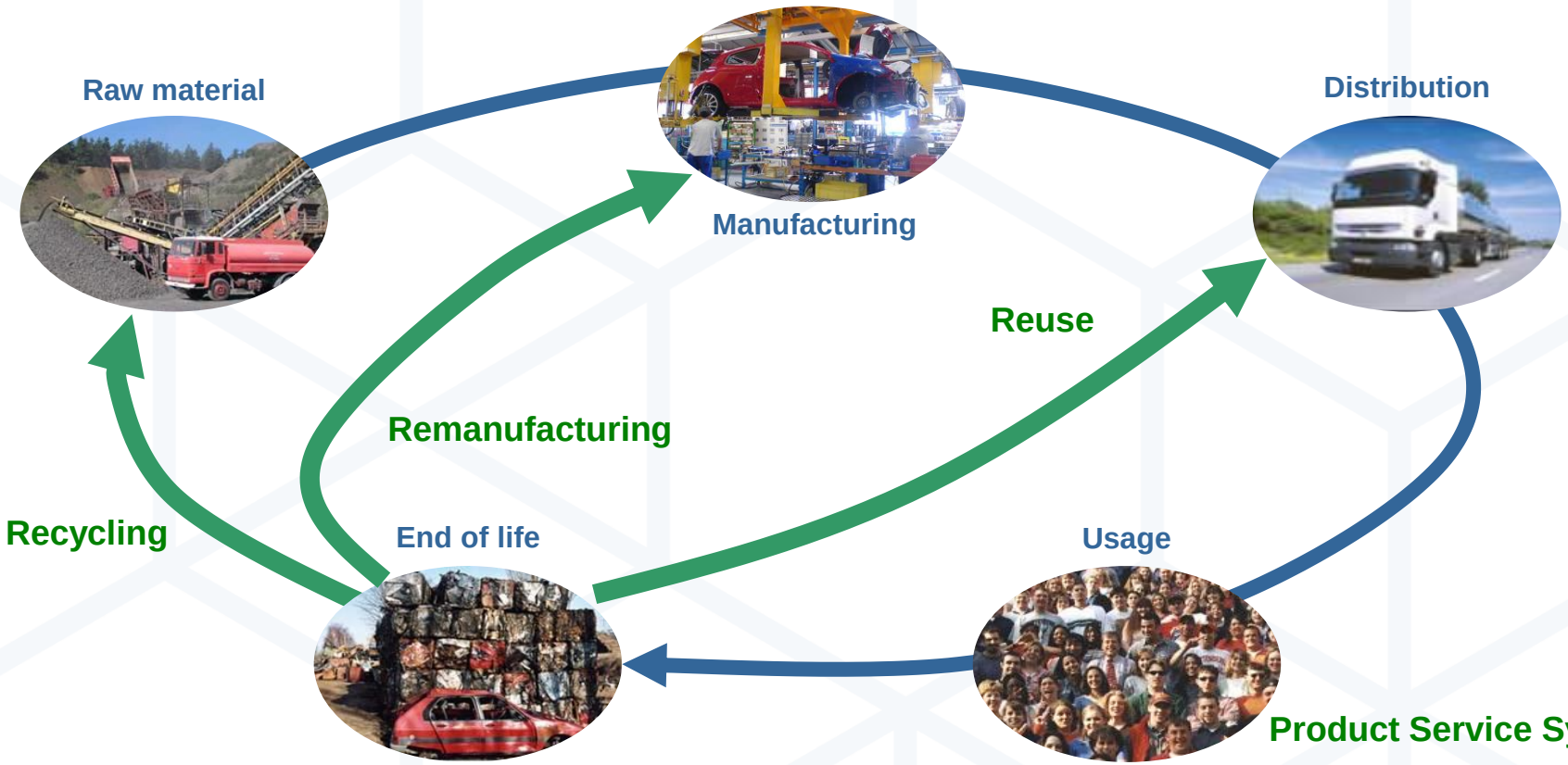
- Industry of the future

Humans in production systems, additive manufacturing, digital twins, etc.



