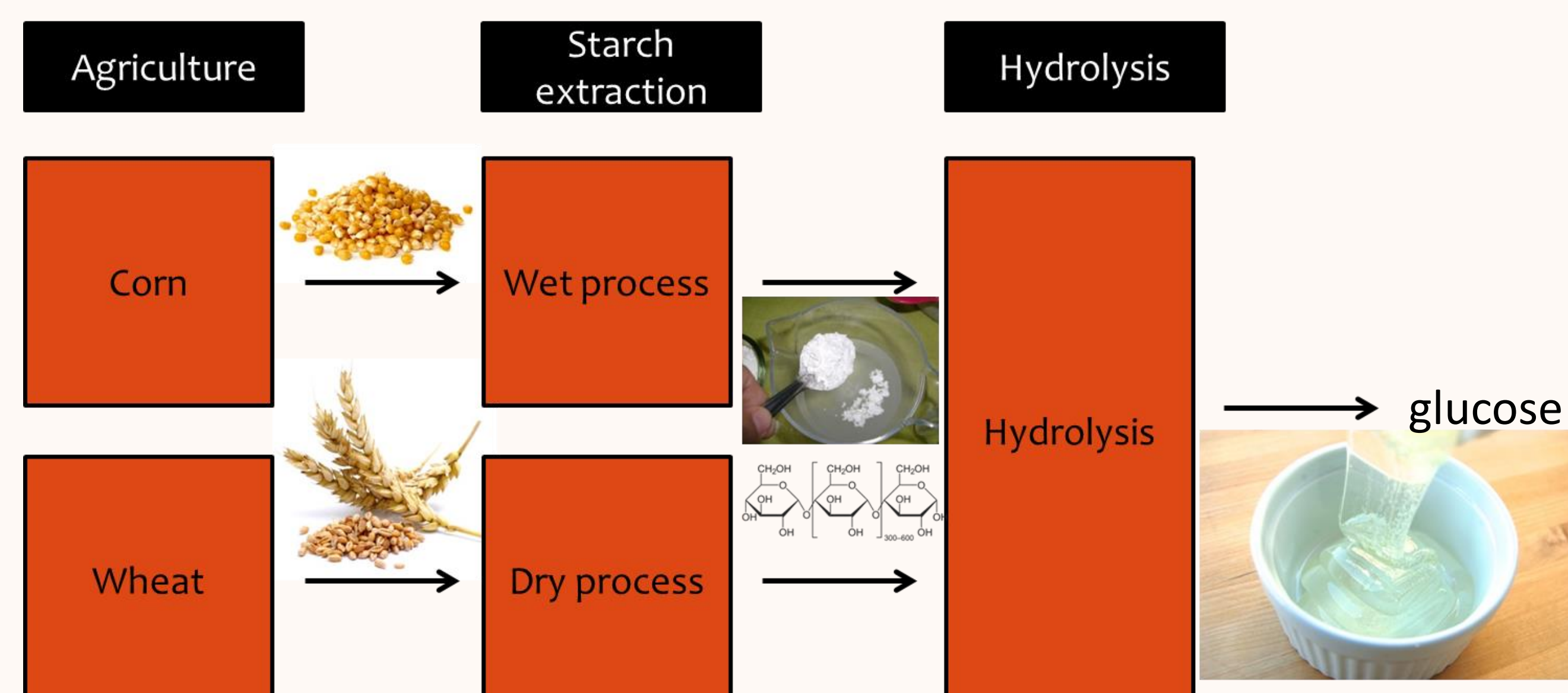


Glucose production: influence of the datasets choice on LCA results

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Introduction



Glucose is an interesting material

- Several applications (food and industry, i.e. binder production)
- Produced from renewable materials (corn and wheat)

