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Introduction

A binder is a material that holds materials together, like a glue. In the building sector, binders are utilized for example in wood panels or insulation materials (glass or stone wool to bind mineral fibres together (Figure 1)).

Knauf Insulation developed in 2009 a bio-based binder ECOSE® without added-formaldehyde with a twofold objective:

- **Health aspects**, to maintain indoor air quality by avoiding formaldehyde emissions, as traditional binders are usually based on phenol-formaldehyde or urea-formaldehyde.
- To reduce its **environmental impacts** as ECOSE® is based on renewable materials (plants starch) and is free of petroleum based products.

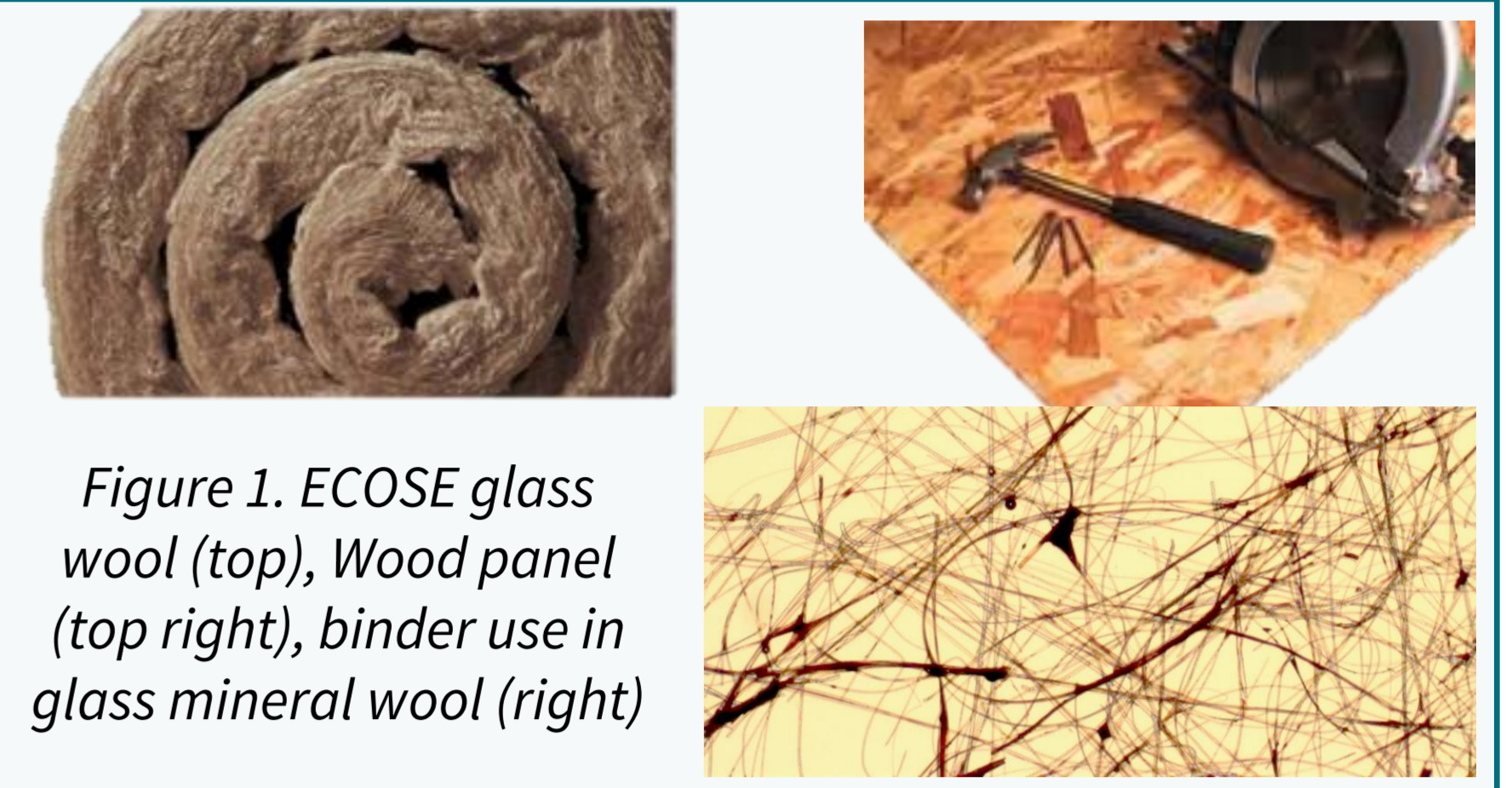


Figure 1. ECOSE glass wool (top), Wood panel (top right), binder use in glass mineral wool (right)

Material & Method

Goals and scope

Assess the environmental impact of bio-based binder production in a Belgian context and obtain robust results using sensitivity and scenarios analysis to compare it with a traditional binder at the application level.

