Environmental assessment of a building board for circular construction made from recycled materials

de la Reta Pablo [1], Léonard Angélique [1],
1. University of Liège, Chemical Engineering Research Unit – PEPs, Belgium
http://www.chemeng.ulg.be – pdelareta@uliege.be – a.leonard@uliege.be

Introduction

The RECOB² project, part of the Walloon platform REMIND (Reverse Mineral Industry in Wallonia), aims to develop an innovative dry screed panel composed of >70% recycled materials (paper fibers, recycled sand, biomass ash, recycled gypsum).



Figure 1. Three dry screed panel samples with the various formulations tested as part of the RECOB² project

Objectives:

- Evaluate the environmental performance of the RECOB2 panel from cradle to grave
- Compare it with a gypsum fiber, laminated with wood fiber insulation panel (EPD)
- Identify environmental hotspots to guide eco-design
- Support circular economy transition in the construction sector

Material & Method

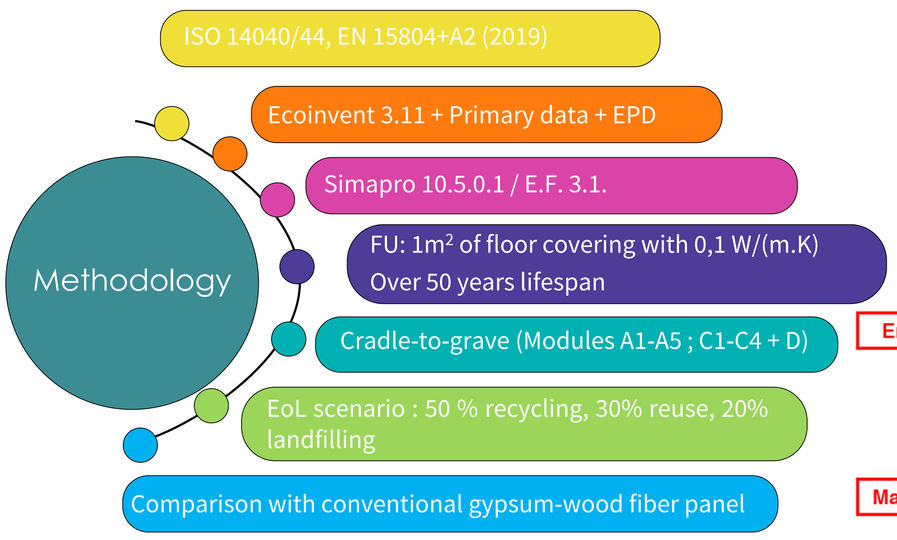




Figure 2. RECOB² dry screed panel ready for installation

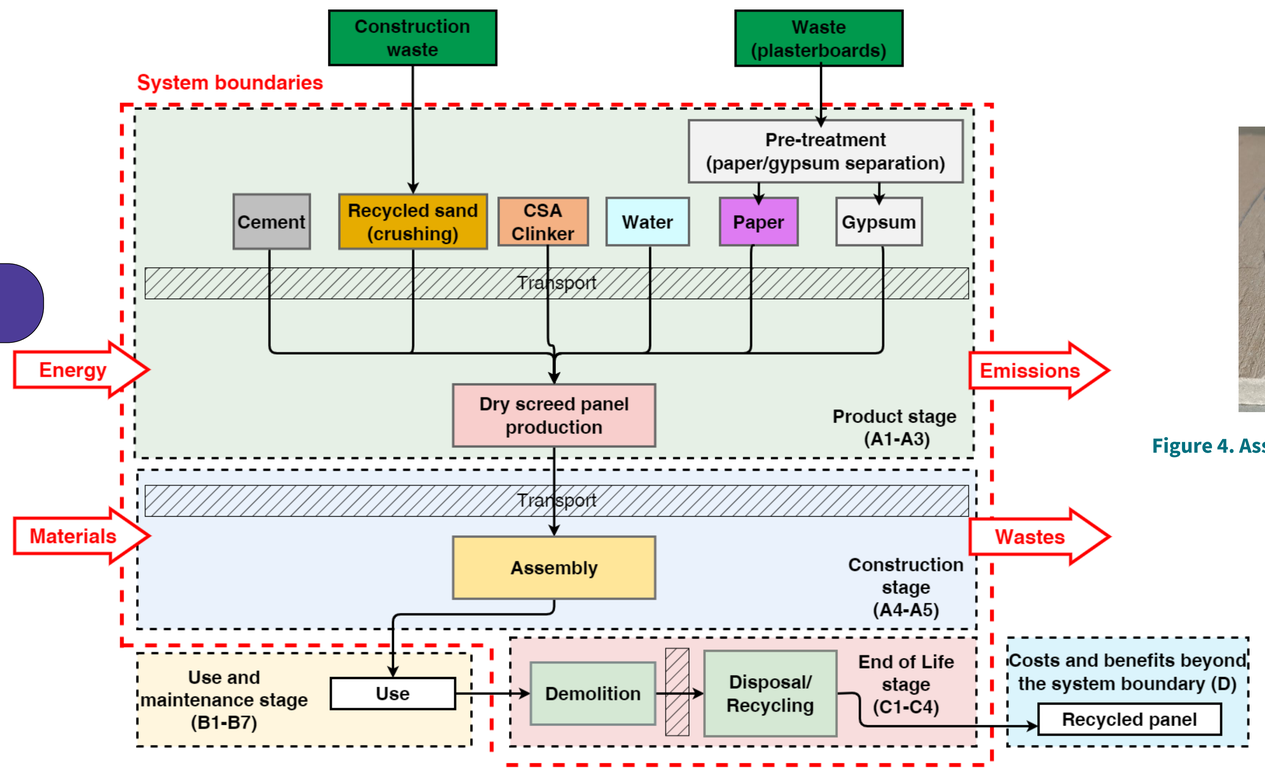


Figure 3. System boundary for the production of 1m² screed panel (RECOB²)



Figure 4. Assembled RECOB² dry screed panel.

Results – Discussion

An LCA was carried out to compare the RECOB² dry screed panel with a commercially available gypsum-wood fiber insulation panel (Figures 5 and 6). A closer examination of the RECOB² panel is provided in Figure 7.

Seven environmental impact categories were selected to compare the impacts of the panel types, namely: Resource use (fossils), climate change, resource use (minerals and metals), ionizing radiation, particulate matter, acidification and photochemical ozone generation.

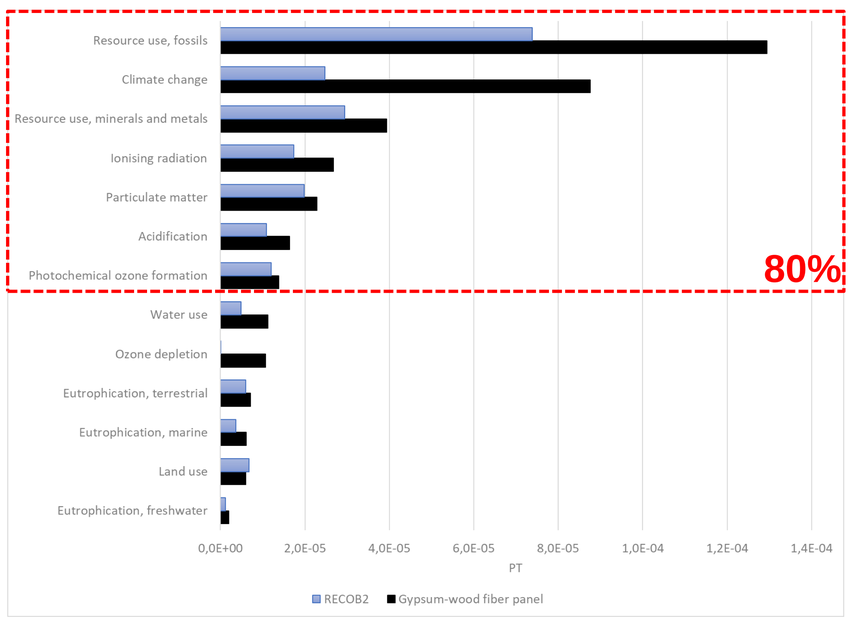


Figure 5. Ponderation results for the comparison between two screed panels : wood fiber vs RECOB²