➔ better understanding of its environmental impact: LCA

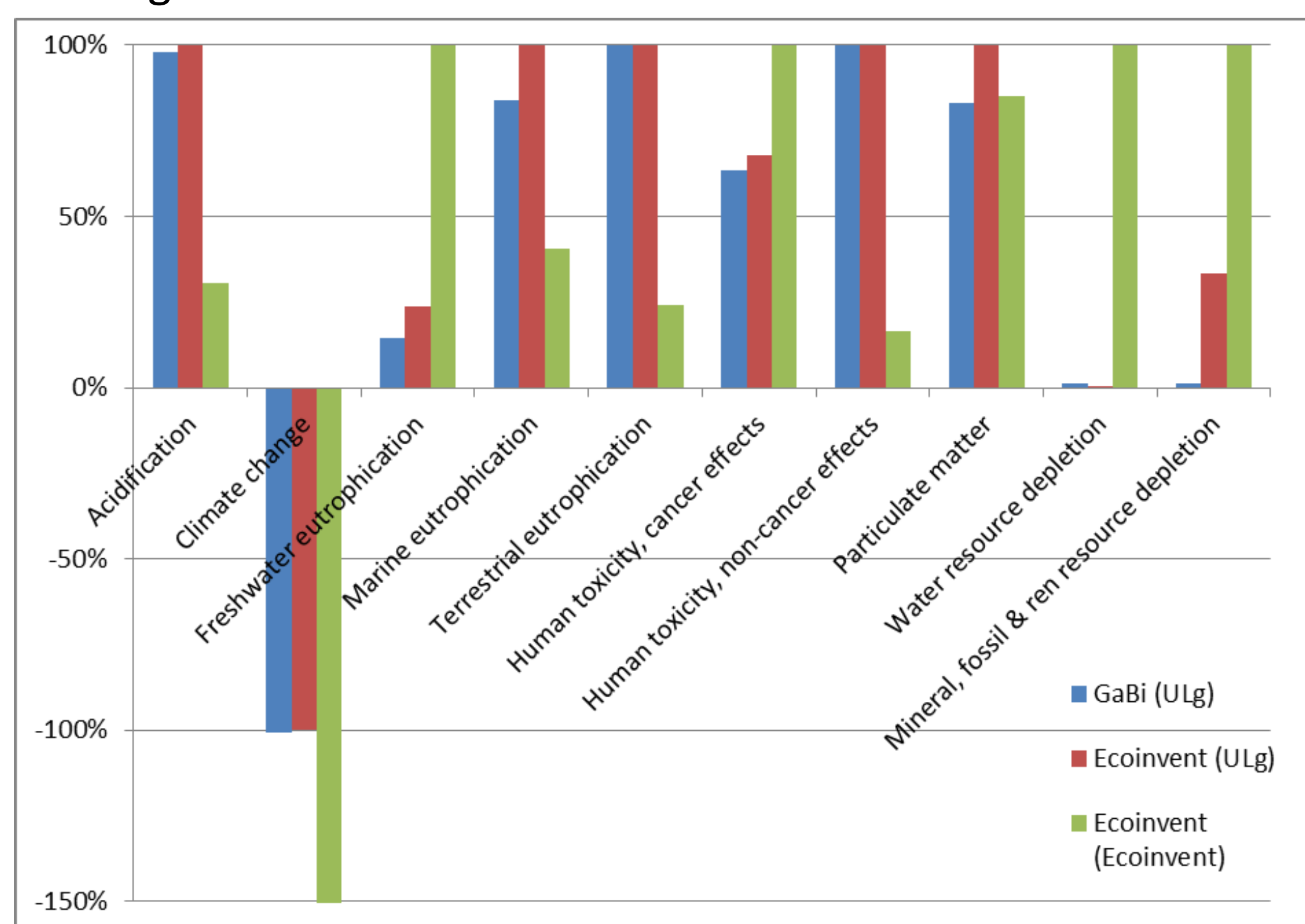
However, LCA of agricultural products have high uncertainties. To increase our results robustness : LCA in three cases and comparison of the results:

