

# Role of Aluminum in Meeting Future CAFE Standards

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# Defining Who We Are

The Aluminum Association's  
Aluminum Transportation Group (ATG)



# Defining What We Do



Auto



Heavy Truck

## Research

- *Safety*
- *Fuel Economy*
- *Aluminum Usage*
- *Sustainability*

## Communicate

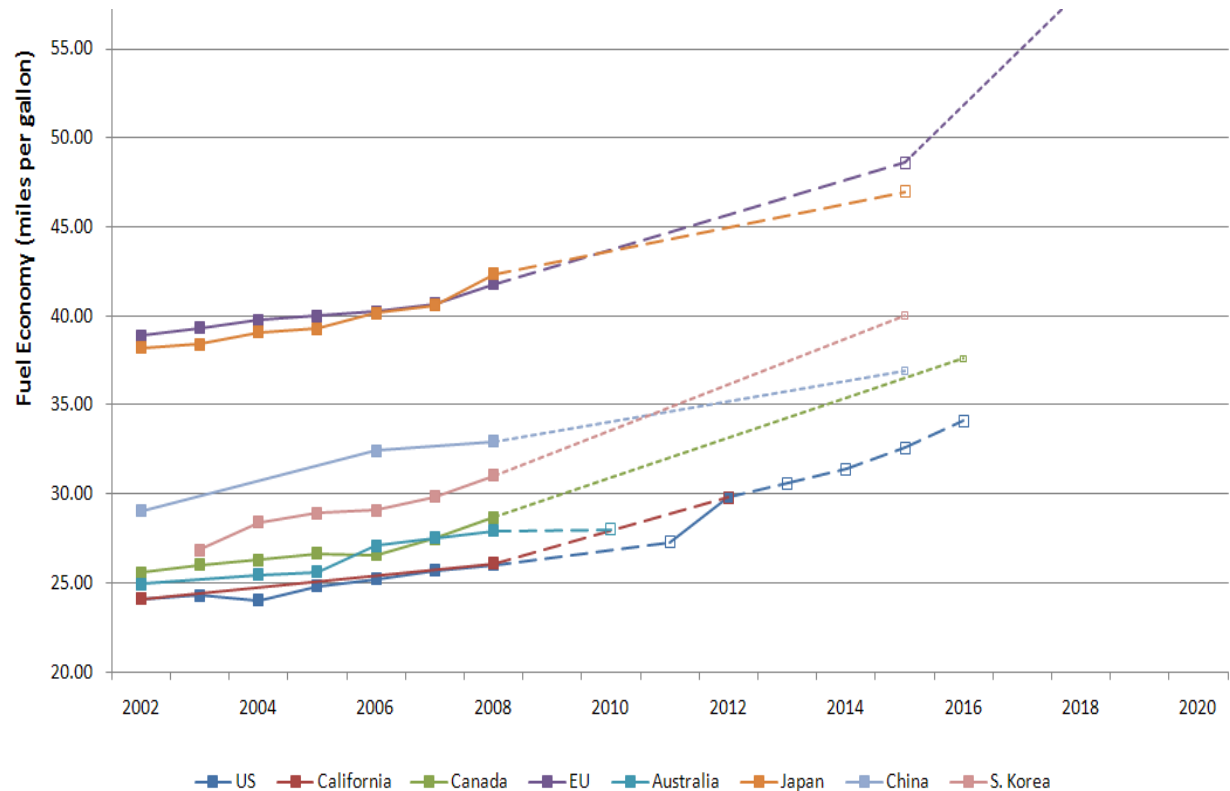
- *Industry*
- *Press*
- *NGO's*
- *Government*

[www.aluminumintransportation.org](http://www.aluminumintransportation.org)

