

The aluminum industry projects that automotive aluminum use could more than double in the next decade; building on the more than 40 years of uninterrupted growth. As automakers strive to meet tough new fuel economy and emissions standards, plans for significant weight reductions are already in motion. Aluminum solutions are becoming part of a more holistic approach to designing and engineering cars and trucks, which include lighter yet stronger materials, smart design, advanced powertrains and cleaner fuels. Aluminum offers the fastest, safest, most environmentally-friendly and cost-effective way to reduce weight and build a better vehicle.



## GROWING DEMAND

Aluminum currently is the second most used material on vehicles and continues to take market share away from the steel industry. Consider:

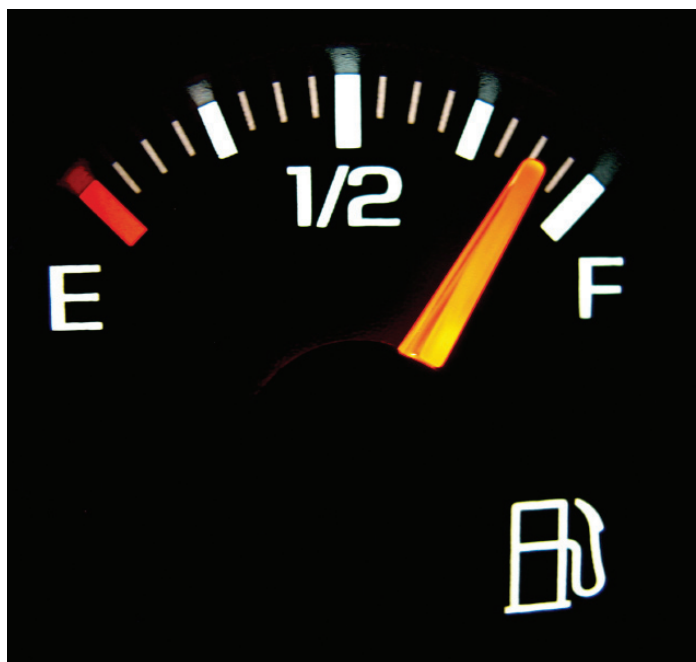
- ▶ Ford CEO Alan Mulally is making lightweight vehicles the foundation of the automaker's plan to meet rising fuel and safety mandates without scrapping the pickups and SUVs that generate most of the company's profits. In fact, the 2011 Ford Explorer uses more lightweight materials to get 20% better fuel economy.
- ▶ GM plans to trim 500 pounds from its light trucks by 2016, and by the early 2020s, it has said it might need to cut as much as 1,000 pounds per truck to meet stricter fuel economy standards.
- ▶ Nissan has reported that all newly redesigned models will be 15% lighter.
- ▶ Audi has reported it intends to slash weight from all its upcoming models "each and every one of them." In fact, the 2011 A4 is reported to be at least 330 pounds lighter than the model it replaces and the next-gen A6, while the same size as the current model, will shed some 176 pounds of weight.
- ▶ Tata Motors plans to build all future Jaguars and Land Rovers from aluminum, according to the company's 2009 annual report.
- ▶ The Tesla Model S is made mostly of aluminum to maximize energy use, efficiency and performance.



## SAFELY DOWNWEIGHTING

Auto aluminum is the safest way to downweight a vehicle. Aluminum is more crash absorbent than steel and offers greater weight reduction potential than steel while retaining strength. Consider:

- ▶ Aluminum absorbs – pound for pound – two times the energy in a crash compared to steel.
- ▶ Replacing iron and steel with auto aluminum creates a weight savings of 45-50%, while increasing vehicle performance and fuel economy without sacrificing automotive safety.
- ▶ Unlike steel, automotive aluminum can be used to maintain or even increase the size and strength of a vehicle's critical front- and back-end crumple zones without increasing overall weight.



## WEIGHT-REDUCTION RESEARCH

The Aluminum Association commissioned Dynamic Research, Inc., to analyze the safety differences in a fleet of SUVs that vary by size and weight, while also studying the safety of the driver in the other vehicle involved in the crash. According to the research findings:

- ▶ If weight is taken out of an SUV and size remains the same, there is less crash energy to absorb, while the vehicle structure remains in place to absorb the resulting energy.
- ▶ A lighter SUV is much less damaging to another vehicle in a crash, particularly a traditional passenger car.
- ▶ If the vehicle crush zone is increased, even by a few inches, it can have a significant and positive safety benefit in every crash situation.

Another study conducted at the University of Aachen for the European Aluminium Association, analyzed 26 automotive components to assess weight reduction for both steel and aluminum. The study found that auto aluminum offers greater weight reduction potential than steel while retaining strength.

- ▶ The maximum weight reduction potential of aluminum in car bodies is approximately 40%, while high strength steel was limited to only 11%. Using high strength steel nearly 40% of the parts analyzed simply could not be made thinner regardless of the grade of steel used. If high strength steel were to be used their stiffness would be reduced and the car's performance would suffer, whereas, aluminum could be used without these impacts.
- ▶ This study combined with other data suggests a total weight savings of about 525 pounds, which could result in 2.7 more miles per gallon or a nearly 10% further improvement in fuel economy.

## EXTREME ENVIRONMENTAL BENEFITS

Aluminum is the most environmentally-friendly way to downweight a vehicle. Vehicles made lighter with aluminum produce fewer overall emissions and need less fuel or battery power to operate, while being infinitely recyclable. Consider:

- ▶ The use of auto aluminum for vehicle downweighting can deliver a substantial reduction in CO<sub>2</sub> and other emissions over the life of the vehicle through better gas mileage, even when considering the CO<sub>2</sub> generated by the initial production of aluminum.
- ▶ On this basis, every pound of aluminum saves 20 pounds of CO<sub>2</sub> emissions over the lifetime of the vehicle. In fact, downweighting the world's overall transportation fleet through the use of aluminum has the potential to reduce greenhouse gas emissions by 660 million tons annually, or nearly 9% of global, transportation-related greenhouse gas emissions.



- ▶ Recycling aluminum saves nearly 95% of the greenhouse gas emissions associated with primary aluminum production.
- ▶ Nearly 90% of auto aluminum is recovered and recycled, and 73% of all aluminum ever produced is still in use today.

## ENVIRONMENTAL RESEARCH

### Emissions Footprint

Independent analysis from the magnesium industry confirms that aluminum – not steel – has the smallest carbon footprint of competing materials when considering the full life cycle of production, manufacturing, on-the-road use and end-of-life recycling phases. According to the study:

- ▶ Magnesium delivers a 15% energy savings compared with steel design and aluminum yields a 20% energy savings.
- ▶ When considering total life cycle CO<sub>2</sub> emissions, magnesium is 12% better than steel and aluminum is 20% better.

### Benefits to Hybrids and Electric Vehicles

When looking at alternative powertrains, a study conducted by IBIS Associates for the Aluminum Association found that both aluminum-structured hybrids and aluminum-bodied diesels could return about a 13% increase in fuel economy, as compared to steel-bodied hybrids and diesel vehicles. Research commissioned by the Aluminum Association with Ricardo also found that opting for high-strength, low-weight aluminum over heavier steel structures for plug-in electric and hybrid vehicles can cut battery costs by approximately \$3.00 for every \$1.00 invested in downweighting with aluminum.

For more information, please visit us online at [AluminumInTransportation.org](http://AluminumInTransportation.org)