- Agricultural data from Belgian practices with GaBi datasets
- Agricultural data from Belgian practices with Ecoinvent datasets
- Agricultural and datasets from Ecoinvent

Data: Agriculture: Belgian practices[1] (with adaptation to available datasets) or Ecoinvent starch extraction and the hydrolyses: literature or industry: same in the 3 cases

Material & Method

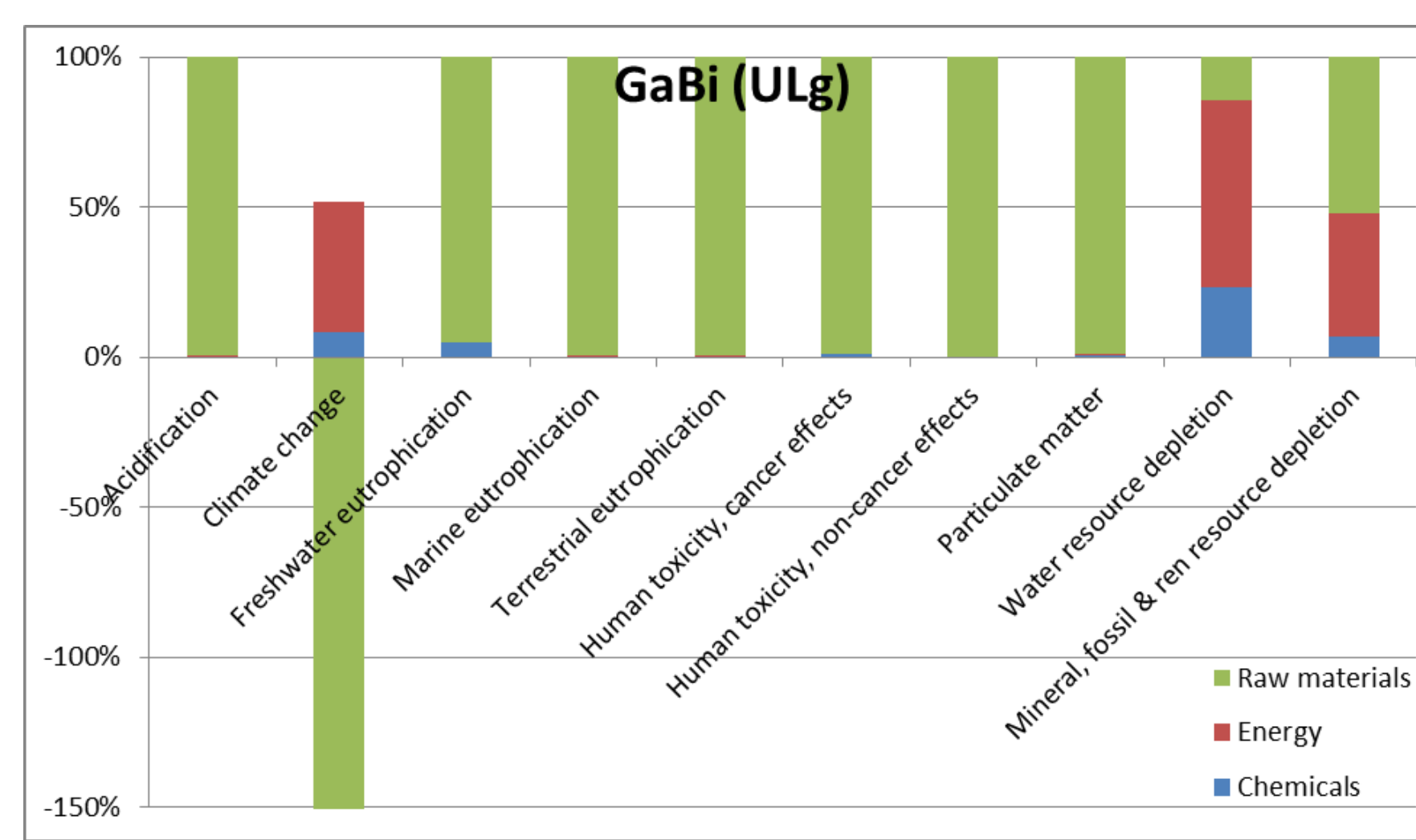
- LCA methodology: ILCD recommended methods [2]
- Categories: normalization + EndPoint + recommendation