Methods

- LCA methodology: ILCD recommended methods [1]
- Categories choice: normalization + EndPoint + recommendation
- Ecoinvent: without long term emissions (as they are not included in GaBi)

The functional unit is the production of 1 kg of dry binder.

Results - Discussion

Background data

The preliminary study underlines the quite large contribution of the agricultural process to ECOSE® production. What is the influence of the background data for the agricultural steps? Comparison between three cases:

- Use of local data for agriculture and GaBi database for background data
- Use of local data for agriculture and Ecoinvent for background data
- Use of Ecoinvent for agricultural steps.

The local data are Belgian data provided by CRA-W [2]

Figures 2 underlines:

- Large differences when local data or European Ecoinvent data are used
- Differences can also be induced by background data (Ecoinvent vs GaBi) (ADP, marine eutrophication, etc.)

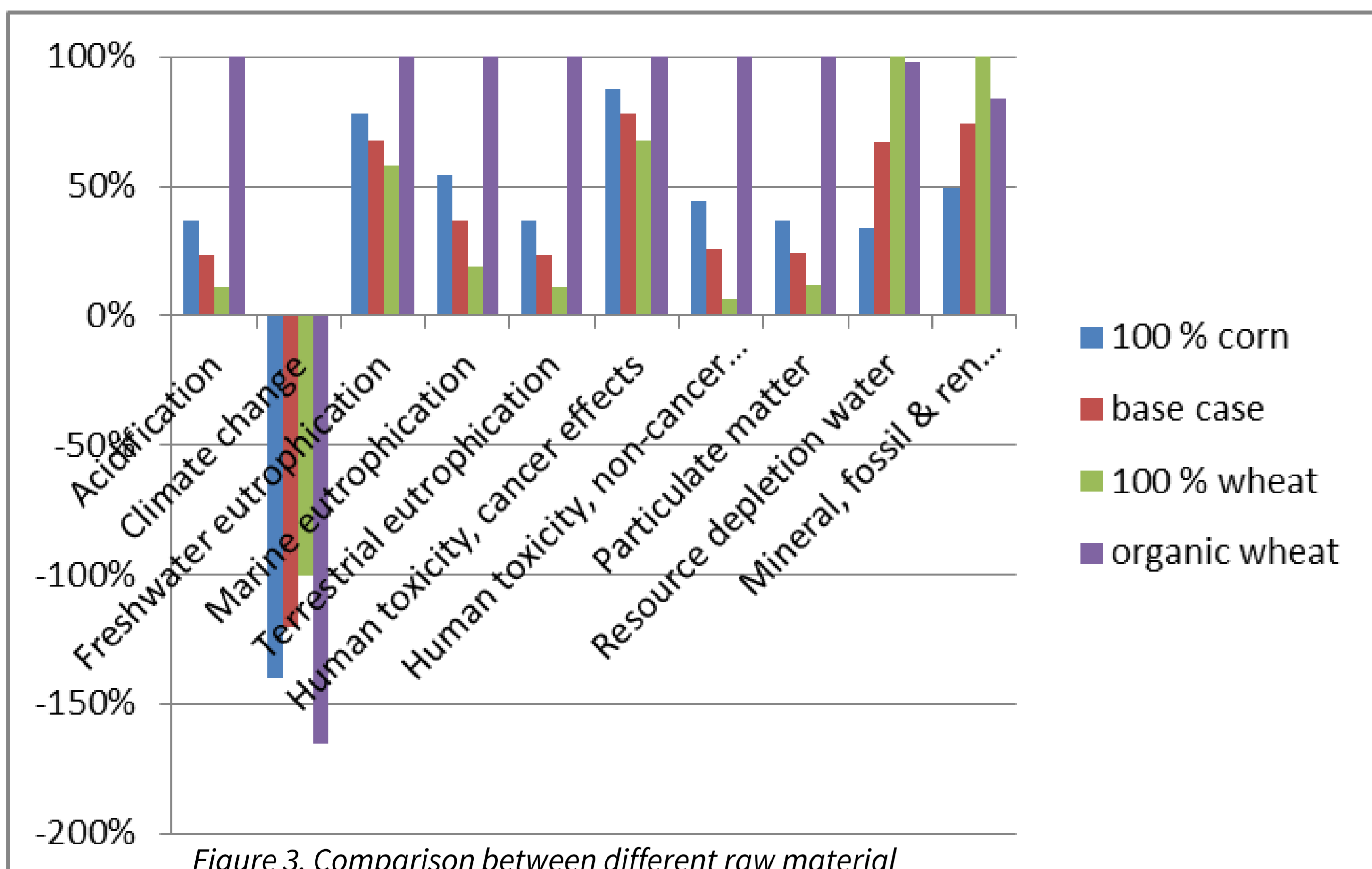
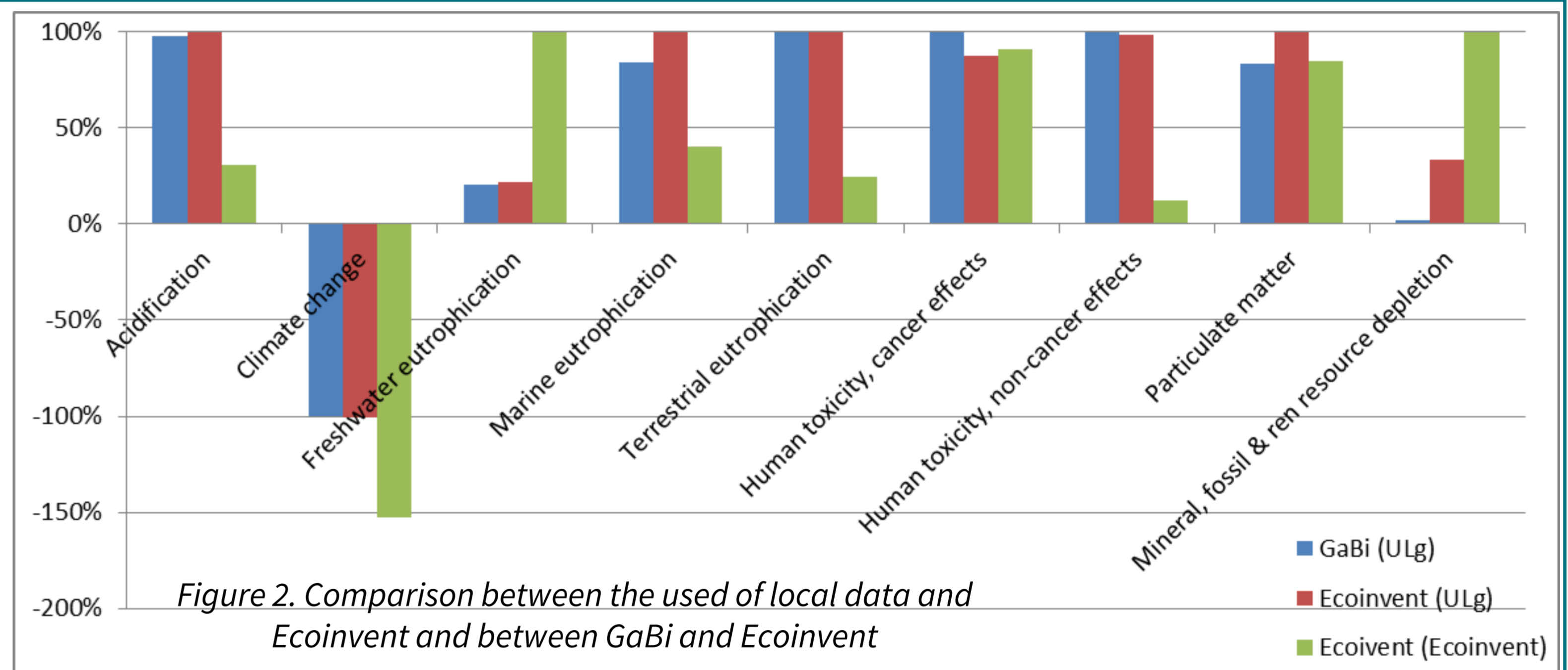


Figure 3. Comparison between different raw material

Allocation

The main component of ECOSE® come with several co-products.

Base case: only the consumptions related to the desired product included (without allocation).

Three allocation procedures are tested and a worst case scenario (no allocations considered but the energy need for the drying of the co-product is also included (as it will be the case if no detailed data are available))

Figure 4 underlines that the differences stay low because the impact is mostly related to the agricultural steps (no allocation on raw material).

