Mineral waste recycling for construction in Wallonia using LCA as an eco-design tool

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4. REMIND, Reverse Mineral Industry in Wallonia – https://remind-wallonia.be/

Context

The **construction** industry is a significant contributor to **environmental pollution**, mainly due to the extraction of natural mineral resources [1]. In Wallonia, Belgium, the need for sustainable development has shifted the industrial interests towards reverse mineral industries. This study focuses on the **selection of local mineral wastes from deconstruction sites** to obtain materials with **equal** or **superior properties** and **minimal environmental impacts**. The study encompasses **5 projects** conducted under the 'REMIND' umbrella (Reverse Mineral Industry) aimed to use **Life Cycle Assessment** (LCA) as a decision-making tool to support **eco-design** and strategic alternative choices associated with targeted construction materials (insulating foam, concrete aggregates, high performance cement, self compacting concrete materials, and alternative binder materials for cements).
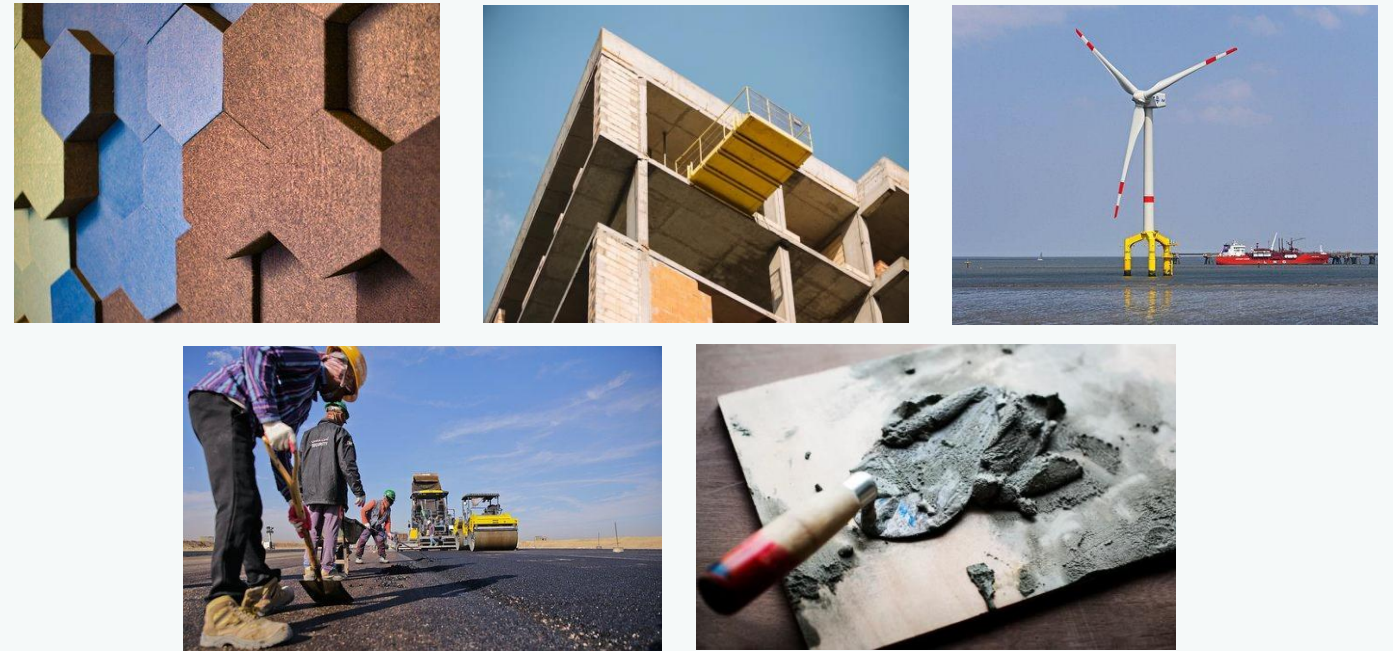

Objectives

This study aims to promote a circular economy in Wallonia → waste recovery & efficient industries