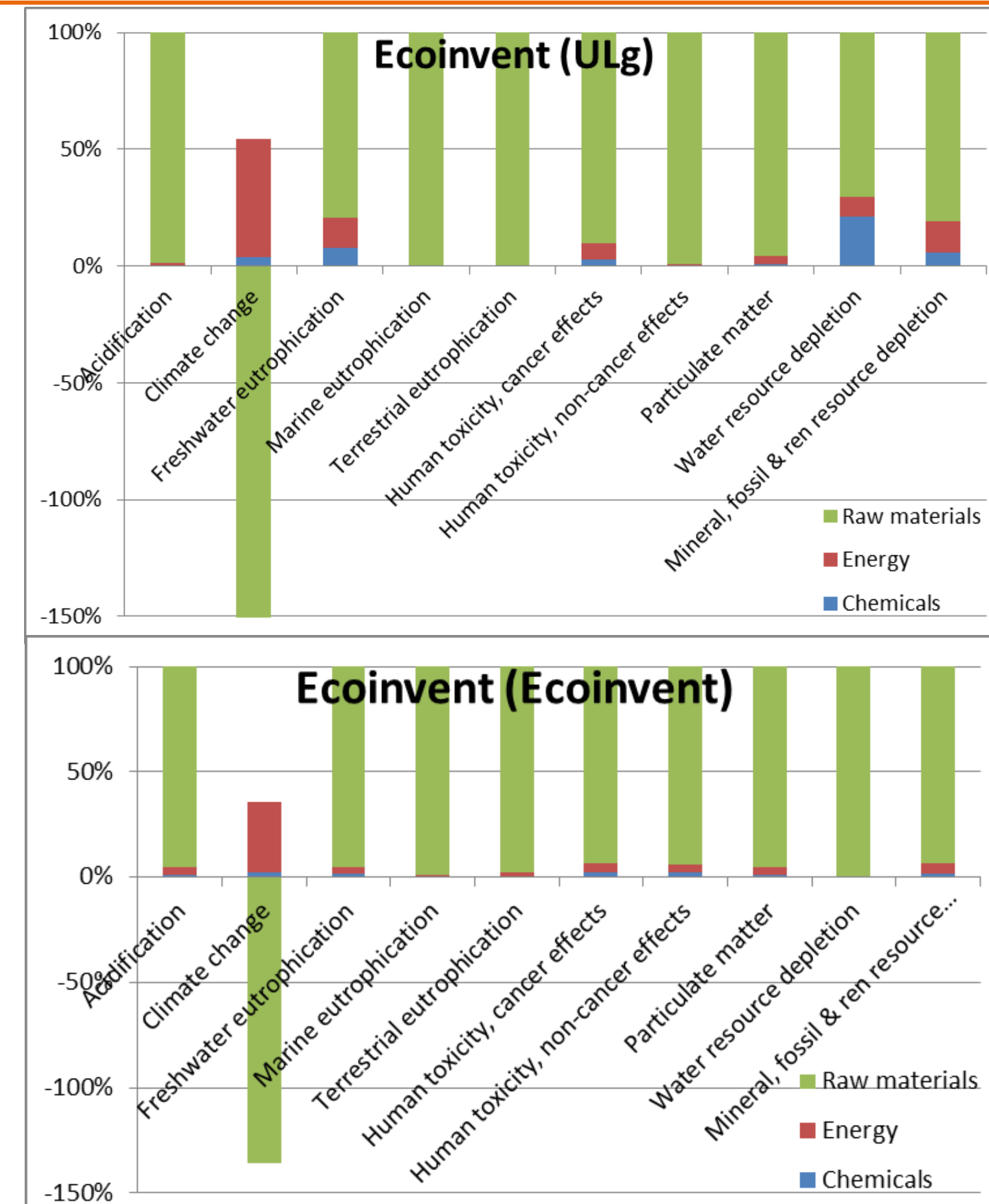
When same data are used for agriculture (GaBi (ULg) and Ecoinvent (ULg)): the results are similar except for