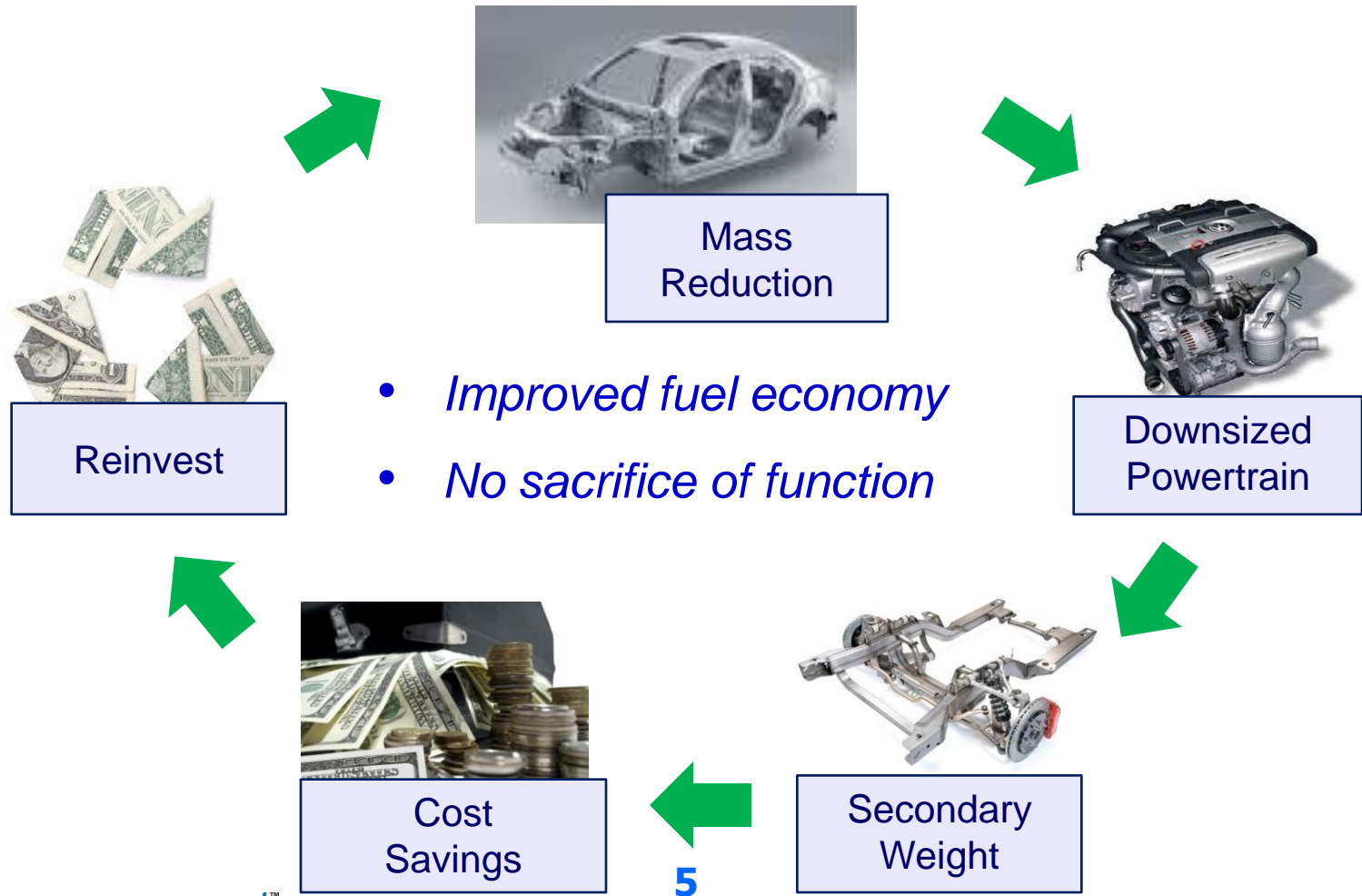
# Weight Reduction Becomes More Vital

- Excess weight is the enemy of efficiency
- Customers won't accept radical downsizing
- Downweighting creates many benefits
- Ability to cut weight will be differentiator for OEM's

