



Pat McNulty

Novelis Inc.

on behalf of

The Aluminum Association's

Aluminum Transportation Group (ATG)

The Aluminum Association's Aluminum Transportation Group



www.aluminumtransportation.org

Role of Aluminum in Meeting Future Federal Fuel Economy Regulations

U.S. Faces Stricter Fuel Economy Regulations

- *October 2010:* the Obama Administration announced next steps toward establishing tighter fuel economy and emissions standards for 2017 through 2025 model-year vehicles.
- *July 2011:* the Obama Administration announced targets to roughly double the average fuel economy of car and light truck fleets from current levels to 54.5 miles per gallon by 2025.
- *September 2011:* Final Ruling to be published.

Mass reduction is key enabler

- **Ford:** Strategy to reduce vehicle weights between 250 lbs. – 750 lbs. by 2015.
- **GM:** Sets goal to trim 500 lbs. by 2016 and 1,000 lbs. by 2020
- **Nissan:** Targets reducing 15% of vehicle weight
- **Audi:** Using aluminum technology to achieve a 25% increase in body stiffness, while reducing weight by up to 20% in A8
- **BMW:** Using more aluminum to cut weight
- **Jaguar Land Rover:** Constructing future vehicles with aluminum bodies



The Virtual Weight Cycle: Enabler for Meeting CAFE Standards



Reinvest



Mass
Reduction

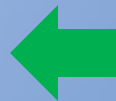


Downsized
Powertrain

- Improved fuel economy
- No sacrifice of safety or function



Cost
Savings



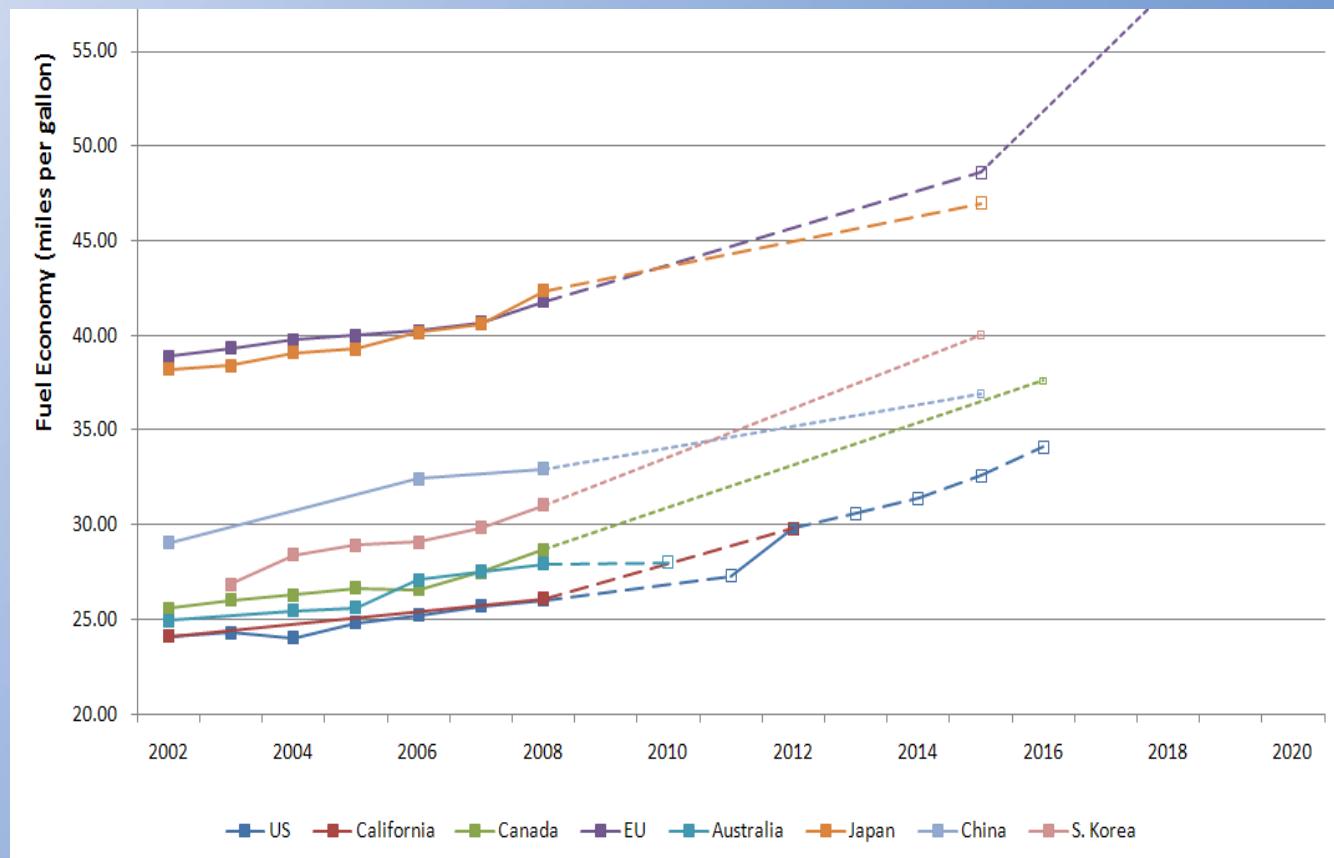
Secondary
Weight



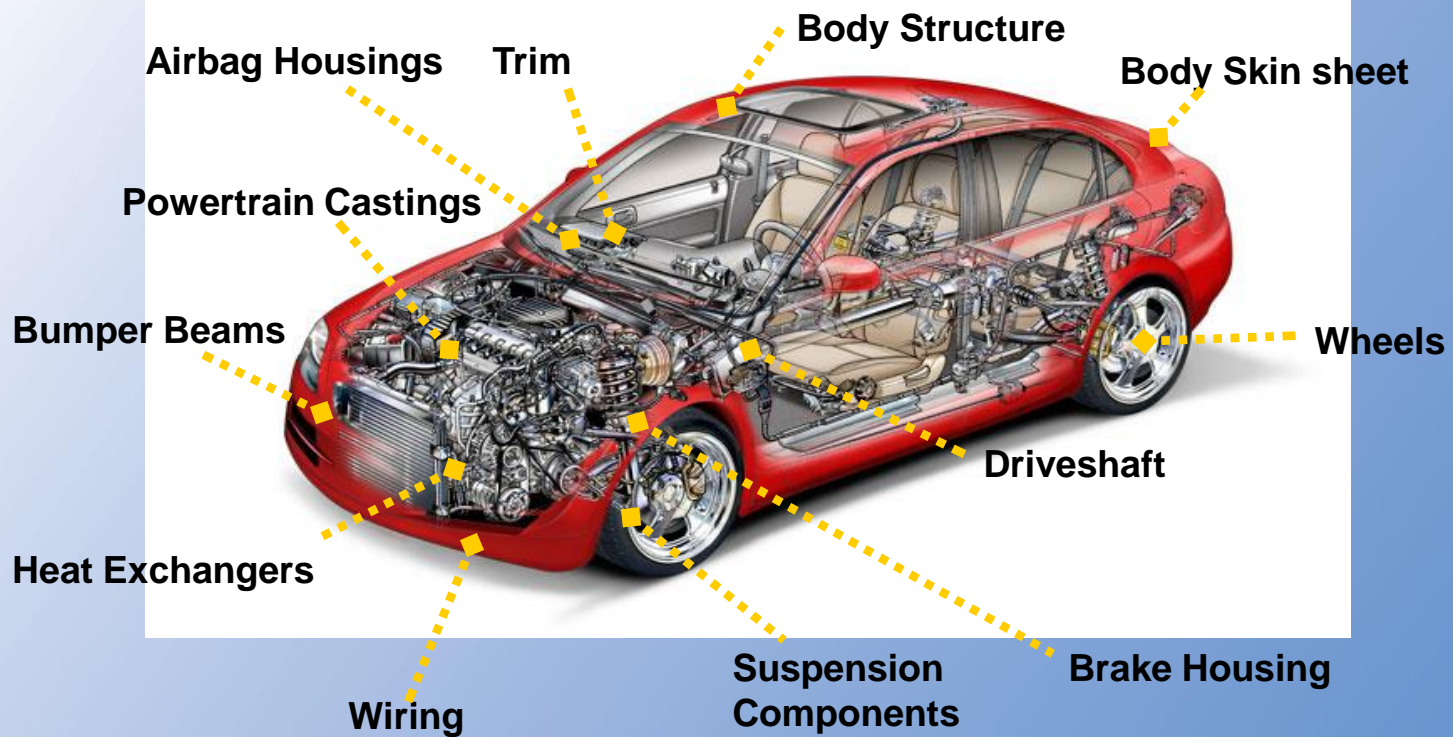
Weight Reduction Becomes More Vital

- All regions of the world focusing on improving fuel economy.
- The ability to safely reduce vehicle mass while maintaining vehicle size and utility for NA customers will be a differentiator for OEM's

Comparison of Global Auto Fuel Economy Standards



Existing Aluminum Applications



- Today's vehicle contains nearly 10% aluminum by weight
- Many vehicles in the U.S. fleet use 400-500 lbs. of aluminum
- Worldwide content is projected to grow to 28-30 billion lbs. per year – up from the current 16-17 billion lbs. – between now and 2020
- More than 95% of automotive aluminum is recycled

Measuring Aluminum's Weight Reduction Potential

University of Aachen (ika) (Germany) & European Aluminum Association (EAA) Study

Objective

Determine potential BIW weight savings

Steel, advanced steels, aluminum

- MMV – Multi material vehicles
- AIV – Aluminum intensive vehicles

Methodology

Model car body, identify components

- Strength limited – crash performance
- Stiffness limited – NVH

Optimize weight of each component

- High-strength steel grades (including ultra high-strength steel)
- High-strength aluminum alloys

Optimized BIW weight assessment

- Steel/HSS (Baseline)
- Steel/High-strength/Advanced Steel
- Aluminum (AIV)

Aachen Study Key Findings

Weight Reduction Potential (BIW and closures)

- Advanced high-strength steel (YS up to 1,200 MPa) = ~11% (145 lbs)
- Aluminum AIV (YS up to 400 MPa) = ~40% (525 lbs)

