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Assessment of the impact of relocating and improving the recycling of scrap metal from end-of-life vehicles and waste from electrical and electronic equipment in Wallonia, using the life cycle assessment tool

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Context of the project

The steelmaking sector already currently represents around 8% of global energy demand and 7% of CO_2 emissions from the energy sector.[1] However, demand for steel and major metals (Fe, Al, Cu, Zn, Pb, Ni) is expected to grow over the coming decades[2], which will necessarily increase environmental damage.

To face the challenge of ensuring the supply of these metals, the Wallonia Region (Belgium) has drawn up a list of projects to reindustrialize Wallonia, while fitting in with the political context and the energy and digital transitions.

The new **"Reverse Metallurgy +"** (RM+) projects are a continuation of the previous "Reverse Metallurgy" (RM) projects (2014 - 2019, 70 M€), which aimed to address the energy, digital and materials themes of the future in the field of **metallurgy**. In line with RM+'s sustainable development approach, the **Life Cycle Assessment** (LCA) method is used to estimate the environmental impacts and benefits of the various projects.

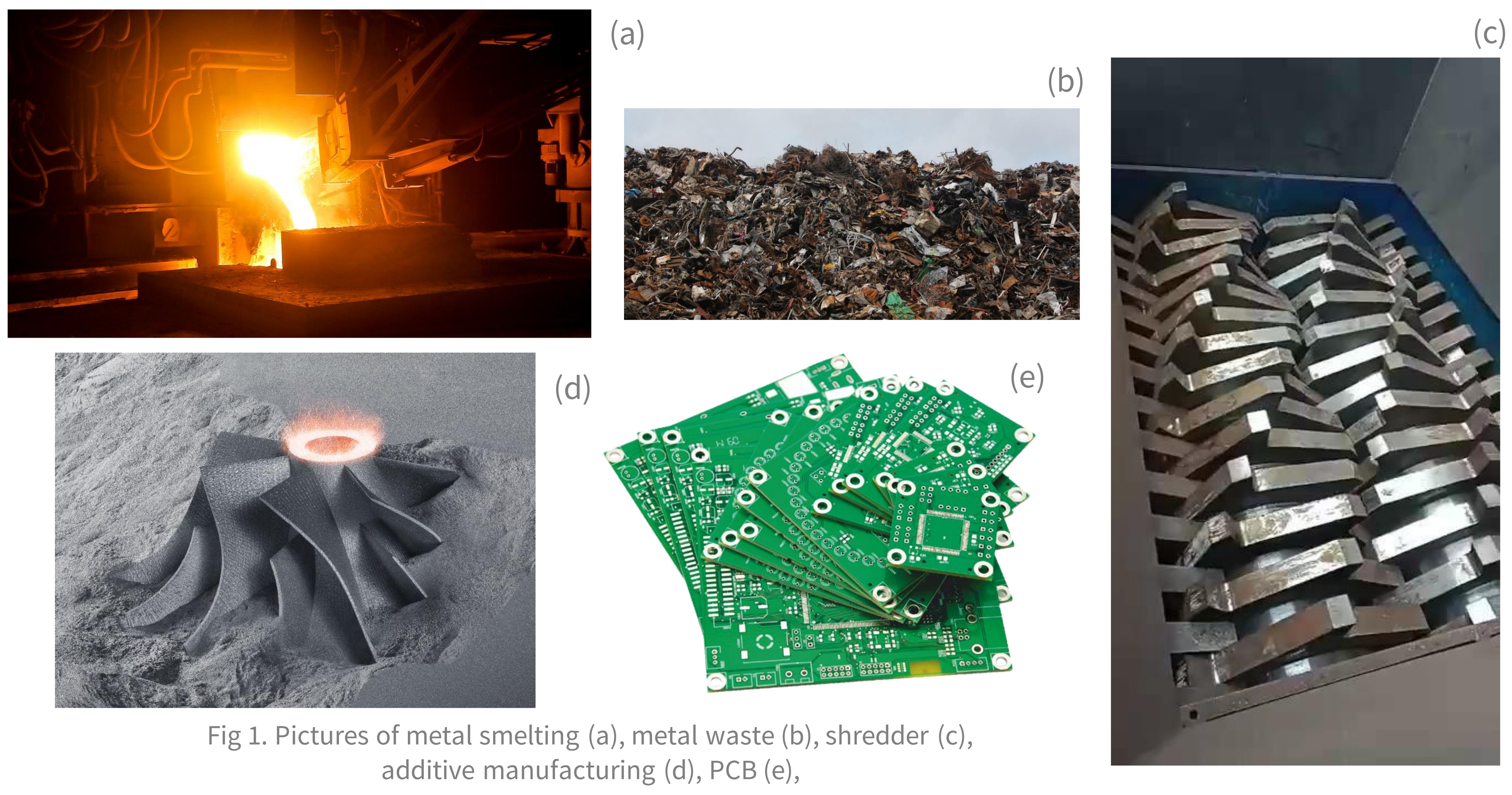

Fig 1. Pictures of metal smelting (a), metal waste (b), shredder (c), additive manufacturing (d), PCB (e),