UMR 5272

Context : Circular economy



The value of products, materials & resources is maintained in the economy as long as possible

Systems integrated design: Human, Environment, Technologies

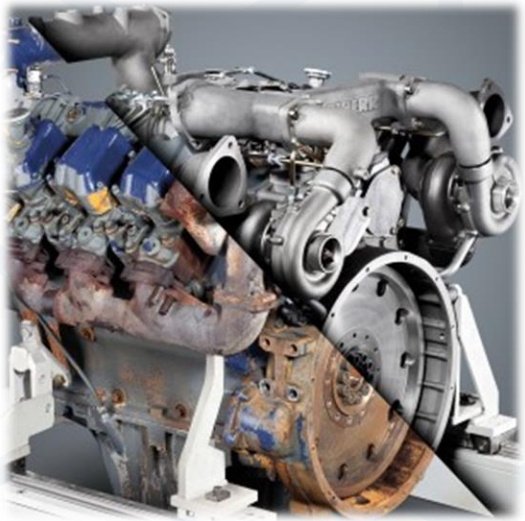
Context : Circular economy

- **Recycling**

Transform used products into raw materials

- **Remanufacturing**

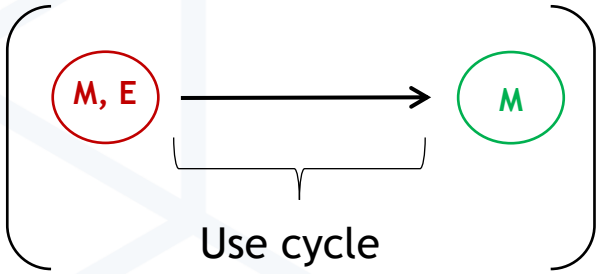
Transform used products into new products (initial performances)



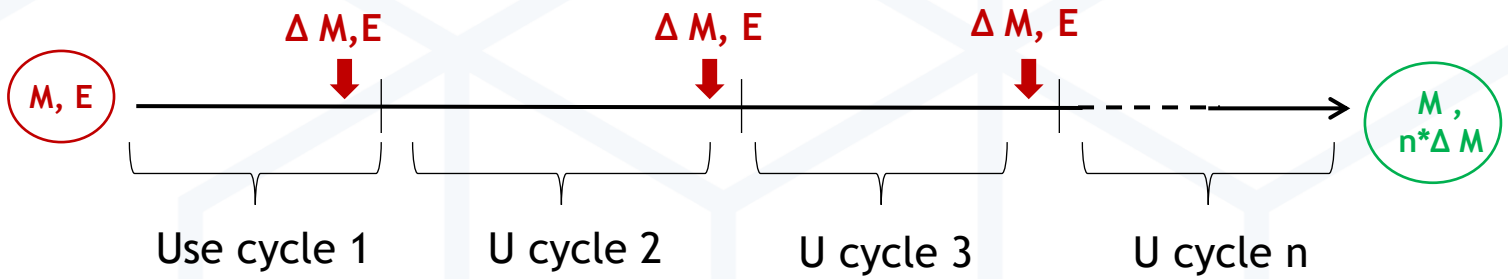
Context : Circular economy

- **Upgrading**
  Transform used products while increasing their performances or functions

Linear scenario



Upgrading scenario

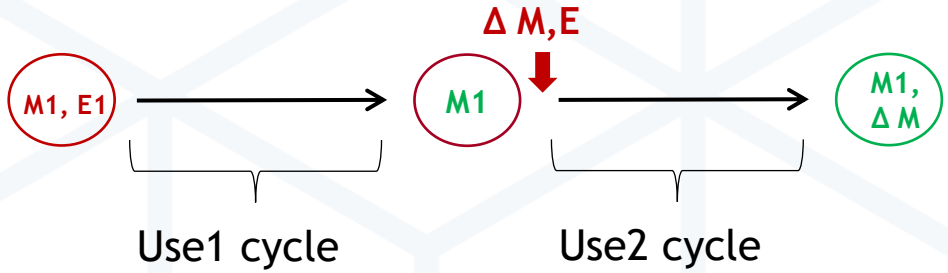


Context : Circular economy

- **Repurposing**
  Transform used products for another different second use

Linear scenario

Repurposing scenario



From a linear production system to a circular production system

Raw material extraction> manufacturig > consumption > waste

Raw material extraction > **de/re-manufacturing** > consumption > used products

Linear production systems	Circular production systems
- Material are « centralised » - They belong to the producer	- Used products" are distributed - They belong to the customer or the manufacturer
- The supply chain is established	- New networks and organizations must be created to obtain the material

From a linear production system to a circular production system

Raw material extraction> manufacturig > consumption > waste

Raw material extraction > **de/re-manufacturing** > consumption > used products

Legal conditions ?

