The impact of material choice in vehicle design on life cycle greenhouse gas emissions

Roland Geyer, Bren School of Environmental Science and Management, University of California, Santa Barbara, CA

There is broad scientific consensus that reducing greenhouse gas (GHG) emissions should be one of the main efforts in addressing anthropogenic climate change. In the USA and many other countries, a significant amount of GHG emissions comes from the transportation sector, in particular from the use of vehicles with internal combustion engines. Since contribution analysis shows that between 80% and 90% of a vehicle's life cycle GHG emissions occur in the use phase, reduction efforts naturally focus on improving fuel economy. However, it does not follow that there is no need to adopt a life cycle perspective to ensure that policy or management decisions yield net emission reductions. A well-known case is the displacement of traditional steel with aluminum to reduce vehicle weight and thus use phase emissions. This presentation reports renewed modeling efforts based on a critical review of previous studies and ongoing efforts to collect up-to-date data. It emerges that life cycle assessments of this issue still suffer from data uncertainties, whose significance is demonstrated through sensitivity and scenario analyses. More importantly, however, studying the GHG impact of material choice in vehicle design clearly shows the limitations of attributional LCA. Consequential analysis is required to ensure the choice of appropriate inventory data and resolve allocation issues. The analysis presented here supports the view that consequential LCA is more scientific than attributional LCA, but also burdened with all the additional uncertainties of predicting the behavior of complex systems.

Contact: geyer@bren.ucsb.edu, (805) 983 7234 Tel, (805) 893 6113 Fax