Methodology

The first step consists of analyzing the literature or data from partners to establish a basic scenario, which will be the **reference scenario** for the study.
Then, data from partners must be collected to assess the impacts of the different stages of the project (current phase of the project).
Finally, once all these steps have been put together to obtain the complete project chain, we can estimate the **total impact of the project**, which can be **compared to the reference scenario**. We will then be able to verify the interest of the project while avoiding transfers of impacts.

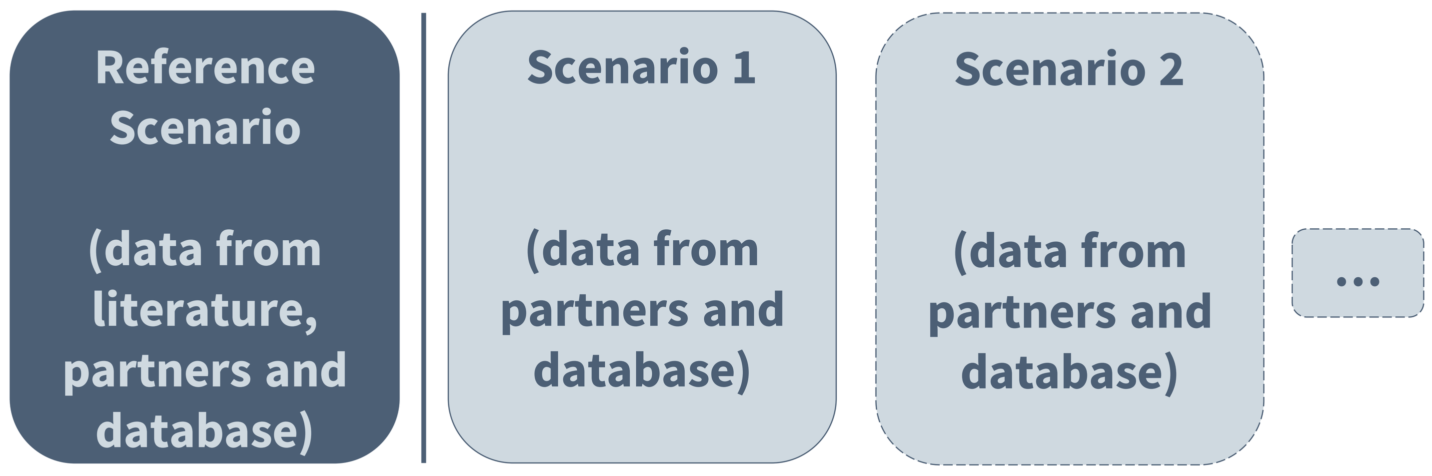

Fig 2. Reference scenario compared to other new scenarios

Objectives

- ✓ Develop a more environmentally friendly metallurgical industry.
- ✓ Become more independent from raw material suppliers by reusing waste (from production and end-of-life products) according to the principle of the circular economy.
- ✓ Evaluate the potential environmental benefits of the projects. Link environmental benefits to economic value which directly depends on the purity of the metal materials obtained (from sorting, recycling or processes).
- ✓ Develop pilot lines and validate them for industrial scale-up.

Goal and Scope

- Relevant Functional Units have been defined for each project.
- LCA inventory:
  - Primary data from industrial partners
  - Secondary data from Ecoinvent 3.9.1[3]
- Software: Simapro 9.5.0.2.
- Method: EF 3.1 impact assessment method (adapted for Simapro).
- Allocation: Economic (if data is available, or mass allocation if not).
- System boundaries: Cradle-to-Gate.
- Compliance with the ISO standards 14040[4] and 14044[5]