✓ **Identify local mineral wastes** from deconstruction depending on the construction product
✓ **Optimize** materials with respect to specific application constraints and environmental impacts
✓ Identify new resource-saving and energy-saving **technologies** and alternative opportunities
✓ Market:
- **Upscale** approach to identify potential markets
- Offer a range of competitive product **prices**
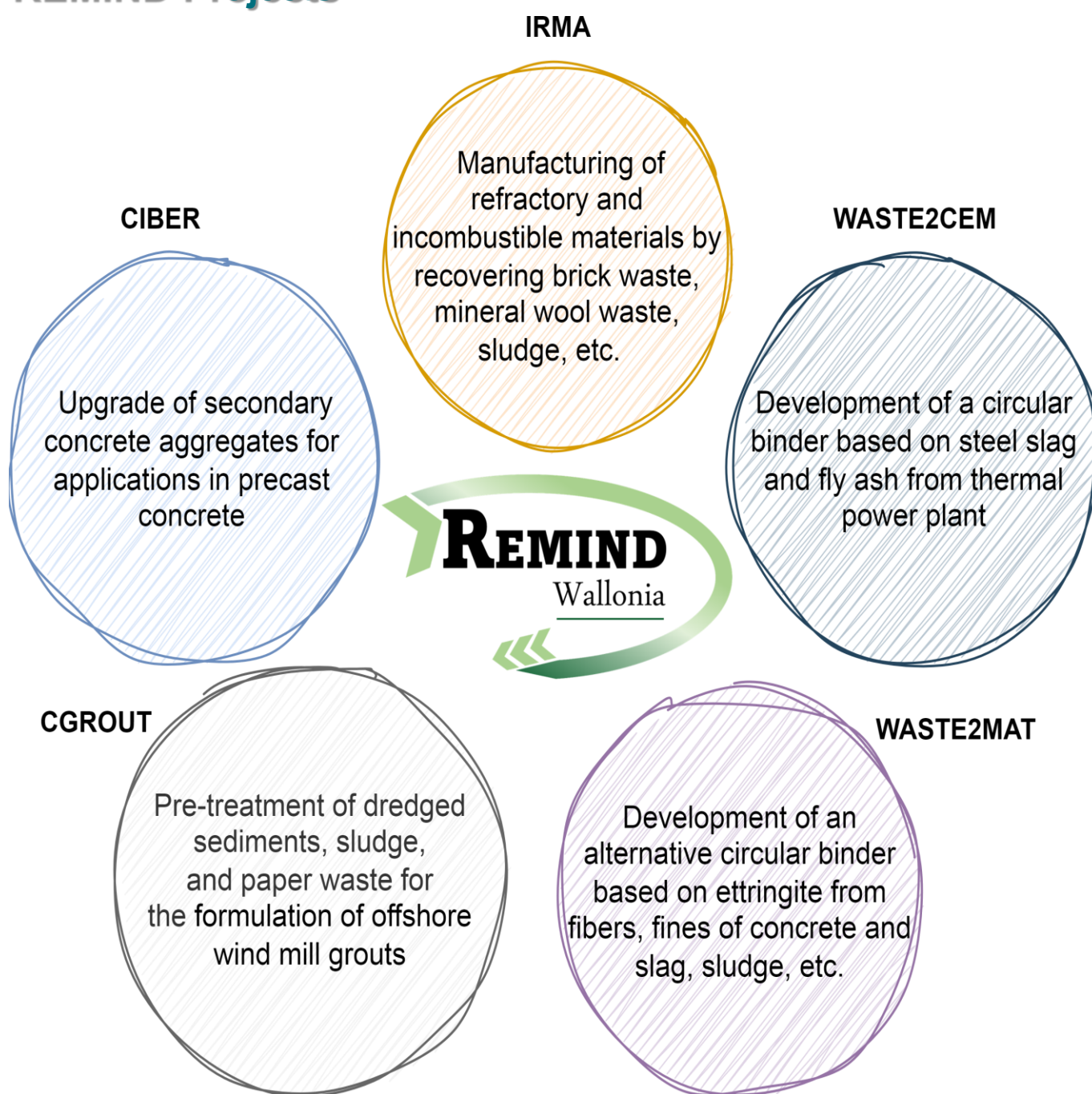- Develop **new sectors** and value chains
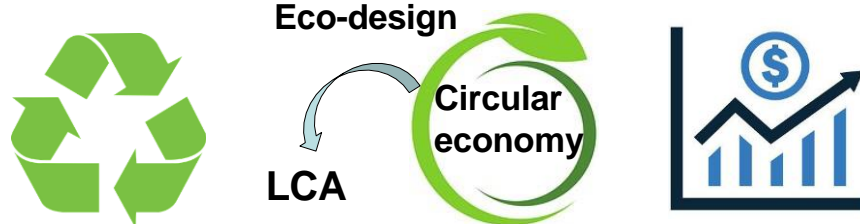
UCLouvain — Eco-selection of materials

PEPs (ULiège) — LCA of elements and systems

CTP — Treatment and recovery of mineral wastes

Industrials Access to raw materials (natural or waste) and industrial know how

REMIND Projects

IRMA
Manufacturing of refractory and incombustible materials by recovering brick waste, mineral wool waste, sludge, etc.

CIBER
Upgrade of secondary concrete aggregates for applications in precast concrete

WASTE2CEM
Development of a circular binder based on steel slag and fly ash from thermal power plant

CGROUT
Pre-treatment of dredged sediments, sludge, and paper waste for the formulation of offshore wind mill grouts

WASTE2MAT
Development of an alternative circular binder based on ettringite from fibers, fines of concrete and slag, sludge, etc.

