How the Use of Different Databases Affects the Comparability of Life Cycle Assessment Results of Fibre Reinforced Polymer Composites

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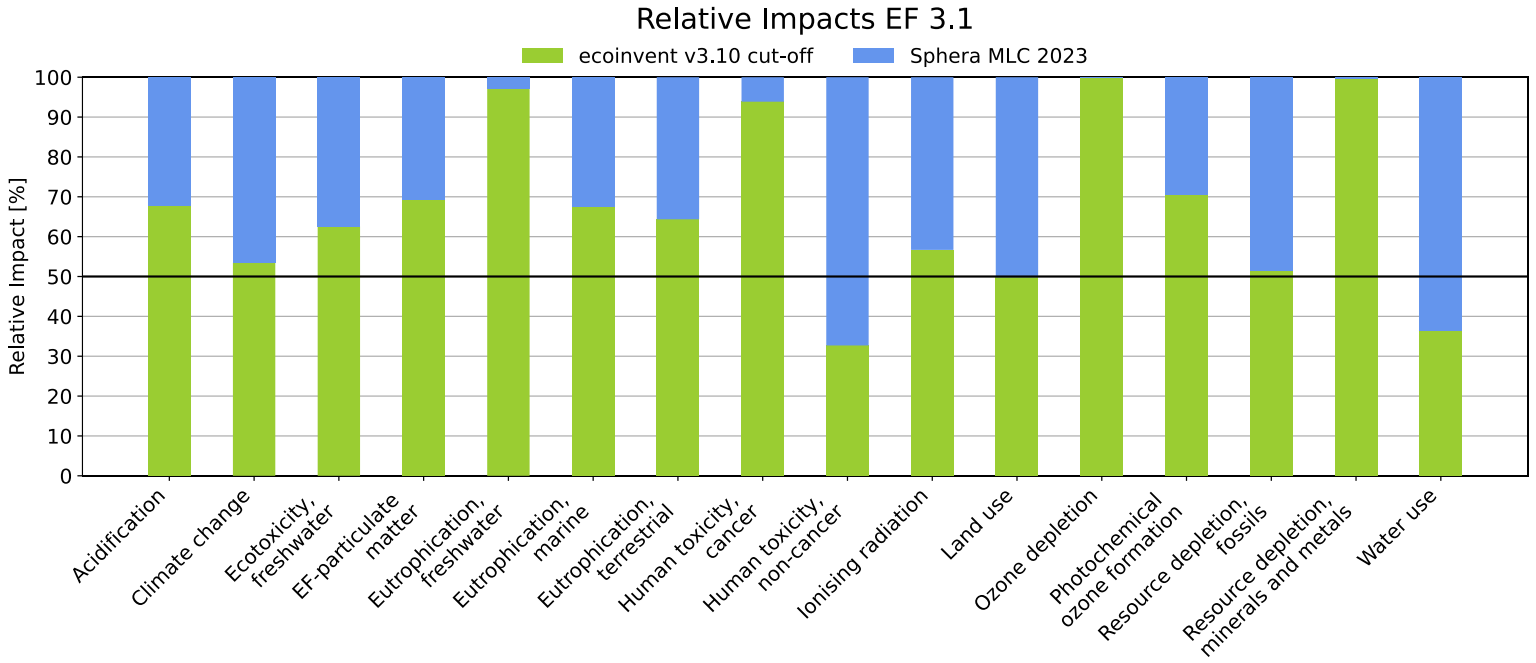
Introduction

Hypothesis

The choice of the background database(s) affects the LCA results of Glass Fibre Reinforced Polymers (GFRP)

Results

- In 13 out of the 16 categories the model with ecoinvent has higher environmental impacts
- In 12 out of the 16 categories the deviation from the 50% line is > 10%
- Smallest difference: Land Use (Δ < 1%)
- Biggest difference: Ozone Depletion (Δ > 99%)



Conclusion

Take Home Message:

LCAs with same goal and scope, functional unit and system boundaries unit **should not** be compared when the database(s) behind them differ.

See you at the poster board!

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HOW THE USE OF DIFFERENT DATABASES AFFECTS THE COMPARABILITY OF LIFE CYCLE ASSESSMENT RESULTS OF FIBRE REINFORCED POLYMER COMPOSITES

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Many individual decisions have to be made while conducting a Life Cycle Assessment (LCA). This applies in particular to the first two phases (Goal and Scope and Life Cycle Inventory [LCI]), in which the foundation of the analysis is laid. This work presents how the choice of selected databases affects the result of a glass fibre reinforced polymer composite (GFRP) within the same goal and scope, functional unit and system boundaries. Using these results e.g. for Environmental Footprint Declarations (EPDs) shows the importance to look into the differences based on different databases.

Background Databases – the backbone of LCA models.

In the Global LCA Data Access Network more than 20 LCA databases/data providers are listed. They differ in a lot of characteristics like:

- Unit process vs. Aggregated process
- Attributional vs. Consequential approach
- Commercial vs. Free
- Location coverage
- Reference year
- Number of datasets
- Sector
- Data origin

All of these characteristics are important to address in the process of choosing the database(s) to be used.

In this work **Ecoinvent (EI)** and **Sphera Managed LCA Content (MLC)** have been chosen. These two databases are the ones with the maximum datasets (~20,000) and they include background data for a generic GFRP model:

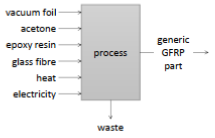

Fig. 1: Simplified aggregated model of producing a generic GFRP part.

The generic model is based on a cradle to gate approach. As impact method Environmental Footprint (EF) 3.1 with its 16 impact categories is used. While the model with EI is built in Brightway2 the model with the Sphera MLC is built in Sphera itself.

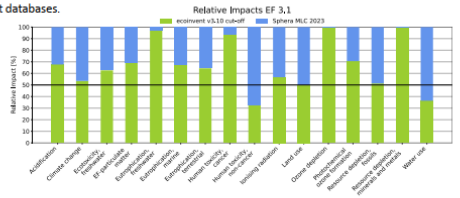

Fig. 2: Relative Impacts of the generic GFRP part using Sphera (blue) and EI (green) in the 16 categories of the Environmental Footprint (EF) 3.1 whereas 100 % is defined as the sum of the individual results of both models.

Unveiling the influence of the databases on the results.

- In 13 out of the 16 categories the model with EI has higher impacts
- In 12 out of the 16 categories the deviation from the 50 % line is > 10 %
- Smallest difference: Land Use (Δ < 1 %)
- Biggest difference: Ozone Depletion (Δ > 99 %)

Knowing that the category 'Climate Change' is the most popular and therefore the most shown and compared one, it is worth taking a closer look at the relative impacts of the individual flows:

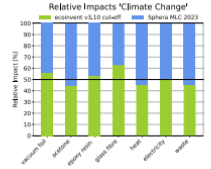

Fig. 3: Relative Impacts of the different flows in the category 'Climate Change' whereas 100 % is defined as the sum of the individual results of both models.

In addition to the steps of the classification and characterisation the results were normalized and weighted with the original EF 3.1 factors to look into the differences regarding the single scores:

Fig. 4: Single Scores of the generic GFRP part for the models with different datatbases.

Another important point to address in this context is the possibility of mixing databases. *What if the model would use the glass fibre from EI and the resin of Sphera?* It can help in filling data gaps in LCI but there will be also uncertainties that need to be looked at.

Take Home Message:

With knowledge about the differences in the data and results, it is clear that even LCAs with the same functional unit should not be compared when the database(s) behind them differ, esp. without looking into the details of the data origin.

Get in touch!

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