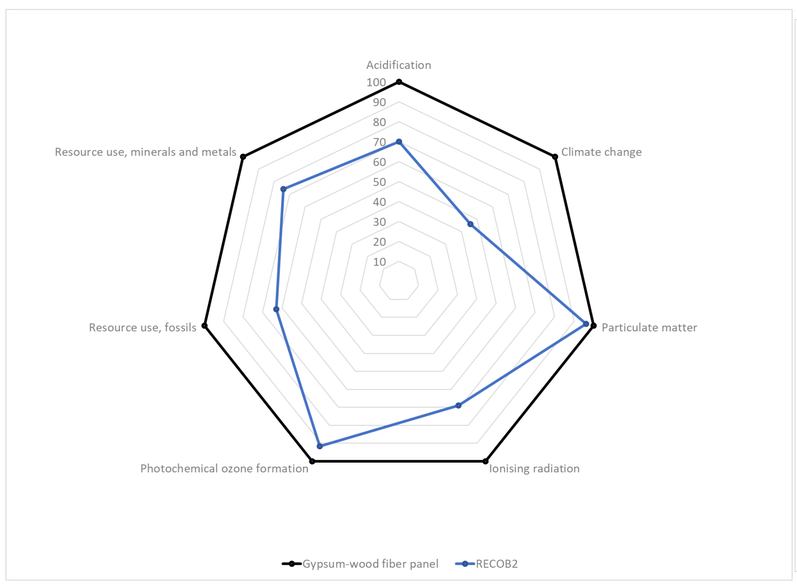


Figure 6. Characterization of the environmental impacts of RECOB² and gypsum-wood-fiber panels. Method : E.F. 3.1.

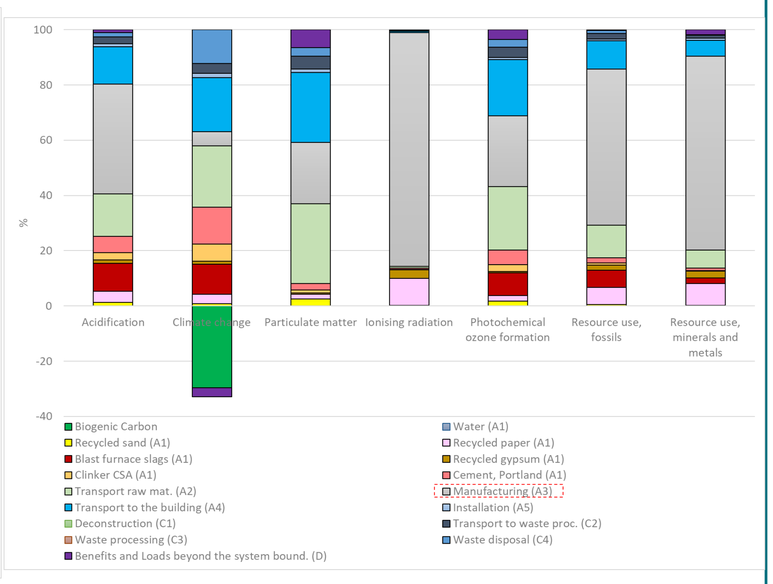


Figure 7. Characterization of the potential environmental impact associated with the production of 1 m² of RECOB² screed panel. Method E.F. 3.1.

Catégorie de dommages	Unité	Gypsum-wood fiber panel	RECOB²
Acidification	mol H+ eq	0,015	0,010
Climate change	kg CO2 eq	3,142	1,442
Particulate matter	disease inc.	1,52E-07	1,46E-07
Ionising radiation	kBq U-235 eq	2,25	1,55
Photochemical ozone formation	kg NMVOC eq	0,012	0,011
Resource use, fossils	MJ	101,031	63,657
Resource use, minerals and metals	kg Sb eq	3,32E-05	2,46E-05

Table 1. Results of the characterisation of the environmental impacts of RECOB² and gypsum-wood-fiber panel. Method : E.F. 3.1.

Main interpretations

Figure 6 shows better environmental performance for the RECOB² panel compared to the gypsum-wood fiber panel.

Module A3 (**manufacturing**) is the dominant hotspot for both panels, mainly due to **Belgium's electricity mix**.

Conclusions

Overall environmental performance is more favorable than conventional reference solutions.

Impact reductions are mainly linked to the substitution of virgin raw materials with resources derived from residual waste streams.

Main hotspot → Module A3 (manufacture) → Electricity consumption

The recovery of gypsum board is also environmentally beneficial compared to landfilling.

This LCA supports the circular economy transition in the building sector by demonstrating the environmental relevance of valorizing waste materials.

References
[1] ISO 2006a. Environmental management – LCA – Principles and framework, ISO 14040. Geneva: International Organization for Standardization
[2] ISO 2006b. Environmental management – LCA – Requirements and guidelines ISO 14044. Geneva: International Organization for Standardization
[3] Ecoinvent, Ecoinvent data v3.12 : 2023 (http://www.ecoinvent.org)

Project and Partnership

- 3,5 years project - started on October 2023
- Total budget: 3,4M€
- Funded by the **Walloon Region** via **Greenwin** calls, this project is part of the REMIND initiative (Reverse Mineral Industry in Wallonia). REMIND is an industrial, technological, and scientific platform that promotes circularity of mineral materials. A special thank to Knauf, who was the project promoter.