FASTER CONSUMER PAYBACK ON HYBRID AND DIESEL POWER WITH ALUMINUM

ALUMINUM IN TRANSPORTATION
THE ALUMINUM ASSOCIATION, INC.

"The next logical evolution in auto design should be to match powertrain advances with improvements in vehicle structures by reducing their weight. Moving to lighter vehicles with materials such as aluminum will help save consumers money at the pump, help save fuel overall and even help save the planet through reduced emissions."

Randall Scheps – Chairman
The Aluminum Association's
Aluminum Transportation Group

It is well known that hybrid and diesel powertrains provide improved fuel economy for today's cars and trucks, but at an increased initial cost to the consumer. Compared to gasoline engines with equivalent performance levels, these advanced powertrains have various payback periods to the consumer of up to several years.

As automakers around the globe are battling a widening array of industry challenges including the need for more fuel-efficient, safe and affordable products, there is clearly an intensifying amount of pressure to quickly find and implement innovative, cost-effective and long-term solutions. With that in mind, the Aluminum Association along with IBIS Associates, an independent consulting firm specializing in technical and economic analysis of materials in manufacturing technology, analyzed the current cost penalties associated with both hybrids and diesels to determine what could be gained by replacing their heavier steel bodies with low-weight, high-strength aluminum.

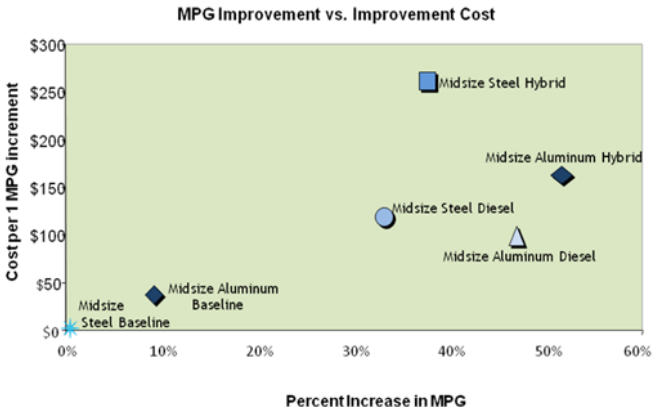
This study demonstrates that by reducing the weight of the vehicle, the horsepower and torque requirements can be correspondingly reduced, leading to a lighter, more affordable powertrain and vehicle that pays the consumer back quicker as a result of improved fuel economy and fewer trips to filling stations.

STUDY FINDINGS

- Advanced powertrains can produce further impressive fuel economy gains with faster payback for consumers, making these newer powertrains more cost effective when matched up with a lighter aluminum vehicle structure.
- A smaller and less expensive hybrid or diesel powertrain is sufficient to match the performance of the heavier steel vehicle, and can potentially achieve a more significant fuel savings with this combination of lightweight structure and smaller powertrain.
- Using fuel prices at the time the study was conducted, the baseline conventional powertrain steel vehicle, driven 12,000 miles, would cost the consumer approximately $1,700 per year. An equivalent aluminum/diesel combination would only cost just over $1,300, a savings of almost $400 per year.
- Aluminum structured hybrids received 13.5 percent better fuel economy than steel-bodied hybrids; similarly, the aluminum-bodied diesel saw a 13.1 percent improvement in fuel economy when compared to the steel-bodied diesel vehicle.

The following table shows there is a strong correlation between lightweighting with aluminum and improving the fuel economy of both hybrid- and diesel-powered vehicles.

- The baseline steel vehicle noted in the table has the lowest cost but delivers the mpg (miles per gallon). All other options to increase fuel economy come with an increased cost.
- In terms of ranking, the aluminum baseline vehicle, at $44 cost per mpg and a 10 percent potential mpg improvement, is the most cost effective.
- The aluminum structure with a diesel engine provided a cost per mpg improvement of $104, a 46 percent potential improvement in mpg.
- The hybrid powertrain offers the largest potential improvement in mpg as seen by the 51 percent gain at $173 cost per mpg.



METHODOLOGIES

Midsize automobiles were used exclusively in the study and included: separate steel- and aluminum-bodied vehicles with conventional gas, hybrid and diesel powertrains.

The steel-bodied vehicle with conventional powertrain and its performance and manufacturing parameters served as a basis for the comparison of alternative scenarios which would achieve equivalent performance, (e.g., acceleration, range and utility), with reduced fuel consumption or operating costs.

The comparable combinations of vehicle structures and powertrain technologies were also assessed using "functionally equivalent" designs whereby a lighter vehicle would require a less-powerful engine to achieve equivalent performance. Powertrain and associated "energy storage" systems were then resized to meet the performance requirements.

Total vehicle cost was assessed through a model where power (horsepower and torque) was calculated according to vehicle performance requirements, acceleration, payload, air resistance, rolling resistance, etc. Using this approach, vehicles of different mass or design had their powertrain requirements sized for functional equivalence.

Data was collected on a wide range of hybrid system components to establish relevant component cost and mass. From this data, system costs and mass were calculated for projected requirements of each system. Diesel powertrain costs were assessed as the differential manufacturing cost for the base engine relative to a conventional internal combustion engine as well as the incremental exhaust control and treatment requirements.

CONCLUSIONS

Alternative powertrains cost more for the improvements they offer, and also bring with them an added penalty for weight, further complicating their value proposition. The research shows that when evaluating the efficiency of the cost of the next mile per gallon improvements, aluminum provides the best alternative for hybrid- and diesel-powered vehicles. The cost for providing a lightweight or lower mass body structure per miles per gallon improvement is less than the cost for the next increment of power needed for the heavier versions of the hybrids and diesels.

In other words, by reducing the weight of the vehicle, the power requirements can be correspondingly reduced, leading to a more affordable powertrain and vehicle with a shorter payback period for consumers. The bottom line when it comes to next generation hybrid- and diesel-powered vehicles: reduce weight, improve fuel economy, reduce emissions and save consumers money faster.