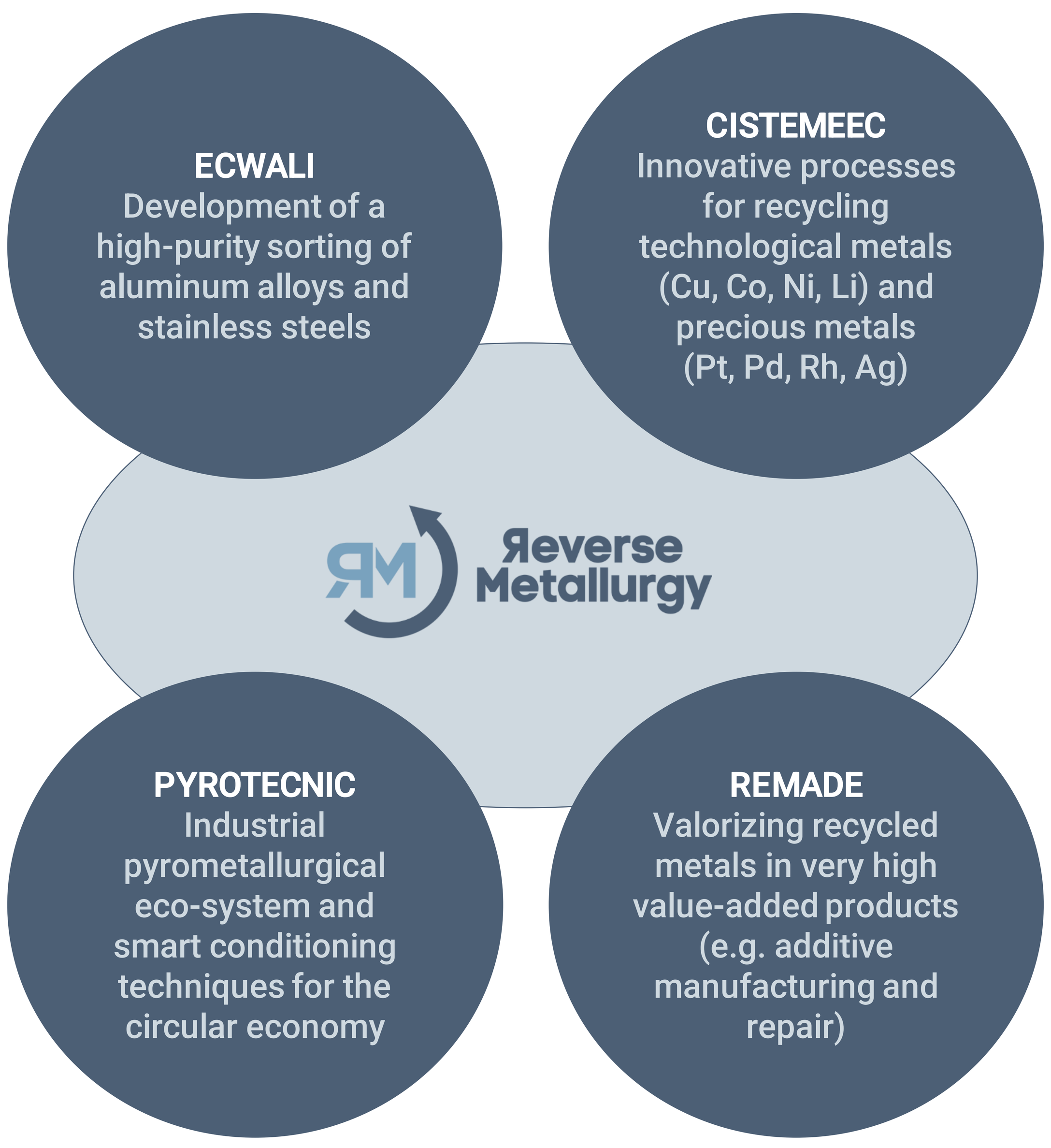

Fig 3. Projects in the "Reverse Metallurgy +" portfolio

State of the art

The RM+ cross-functional projects are a continuation of the RM. They are therefore based on a link already established with most partners, and, in some cases, on pilot lines already in place. The theme of circularity is grouped under 3 axes: Digital, Energy and Materials of the future.

Challenges

1. Bridging stakeholders: This involves bringing together manufacturers, universities, research centers, and institutional stakeholders to foster the emergence of innovations from laboratories to industrial scale.
2. Optimizing the metal value chain: The goal is to coordinate scientific and industrial expertise in the field of metal recycling to optimize the metal value chain and create new economic and scientific value chains.
3. Commitment to the circular economy: Reverse Metallurgy + positions itself as a driver of the circular economy by promoting production, exchange, and sharing in a way that preserves natural capital and limits the waste of raw materials.
4. Developing new technologies and partnerships: It aims to develop new technologies by relying on cutting-edge skills, pilot units in metal recycling, and international networks, while seeking new partnerships to solve industrial challenges and expand its expertise.

Project and Partnership

- ✓ **Duration:** 48 months for each project (July 2022 – June 2026)
- ✓ **Total projects budget**: 100 M€ - Wallonia Region (60%) and EU funding (40%) under the Next Generation EU programme

More info about the project here

✓ **Workplan for LCA**

WP1 - Scoping Study

WP2 – **Life Cycle Inventory**

WP3 - Environmental Impact Analysis

WP4 - Benchmarking

WP5 - Reporting

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PNRR

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