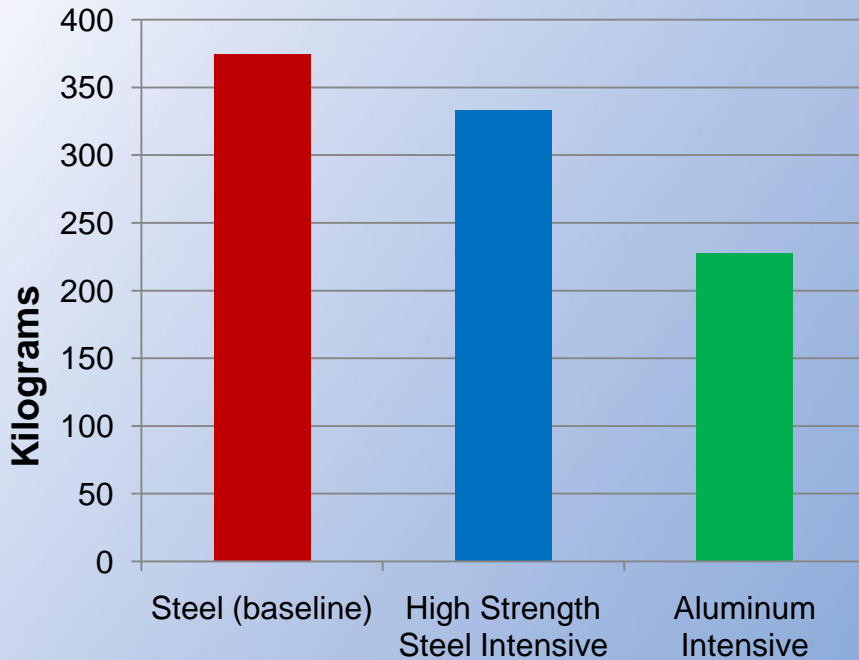
MMV Aluminum Body Component Candidates

- Closure panels
- Longitudinal beam
- Roof
- Strut tower
- Floor
- Sidewall

***Strength not the limiting factor
for conversion from steel to
aluminum for most components***

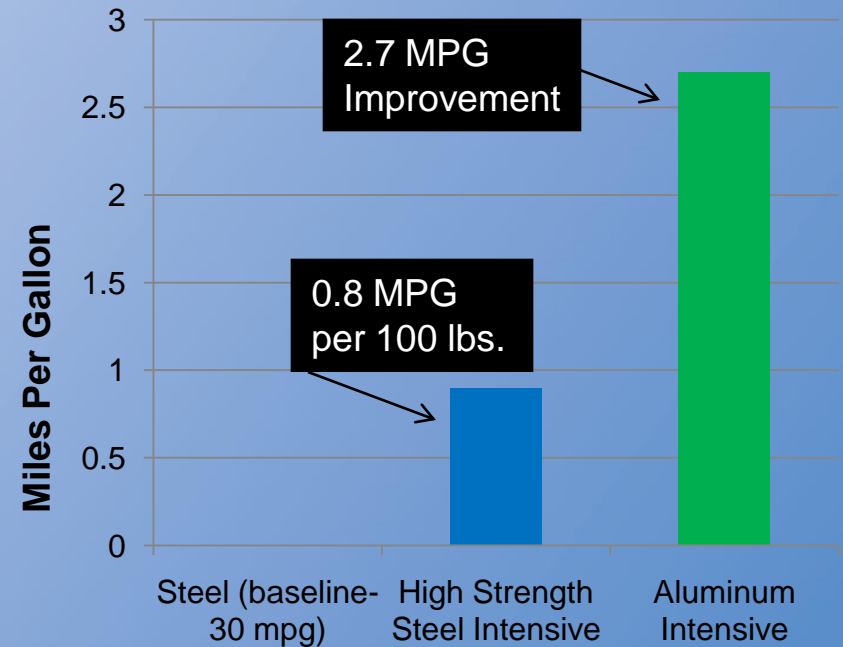
Weight Savings Translates to Fuel Economy Improvement

Mass of Body-in-White



Source: ika - University of Aachen and the European Aluminium Association (EAA)

Fuel Economy Improvement



Source: Aluminum Association calculated based on ika mass reduction data; assumes 23% secondary weight savings

Benefits Intensified in Hybrid & Electric Vehicles

Objective

Evaluate the impact of vehicle weight reduction on electric vehicle performance, range and battery size.

Methodology

Converting vehicles to PEV, or PHEV with a range of 40 or 80 miles as per FTP75 (city) drive cycle.

- Small car (approximating BMW Mini)
- Small SUV (approximating Saturn Vue)

Note: PHEV, drives only on batteries, but carries mass of engine and associated “support systems,” cooling, exhaust, fuel, etc.

