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Framework for the assessment of sustainability profile of lightweight solutions within the automotive field

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The automotive sector is currently facing intense regulatory demands to enhance the sustainability profile of new vehicles. Within this evolving framework, a great effort is currently devoted to the introduction of a series of innovations targeted at reducing the environmental impact of cars Life Cycle (LC), among which lightweight design is one of the most effective. This study develops a customized framework to assess the potential of lightweighting in reducing the environmental effects caused by passenger road transportation. More specifically, the work relies on Life Cycle Assessment (LCA) modelling of use phase, and it makes available a model able to evaluate the influence of mass reduction for a wide range of applications (in terms of propulsion technology, car size, and electricity grid mix) and for the Life Cycle Impact Assessment (LCIA) categories most relevant within the automotive field. The main advantage of such an approach lies in capability of estimating the use-phase effects via readily applicable indicators with strongly reduced need for data collection, thus resulting in a considerable saving in both time and personnel involvement. The utility of the refined framework is finally demonstrated through the application to a real-life case study, the re-design of a C-segment car roof which provides the investigation of different lightweight alternatives both in terms of materials and manufacturing processes.

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