Economical conditions ?

Local closed loop organisation ?

New logistic infrastructure ?

Diagnostic, monitoring and prognostic ?

New skills and competencies ?

Large scale ?

Automation vs. Agility ?

Consumers' and workers' acceptation ?

We need to design new industrial systems able to support circular scenarios

The CIRCULAR Project

Circular
Univ. Grenoble Alpes

- To develop the conditions of existence as well as the technologies necessary for the creation of new circular industrial systems able to transform products that are no longer used into new products

- To make effective the transition to agile circular industrial systems and to provide solutions for their management at the scale of a territory

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Project Hypothesis

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- Only an efficient, responsible and acceptable Human/Machine collaboration enables the necessary agility for those systems
- The industrial processes and their environment have to be systematically redesigned to adapt to the new inputs: the used products
- The massive deployment of the reuse-oriented processes needs specific incentives and industrial conditions

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Challenges

- Incorporation of 4.0 technologies in the context of the circular economy
- Diagnostic and prognosis issues related to the circularity of products
- Measure of the performance of circular industrial systems and their conditions of existence
- Management of circular value chains, at the territory scale
- Support the transition to new circular industrial scenarios

Collaborative work

Numerical solutions

Circularity conditions

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Challenges

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Development of an adaptive work cell to be able to identify new skills developed by workers in a 4.0 environment

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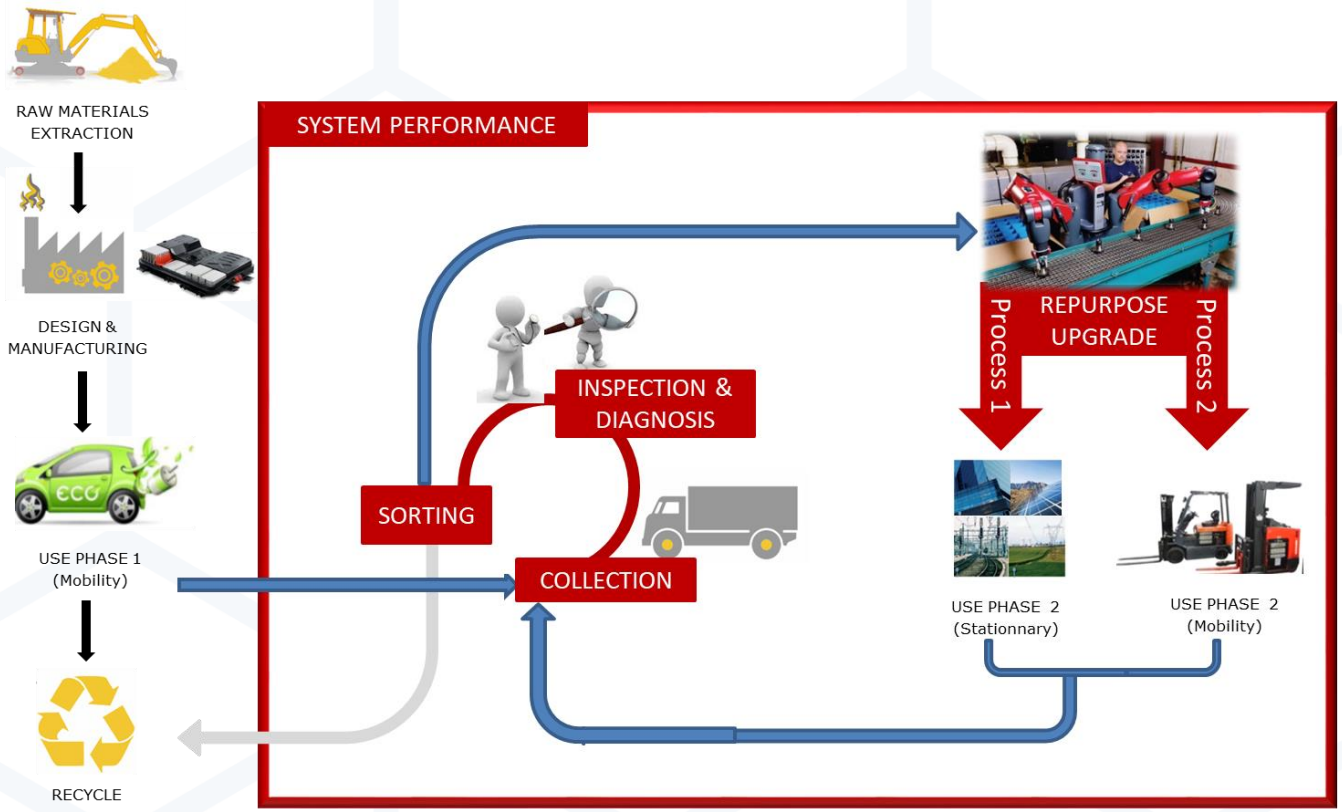

