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CORRECTION

Correction to: On the calculation of fuel savings through lightweight design in automotive life cycle assessments

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In the 2010 volume 15 page 128–135 article "On the calculation of fuel savings through lightweight design in automotive life cycle assessments" (Koffler and Rohde-Brandenburger 2010) in the International Journal of Life Cycle Assessment, the following statement can be found regarding reductions in fuel consumption due to mass savings on a component level if power train adaptations are to be accounted for:

"The one information that cannot be deduced is the relative fuel saving compared to the status quo in percent, as this would employ the division by zero [comment by the authors: zero since the original design doesn't experience any change in mass]. It can therefore not be calculated meaningfully for single components based on the underlying assumptions concerning functional equality and power train adaptation."

Since then, this position has been adopted by the Canadian Standards Association's "Guidelines for conducting LCA of auto parts incorporating weight changes due to material composition, manufacturing technology, or part geometry" (CSA 2014) and the journal article has been referenced widely by other papers on automotive lightweighting.

However, the statement is not correct as-is and requires revision. This letter therefore serves to correct the notion that percentage reductions cannot be meaningfully calculated in these cases.

Since the FRV is a linear factor, the percentage reduction in fuel economy will equal the percentage mass reduction if no powertrain adaptation takes place, so a 10% weight reduction will decrease the mass-induced fuel consumption of the part by 10% correspondingly based on the fuel reduction value without power train adaptation of 0.15 l/100 kg × 100 km reported by (Koffler and Rohde-Brandenburger 2010) for gasoline engines (see Fig. 1).

Nevertheless, the additional fuel savings can still be shown if calculated as the difference between the FRVs including and excluding power train adaptation, i.e., (0.35–0.15) l/100 kg × 100 km, times the mass difference, which is 10 kg in the example. As can be seen from Fig. 1, the net percentage fuel savings between the original component and the lightweight design then increase from − 10% (without power train adaptation) to − 23% (with power train adaptation).

With this, the above cited statement from the 2010 article becomes obsolete. The authors recommend using the calculation procedure exemplified in Fig. 1 to calculate the percentage fuel savings on a component level that account for additional power train adaptations.

The online version of the original article can be found at https://doi.org/10.1007/s11367-009-0127-z

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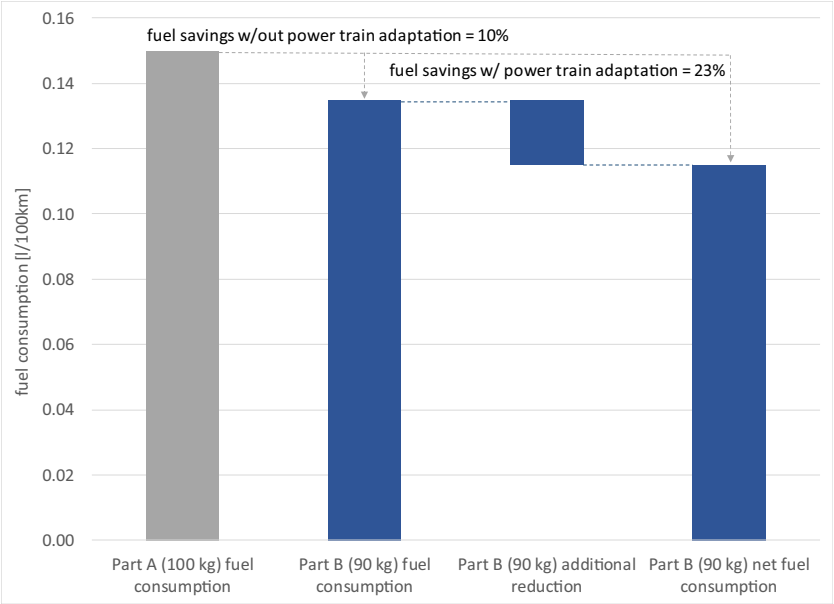

Fig. 1 Mass-induced fuel consumption and additional fuel savings through drive train adaptation