- Freshwater eutrophication
- Water depletion
- Resources depletion

When Ecoinvent datasets are used for agriculture: higher differences



Large contribution of agriculture part



Differences between GaBi and Ecoinvent when ULg data are used for agricultural phase

Impact categories	Unit	GaBi			Simapro		
		chemicals	energy	Crops	chemicals	energy	Crops
Freshwater eutrophication	kg P eq	6.63E-3	2.36E-4	1.27E-1	1.65E-2	2.89E-2	1.74E-1
Water resource depletion	kg m3	1.04	2.80	6.61E-1	2.34E-1	9.54E-2	7.84E-1
Mineral, fossil & ren resource depletion	kg Sb eq	9.77E-5	5.72E-4	7.24E-4	2.07E-3	5.05E-3	2.99E-2

Agriculture: Differences related to fertilizers

- Freshwater Eutrophication: 1 ha of wheat, fertilizer contribution:
 - GaBi: 0.002151 kg P-eq
 - Ecoinvent: 0.141 kg P-eq
- Resources depletion: 1 ha of wheat, fertilizers contribution:
 - GaBi: 0.00129 kg Sb-eq
 - Ecoinvent: 0.0589 kg Sb-eq
- Calcium ammonium nitrate = main fertilizer

Calcium ammonium nitrate	Unit	GaBi	Ecoinvent	GaBi	Ecoinvent
Freshwater eutrophication	kg P eq	1.81E-06	2.41E-04	0%	2%
Mineral, fossil & ren resource depletion	kg Sb eq	8.14E-07	9.14E-05	1%	100%

- Freshwater eutrophication related to phosphate emissions in water: Emissions in Gabi are 10000 smaller. Sources of the emissions in Ecoinvent:
 - Factory
 - Nitric acid < Ammonia liquid < ammonia reforming < factory
- Resources depletion
 - In Ecoinvent : 388 µg indium: 64 % of the impact (factory)
 - GaBi: No indium consumption

Energy (Belgium mix: average 2009 - 2013)

- Freshwater eutrophication: difference coming from natural gas: 1 ton of glucose
 - GaBi: 1.1 E-4 kg P-eq
 - Ecoinvent: 2 E-2 kg P-eq

- Difference coming from natural gas

For 1 MJ: GaBi: 1000 smaller.

Why these differences??

