Use of Life Cycle Assessment to support in the Eco-Design of a glass-wool process

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The Life Cycle Analysis (LCA) methodology has been used to study glass wool production by Knauf Insulation in order to publish Environmental Product Declarations (EPD) and to initiate eco-design programs. The LCA methodology evaluates and quantifies the environmental impacts for every stage of a product's life. The ISO 14040 and 14044 norms [1, 2] provide the general guidance for performing an LCA. The process has been modelled in GaBi v5 [3] with industrial data. The studied materials are produced by Knauf Insulation, and are manufactured in 2 factories, one in France and one in Belgium.

In this study, the impact on climate change has been study with more accuracy. The production step is the most impactful in this latter category. A detailed study (see figure 1) underlines the importance of the natural gas production and combustion. The extraction and transport or raw materials for the wool also have a significant impact. Nine other impact categories, with the ReCiPe methodology [4], have also been considered (see figure 2). A comparison between two production plants underlines the importance of waste generation.

Some process improvements have been studied in details. In the first scenario, less waste is generated. It allows a reduction of the climate change by 3% when the entire life cycle is considered. The impact on other environmental impact categories is also determined using ReCiPe methodology. Reducing the waste production is useful for all impact categories and more in the impact categories where the influence of raw material is higher (climate change, fossil depletion, particulate matter formation and terrestrial acidification). In the second scenario, a change in the energy mix for the electricity production is assumed: the French mix is totally replaced by photovoltaics. If the entire life cycle is considered, the climate change is reduced by 6 %. Nevertheless, when other impacts categories are considered, the results are dependent of the category. The impact categories where the decrease is highest are ionising radiation (95 %) and ozone depletion (96 %). Whereas, in some categories, the impacts become higher such as for terrestrial ecotoxicity (211 %) and metal depletion (567 %). The European normalisation underlines that the use of photovoltaic allows an impact reduction in the 3 categories with the highest impact.

In conclusion, the LCA is a powerful tool for eco-design because it allows a better understanding of the environmental impact and help to prevent impact transfers from an impact category to another or between life cycle steps. Moreover, the LCA quantifies environmental performances which is useful for communication.

References:

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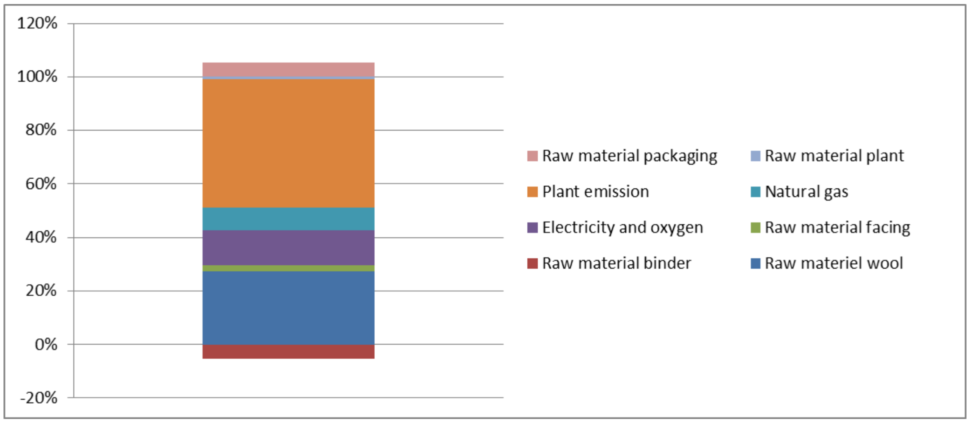

Figure 1: Climate change for the production step

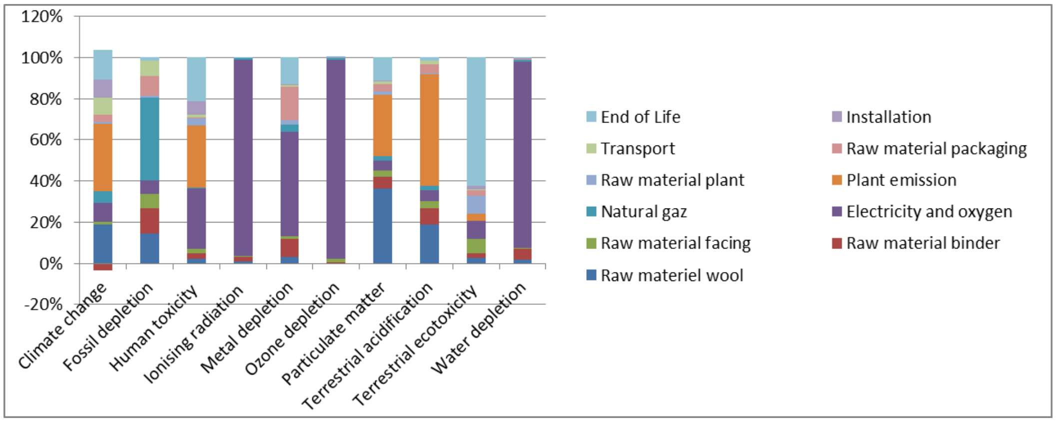

Figure 2: ReCiPe - characterisation in relative percentage