PLASTIC HELPS AUTOMAKERS BUILD MORE FUEL EFFICIENT, SAFER CARS

AMERICA'S PLASTICMAKERS MAKING SUSTAINABLE CHANGE | American Chemistry Council

"Lightweighting" Drives Down Greenhouse Gas Emissions

Ford Motor Company: "Few innovations provide a more wide-ranging performance and efficiency advantage than reducing weight. All factors of a vehicle's capabilities—acceleration, handling, braking, safety, efficiency—can improve through the use of advanced, lighter materials."[1]

Automakers Use Lightweight Plastic to Improve Fuel Efficiency

For decades, Congress has mandated improved automobile fuel efficiency. As a result, our nation's carmakers have turned more and more to sustainable, durable, lightweight plastic to decrease the weight of car parts, which reduces fuel use.

> **Department of Energy: "A 10% reduction in vehicle weight can result in a 6% - 8% fuel economy improvement."**[2]

Carmakers are squeezing more miles out of a gallon of gas in part by replacing heavier materials with lighter weight plastic. Today's cars on average are made of about 50% plastic by volume but only 10% by weight. Increased fuel efficiency cuts auto emissions, reduces our nation's energy use and saves us money at the pump. "The use of plastics in automobiles saves considerable energy over the life of the vehicles."[3]

Lightweight Plastic Helps Reduce Greenhouse Gas Emissions

Studies demonstrate that lightweight plastic components help cut greenhouse gas emissions from our cars and trucks – use of heavier alternative materials would lead to significantly increased greenhouse gas emissions.

- "Replacing plastic vehicle components with alternatives would more than double their weight… The greatest environmental cost [would arise] from greenhouse gas emissions."[4]
- "The results show that the lightweight plastic product outperforms the metal product for global warming potential and primary energy demand, meaning that the net impact indicator over the full life cycle is lower."[5]
- "If plastic components in passenger vehicles produced in North America… were replaced with alternative materials, the vehicles would require an additional [89 million gallons] of gasoline and diesel to operate over their lifetimes."[6]

Plastic Enables Self-Driving Vehicles, Advanced Propulsion Systems and Infrastructure

Autonomous (self-driving) vehicles can reduce accidents caused by human error and provide freedom of mobility for underserved members of society, including the elderly and disabled. Sustainable, lightweight plastic and composites will enable more flexible vehicle interiors and help offset the extra weight of self-driving vehicle sensors, cameras, wireless 5G transmitters and LiDAR (light detection and ranging)… all necessary for autonomous vehicles to sense the road, each other, signals, signs, refueling stations, tolls and adjacent architecture.

Plastic also will help enable the hybrid, electric and hydrogen fuel cell vehicles that will reduce carbon emissions and

support U.S. leadership in advanced mobility and materials manufacturing. Plastic will be key for reducing vehicle weight in electric vehicles (EV) and batteries. For example, EV batteries – which today typically comprise about a third of vehicle mass – continue to shed weight in part due to lightweight plastic battery packs, which can improve vehicle range.

Polymers will be critically important to create the infrastructure to support advanced propulsion and autonomous vehicles. Charging and refueling stations made with plastic and composites are impact and corrosion resistant, help prevent tampering, provide electrical insulation safety and can withstand many extreme weather conditions.

Plastic/Composites Help Protect Vehicle Occupants and Pedestrians

Safety advances in today's vehicles save countless lives and reduce injuries. Plastic enables air bags, seat belts, and safety glass plus energy absorbing innovations such as front-end modules, modular seats and bumpers that protect vehicle occupants every day.

In addition, fiber-reinforced polymer composites (such as carbon fiber-reinforced plastic) absorb multiple times the crush energy of steel. In fact, polymer composites can not only reduce vehicle baseline weight compared to high strength steel but can exceed NHTSA crash requirements.[7] That's one reason racing cars tend to be made with super strong yet lightweight plastic composites.

Plastic also helps save lives during pedestrian and bicyclist impacts. Energy absorbing plastic-based bumpers, hoods and windshields help protect pedestrians and cyclists in collisions. And flexible sensors molded into plastic components help alert drivers to cyclists and pedestrians.

Plastic Helps Transition to Circular Economy

Automotive plastic and composites companies are working with automakers to reduce the environmental impacts of vehicles. Some examples include designing vehicle systems and components for end-of-life recyclability and using recycled plastic throughout the vehicle, such as in headlamps, bumpers, lift gates, seat cushions and upholstery, insulation and critical engine components.

Many major automakers also have set goals and begun implementing initiatives to improve the circularity of their operations, including their use of plastic. Plastic makers are committed to working together and with part suppliers and automakers to help the automotive industry transition toward a more circular economy, in which plastic and other materials are reused instead of discarded.

A recent study found the value of the circular economy is expected to reach $4.5 trillion in the United States by 2030 – with $400 to $600 billion of benefit to automotive companies and their suppliers.[8]

[1] https://media.ford.com/content/fordmedia/fna/us/en/news/2015/01/12/ford-redefines-innovation-with-gt-supercar.html
[2] Lightweight Materials for Cars and Trucks, U.S. Department of Energy, Vehicle Technologies Office
[3] https://www.greenbuildingsolutions.org/wp-content/uploads/2016/05/Comparative-Energy-Evaluation-of-Plastic-Products-1991.pdf
[4] https://plastics.americanchemistry.com/Plastics-and-Sustainability.pdf
[5] https://plastics.americanchemistry.com/Education-Resources/Publications/Life-Cycle-Assessment-of-Polymers-in-an-Automotive-Bolster.pdf
[6] https://plastics.americanchemistry.com/Plastics-and-Sustainability.pdf
[7] https://www.automotiveplastics.com/wp-content/uploads/2019-gmu-Hollowell-CarbonFiber-Lightweighting-final-report-v2.pdf
[8] https://www.accenture.com/t20160913T221220__w__/bd-en/_acnmedia/PDF-27/Accenture-AutomotiveLatestModel_Infographic.pdf, Accenture, "Automotive's latest model: Redefining competitiveness through the circular economy," 2016