Raw material

The main component of ECOSE is produced from plant starch. This starch can be produced from wheat or corn. The base case is a production from a mix of wheat and corn). Scenarios analysis :

- Production from wheat
- Production from corn
- Production from organic wheat

Figure 3 underlines:

- Production from organic wheat is generally worst (in Belgium, traditional wheat has a far greater yield, and for organic wheat large amounts of organic fertilizers are needed, meaning large field emissions)
- Production from traditional wheat is generally more environmental friendly because more fertilizers are used in maize production

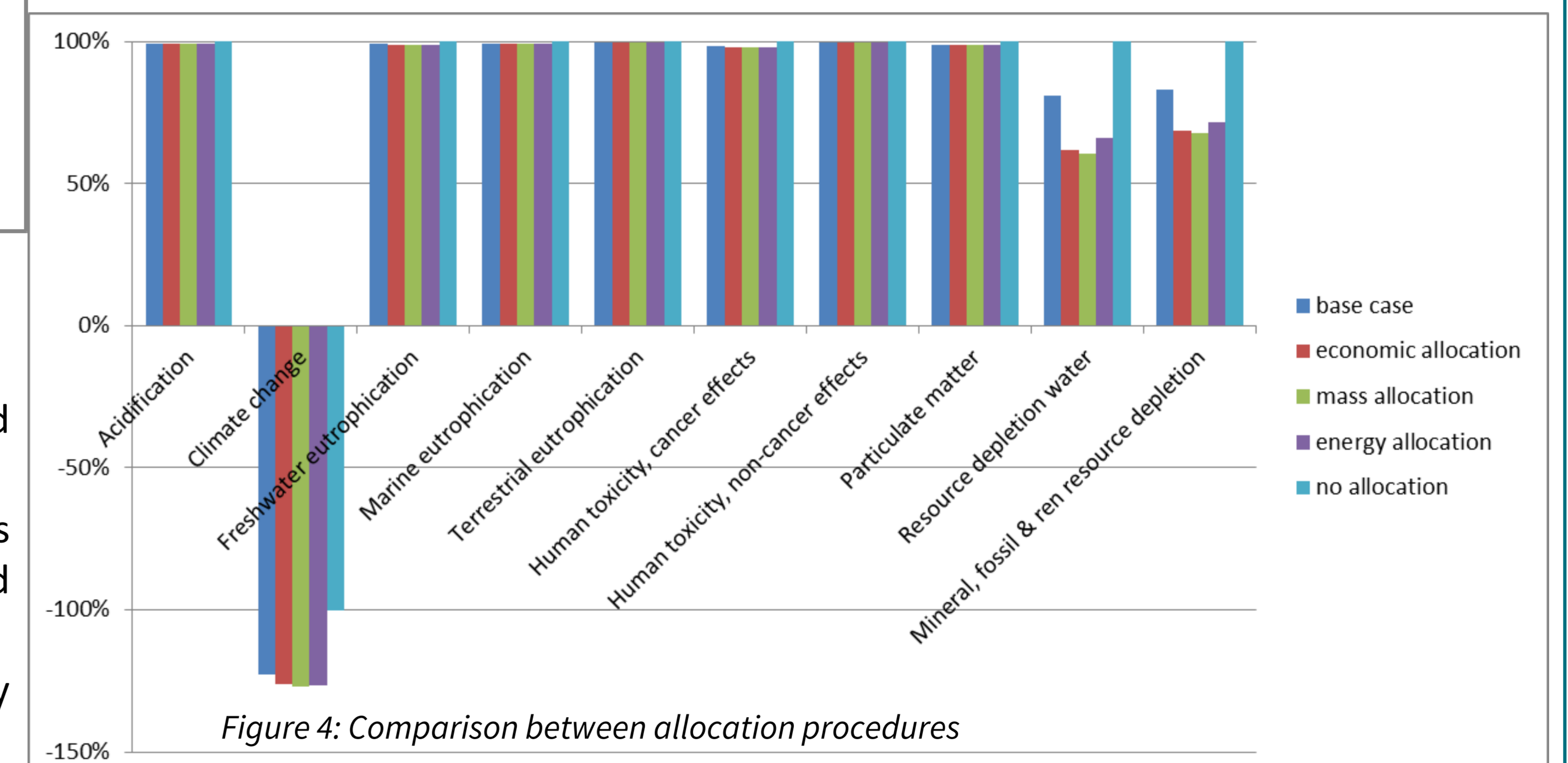


Figure 4: Comparison between allocation procedures

Conclusions

- Agricultural products: the use of specific data could really improve the results
- Influence on background data (impact of the database used)
- Influence of the raw material used in starch production for ECOSE®

References

- [1] European Commission - Joint Research Centre and Institute for Environment and Sustainability, International Reference Life Cycle Data System (ILCD) Handbook- Recommendations for Life Cycle Impact Assessment in the European context. 2011
- [2] Walloon Agricultural Research Centre (CRA-W), ALT4CER project. 2014.

These analyses will allow comparison between ECOSE and traditional binders. This comparison should be realized at the application level (glass wool, wood panel, etc.) because the implementation of the binder can be different. Besides, the comparison between binders is only relevant when the change of binder does not change intrinsic product properties.