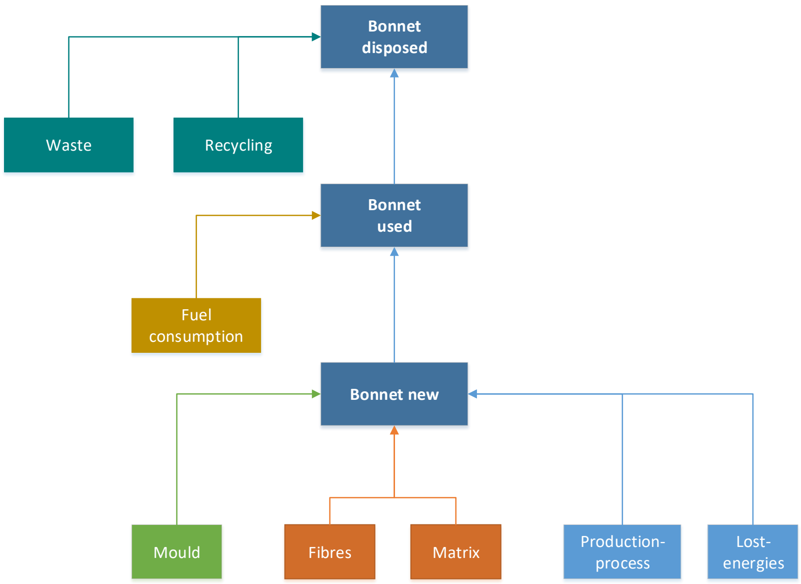
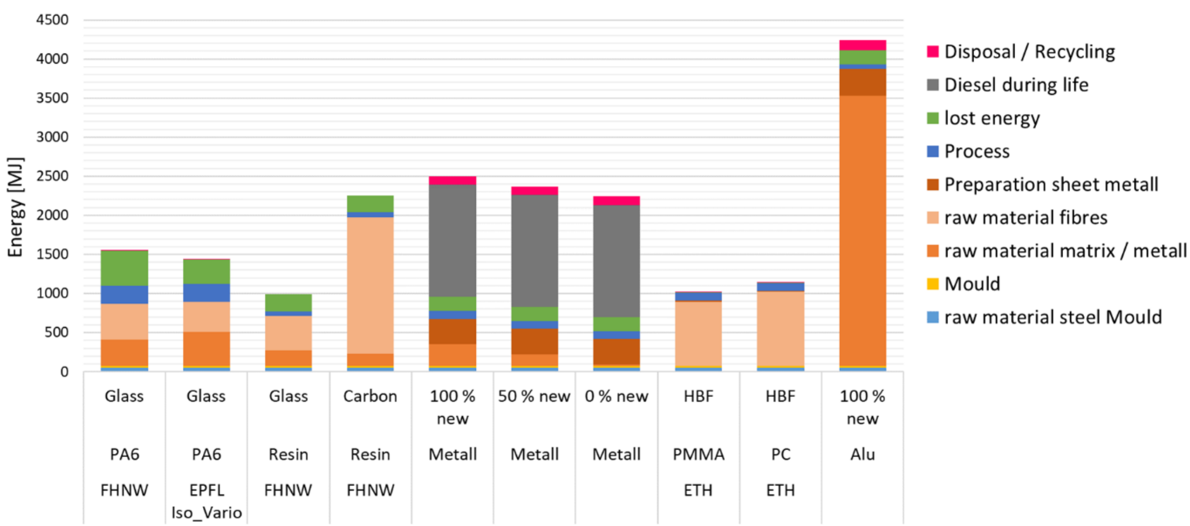
Capacity Area A3 Topic 1.3 Deliverable 2

Report of life cycle and cost performance of processes

To evaluate the potential of the three newly developed thermoplastic production processes compression resin transfer molding (RTM at FHNW), in-plane RTM with flow channels (EPFL) and bicomponent fibers (BCF at ETH Zurich) a life cycle analysis was done. These three processes were compared with the conventional production of a metallic bonnet.



So far the results looks promising: The production of a plastic bonnet needs more energy as the one made of metal, but with the reduction of weight, the amount of used fuel is smaller. This results that the plastic bonnet has a better energy balance after about 100'000 driven kilometers. For the complete life cycle assessment (LCA), the used resources and the impact on human health, ecosystem quality and the climate change are analyzed. In the end, a sensitivity analysis (which is not yet done) should be carried out to analyze the part with the biggest optimization potential.



The approach of activity-based cost analysis has been used to evaluate the materials and processing costs generated by the manufacturing of a part, with similar dimensions as a car bonnet (flat panel with dimensions of 150*160*0,3 cm), with the studied technology at industrial scale. The total cost as well as the different expense items were calculated as a function of the number of parts produced. Moreover, different impregnation strategies (single injection inlet, double injection inlets and peripheral injection) and temperatures (240°C, 260°C and 280°C) were studied to assess the impact on the injection time and final cost.

The model showed that for high volume productions the main expense items were found as the material costs and labor. The results showed (for a 300 000 parts production, as a reference) that going from a single injection point to a peripheral injection set up, the injection time is reduced by 84% and the price by 40% or 47% depending on the production temperature. The injection method also affects the expense items' ranking and the labor cost is reduced by almost 50% when choosing a peripheral injection (at the expense of the material cost share). An increase in the injection temperature would reduce the injection time by 30% and 50% going from 240°C to 260 or 240 to 280°C respectively, whatever is the injection method. The temperature also influences the price of the part and the last calculations are carried out at the moment. Finally, moving from the "worst" scenario (single injection at 240°C) to the "best" one (peripheral injection at 280°C) the injection time is reduced by 92% (price comparison to be reported soon).