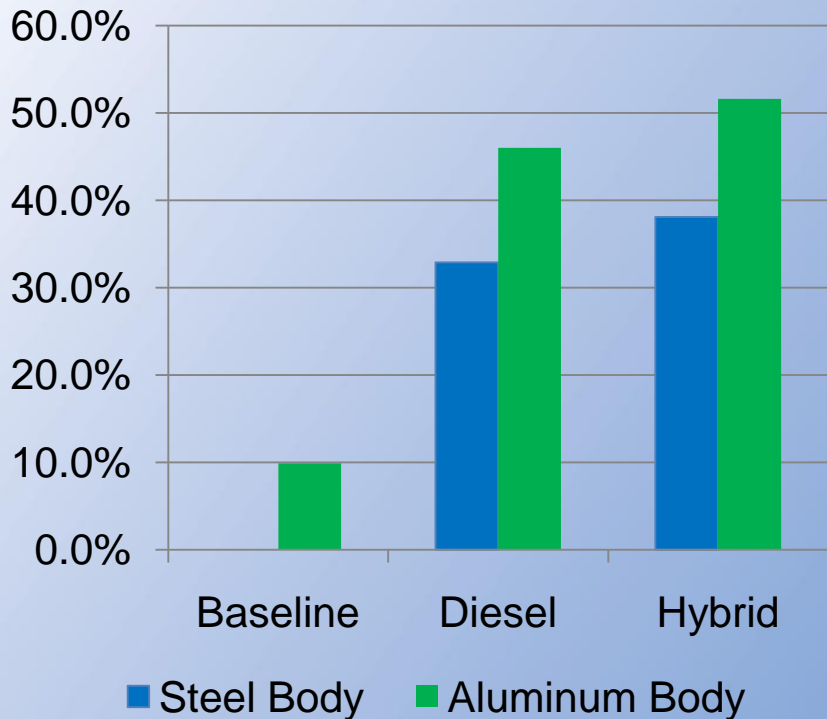
PEV and PHEV Study Key Findings

Results

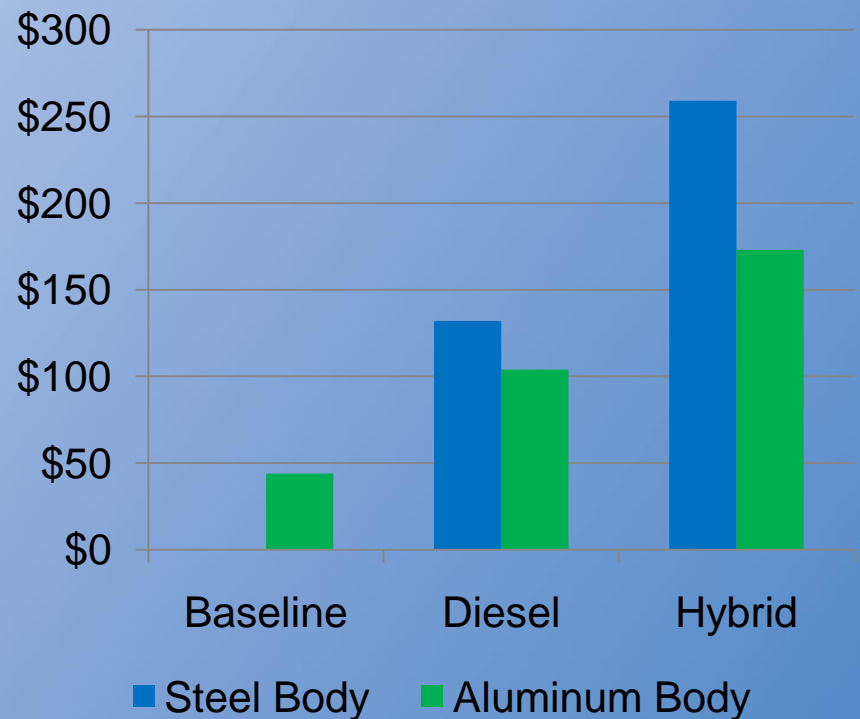
- Aluminum use in electric vehicles can yield a savings of up to \$3,000 per vehicle
- 10% weight reduction yields **4 - 6%** reduction in battery size
- By reducing the mass of the vehicle by **20%**, the vehicle's range can be improved by up to **20%**

Mass Reduction Creates Value – Advanced Powertrains

Percent Increase in MPG



Cost per 1 MPG Increase



Time for Reducing Vehicle Weight is Now

- A necessity in the holistic approach to meeting U.S. and global regulations without sacrificing safety or functionality.
- Underpins and compliments the advanced powertrain technologies.
- Offers better CO₂ and fuel savings than other competing materials.
- Technology that is ready today.

Thank You



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