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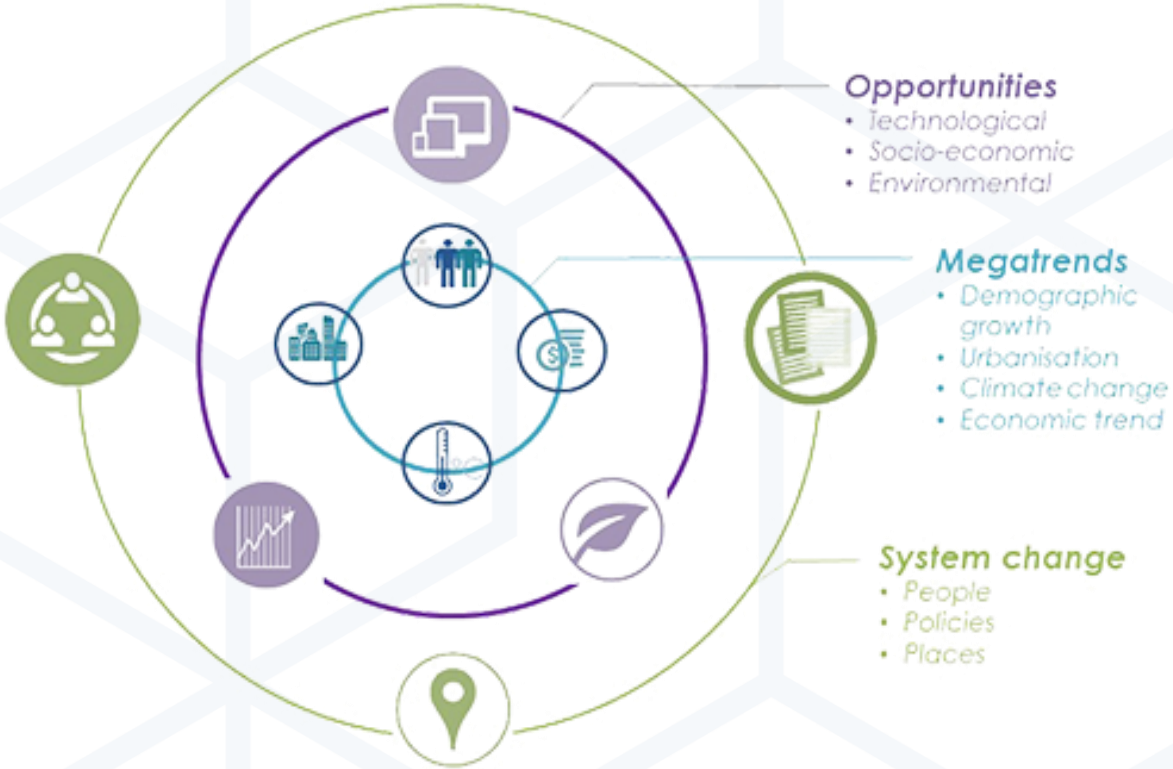

Source OECD (2018)

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The European Green Deal

A New Circular Economy Action Plan

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

LOI ANTI-GASPILLAGE pour une économie circulaire

CONCLUSION

- Circular economy is becoming popular, reinforce existing scenarios and create new ones
- Those new scenarios have to be supported by new industrial systems that have to be particularly agile
- Some solutions to increase the agility of such systems are investigated
- Those solutions will serve all the circular economy scenarios
- The question of the performance of such systems remains tricky !

Thank you!


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