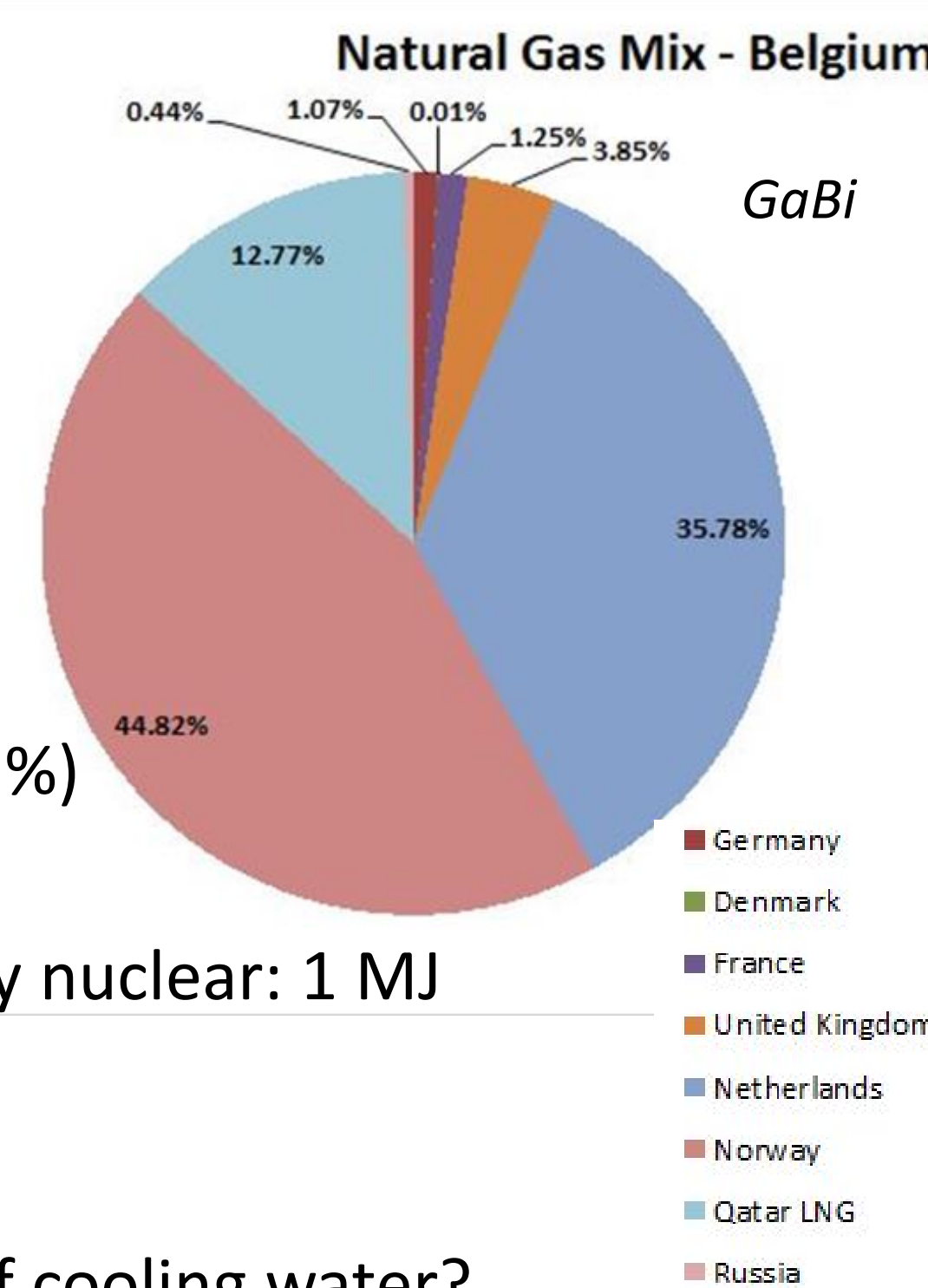
- Origin of the gas:
 - GaBi (closer to market reality)
 - Ecoinvent: DE (2 %), NL (51 %) and NO (48 %)
- Allocation? Difference in system boundaries?

- Water depletion: coming from electricity, especially nuclear: 1 MJ

- GaBi: 5 E-3 m³
- Ecoinvent: 2 E-4 m³

Why these difference? Difference in modeling of cooling water?

Note: In fossil depletion (ReCiPe) and climate change, energy obtains similar scores in the two softwares)



Conclusions

A change in the used database, even among the most used ones, can have an large influence the results. Especially on agricultural processes, even when the practises are modelled similarly by the users in the two databases. For example, the infrastructure could have large contribution. The differences are even larger when the generic database for agricultural process are compared with countries specific data. Comparison of agricultural products between each others, but also with fossil-based product should be realized with high caution. Moreover, some differences are difficult to explain, even with a detailed analysis.

References

[1] Walloon Agricultural Research Centre (CRA-W), ALT4CER project. 2014.

[2] 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.