Modeling Commercial Transport in LCA

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Like electricity generation, transport of goods is a part of most, if not all, LCAs. Select LCA studies conclude that transport can be an important component of LCA results and that energy consumption and emissions vary greatly as a function of assumptions for transportation mode, distances traveled, backhaul, cargo-payload, and travel conditions. Despite these findings, little guidance was found on how to model commercial transportation in LCA. Given the potential importance to all LCA results, a discussion of methods, assumptions, and issues of commercial transport modeling in LCA will be presented.

Our work defines two categories of commercial transportation models in LCA:

1. **Proportional transport models**: transport process inputs and outputs are estimated as proportional to the transport process reference flow (i.e., inventory is proportional to "kg-km" or "km transported").
2. **Parametric transport models**: transport process inputs and outputs are estimated as a parametric function of the transport process reference flow.

Essentially, proportional transportation models are developed from the results of parametric models to apply to a class of vehicles (the results are "binned"). Classes can capture vehicle mode, size, cargo type, fuel, operating conditions and location: a light duty petrol truck for hauling liquids traveling in a city in Switzerland is different from a heavy-heavy duty diesel truck carrying solid cargo traveling on a highway in the US. Matrix or input-out based LCA computational structures use proportional unit process models and LCA databases present data in classes. Beyond emissions, select sources include models for equipment construction, maintenance, and disposal.

Based on these definitions, we investigate modeling and data issues for water, rail, and road transport. We describe methods and data for the estimation of transport distances (including co-location rules for industrial processes) and variation in backhaul assumptions as a starting place to understand the contribution of transport on LCA results and related uncertainties.