

FACT SHEET: IMPACT OF LIFE CYCLE EMISSIONS WHEN LIGHTWEIGHTING WITH ADVANCED HIGH-STRENGTH STEEL VS. ALUMINUM

The Steel Recycling Institute (SRI), a business unit of the American Iron and Steel Institute (AISI), recently completed a study of the impact of lightweighting on greenhouse gas (GHG) emissions and energy consumption. The purpose of this study was to evaluate the full life cycle of a vehicle instead of focusing only on tailpipe emissions. The results clearly show focusing on tailpipe only emissions may lead to the unintended consequences of higher GHG emissions over the life cycle of a vehicle. In light of the fact that alternate lightweighting materials cost significantly more to the consumer than lightweighting with steel, a tailpipe only focus will mean more costly vehicles that do not improve the overall environment. The results of this scientific, ISO conformant study demonstrate that the Administration should reconsider the fuel economy/GHG standard based on the full trade-offs associated with forcing aggressive lightweighting as a compliance approach.

AHSS: The Highest Value Solution for Automakers and Consumers

Lightweighting with advanced high-strength steel (AHSS) improves a vehicle's overall environmental impact. Current fuel economy and GHG emissions regulations focus only on the driving phase. However, a study released by the Steel Recycling Institute (SRI) concludes this exclusive driving phase focus can actually result in higher GHG emissions. This increase comes primarily from the difference between the material production phase emissions of AHSS and aluminum.

A Sound Environmental Choice

SRI has released a peer-reviewed, ISO-conformant study comparing vehicle life cycle emissions lightweighted by AHSS and aluminum. This study shows AHSS-intensive vehicles have lower or equivalent total GHG emissions compared to aluminum-intensive vehicles. This result was true for every class of vehicle tested – sedans, trucks, SUVs and alternative powertrain vehicles.

- The use of aluminum instead of AHSS to lightweight the vehicle body structure and closures results in a significant increase in materials production GHG emissions in all cases.
- AHSS-intensive vehicles were shown to have lower life cycle GHG emissions vs. aluminum-intensive vehicles in over 90 percent of the 5,000 cases studied for each vehicle type.
- The dramatic increase in production emissions for vehicles lightweighted with aluminum over AHSS is not offset by emission reduction benefits during the use phase until at least the end of the vehicle's useful lifetime, and in several cases they are never offset.
- In some cases, the aluminum vehicles had higher life cycle GHG emissions than even the original (pre-lightweighted) baseline vehicles. In these cases, when focusing only on GHG emissions, it would be better to not lightweight at all than to lightweight with aluminum.
- The study was peer reviewed by a panel of experts from Harvard, MIT, Argonne National Laboratory and thinkstep. Their review insures the most up-to-date data was used as input to a previously peer-reviewed life cycle model created by the University of California Santa Barbara. The successful completion of this review makes the study ISO conformant.

Tailpipe-Focused Regulations Risk Environmental Costs

As tailpipe GHG emissions decrease to meet regulations, production emissions become more significant to a vehicle's life cycle GHG profile.

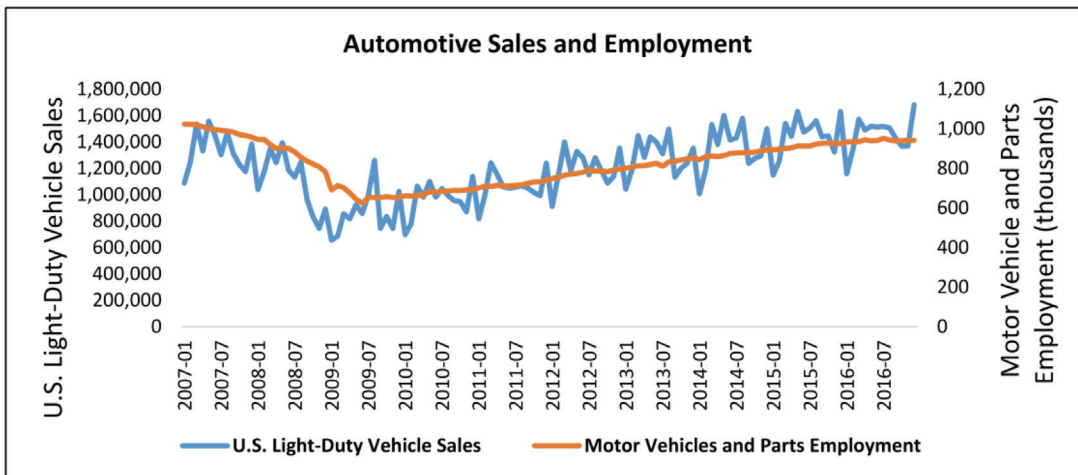
- Primary aluminum sourcing has a significant effect on the production phase emissions of the aluminum-intensive vehicles.
- North American primary aluminum production results in four to five times greater GHG emissions than steel production by weight, and imported primary aluminum releases on average eight to nine times greater GHG emissions. (See SRI study report Table 2.)

- Most steel used in North American vehicle production is produced in North America. In contrast, over the last several years, imports of primary aluminum ingot into North America have increased significantly.
- As an example, lightweighting all of the vehicles considered in the study with aluminum would result in higher GHG emissions of 12 million tons or the equivalent of the emissions from the annual electricity use of 1.6 million U.S. homes. (Based on EPA’s GHG equivalencies calculator and 6.2 million vehicles, or one-third of the 2016 fleet these vehicles represent.)
- Other examples include the equivalent to:
 - 1.2 billion gallons of gasoline consumed;
 - 26.7 billion miles driven by an average passenger vehicle;
 - 2,757 wind turbines running for an entire year; or
 - 12.8 million acres of U.S. forests to sequester the CO₂.

AHSS is Cost-Effective for Consumers and Keeps Jobs in the U.S.

Aluminum requires seven times the amount of energy to produce the equivalent amount of steel. Because of this, sheet aluminum for body and closure applications costs around two to three times the amount for steel.

- Lightweighting with AHSS is least disruptive to automakers’ current infrastructures because it enables manufacturing and assembly at the rate currently required by automakers.
- Several studies have been published showing lightweighting these components with aluminum in the average vehicle will cost at least \$600 more than lightweighting with AHSS. (references include studies from NHTSA and CAR)
- Vehicle sales for 2018 are forecasted to decrease in 2017 in part because of the increased purchase price².
- Decreased vehicle sales/production directly impacts the number of jobs related to manufacturing vehicles and vehicle parts as show in this chart³.
- The cost for insurance and repair is proportional to the increased cost of a vehicle. Therefore, the total cost of ownership will increase for consumers when purchasing a vehicle lightweighted with aluminum.



1. <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>
 2. Wards Auto
 3. Mitch Bainwol, Dec 2017



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