State of the art (after 6 months) ⇒ in progress

✓ Primary data collection from industrials about raw materials + transport to production site + processing ⇒ *inventory and LCA*
✓ Secondary data from Ecoinvent 3.9
✓ Characterisation: - FU for each system
- System boundaries based on EN 15804+A2 [2]

Material and energy balance of all the processes included in the study
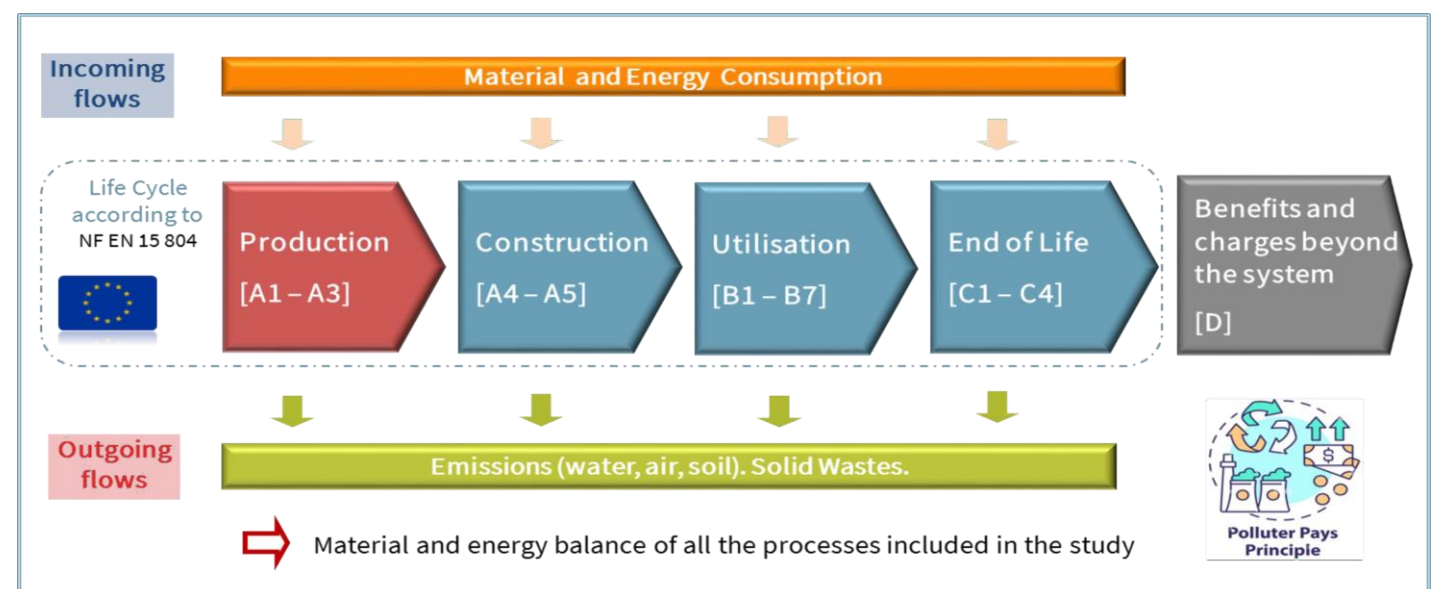
Methodology

✓ **Selection** of local mineral wastes -> compatible with the industrial end products
✓ Case-by-case **characterization** of waste through laboratory analysis to determine physical, chemical and mechanical properties
✓ Evaluate the environmental impacts using **LCA ISO 1440/44:2006** in a **cradle-to-grave** perspective for each scenario (traditional/new process + pre-treatment of wastes) -> ensuring compliance with environmental standards
✓ Material science **optimization** approach to study alternative materials (Ashby) [3]

Projects and Partnerships

✓ **39 months for each project** - started in October 2022
✓ **2 phases**
- Industrial Research → **GO**/NO GO
- If Go -> Experimental Development and Upscaling
✓ ~ **€18.7 million in budget (including €4 million in "pilots")** ⇒ **€11.5 million in subsidies (via the PNRR)**

✓ **Funded by The European Commission and Walloon Region and supported by GreenWin**

Scan me to know more about this project

References
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2 Ioannidou D., Foster. C., Symeonidis A., Muller J., Bourgault G., FitzGerald D., Moreno Ruiz E., (2021). Documentation for the 'Allocation, Cut-off,EN15804' system model, ecoinvent Association, Zurich, Switzerland.
3 Ashby, M.F.. Materials Selection in Mechanical Design. Netherlands, Elsevier Science, 2016. Ashby, Michael F. Materials and the environment: eco-informed material choice. Elsevier, 2012.