*Comparison of Auto Fuel Economy Standards*



# The Virtuous Weight Cycle: Enabler for Meeting CAFE targets



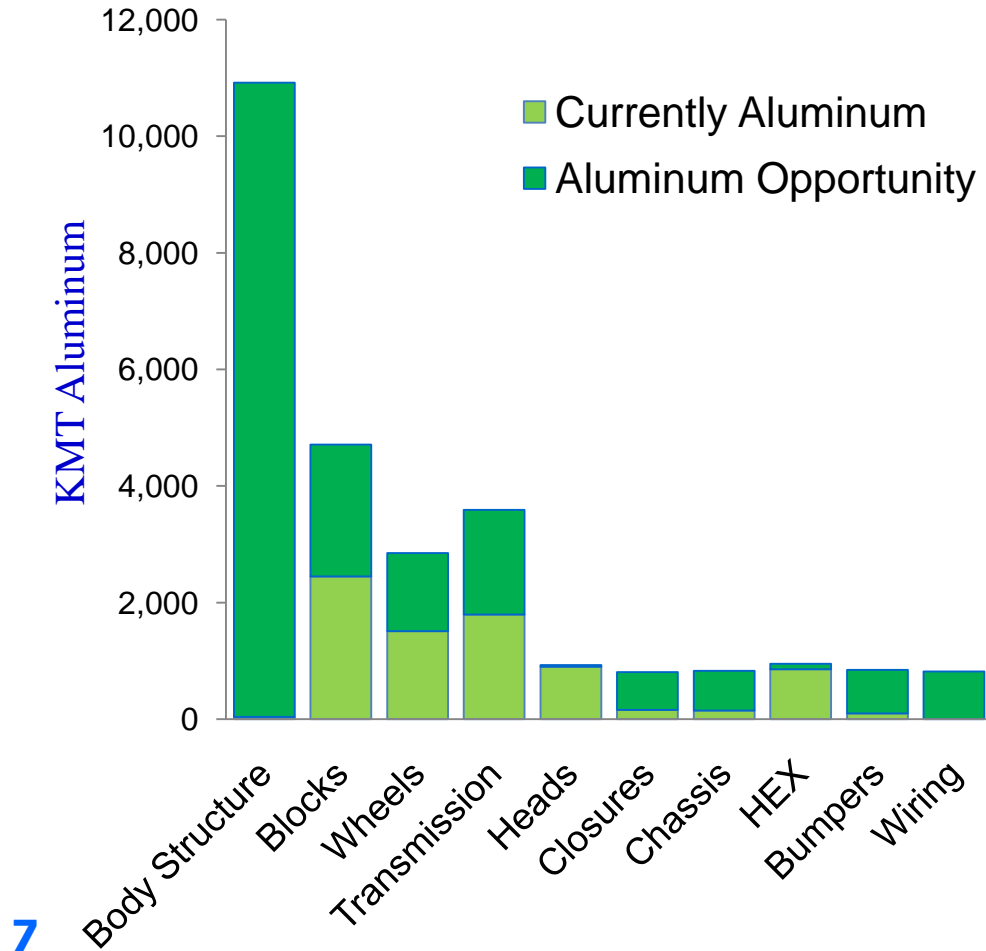
# Downweighting Is Critical

## *What the OEMs are saying*

- **GM** plans to trim 500 lbs. from light trucks by 2016 and as much as 1,000 lbs. by 2020 (*Automotive News*)
- **Ford** plans on taking between 250 to 750 lbs. out of each model year (*Bloomberg*)
- **Nissan** set a goal to reduce 15% of vehicle weight (*Automotive News*)
- For the past 15 years, **Audi** has utilized the ASF<sup>®</sup> (the aluminum-based Audi Space Frame technology) to achieve benefits of downweighting as seen in the 2011 A8, such as a 25% increase in body stiffness, while reducing weight by up to 20% (*Audi*)
- **Jaguar Land Rover** plans to reduce CO<sub>2</sub> emissions by 25% over the next five years (*Environmental Leader*)

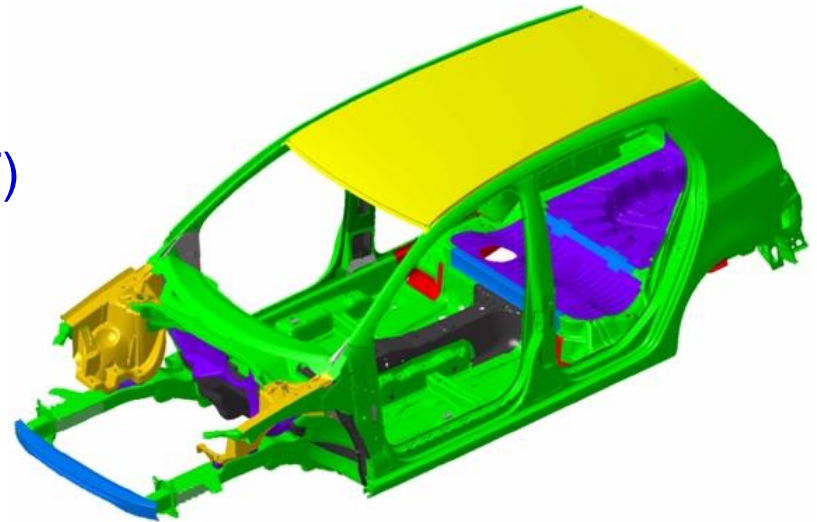
# Body in White is the Next Frontier for Downweighting

- Aluminum use continues to grow in established areas
- Body and closures ~35% of car's weight 350 lbs. weight reduction is in reach
- Steel has historically dominated, but potential weight savings with steel are diminishing
- **Aluminum is the next logical step**



# Aluminum: The Next Logical Step

- Saves more weight than steel
- As safe as steel
- More recyclable than carbon fiber (CF)
- Compatible with existing capital base unlike magnesium or CF
- Available in more product forms than magnesium, steel or CF
- More corrosion resistant than steel or magnesium
- Cost competitive with other fuel saving technologies like hybrid systems



*350 lbs lighter with aluminum!*

# A Real-World Example

Room of a full-size with mileage of a mid-size

- No compromise to safety or roominess
- 2.7 MPG improvement
- More agile handling and braking
- Existing stamping assets
- Lower powertrain cost

EPA Size Category	Large	Mid
Curb Weight Today	3199	2723
Weight Reduction with Aluminum body	(345)	
New Curb Weight	2698	

# Lightweight Potential

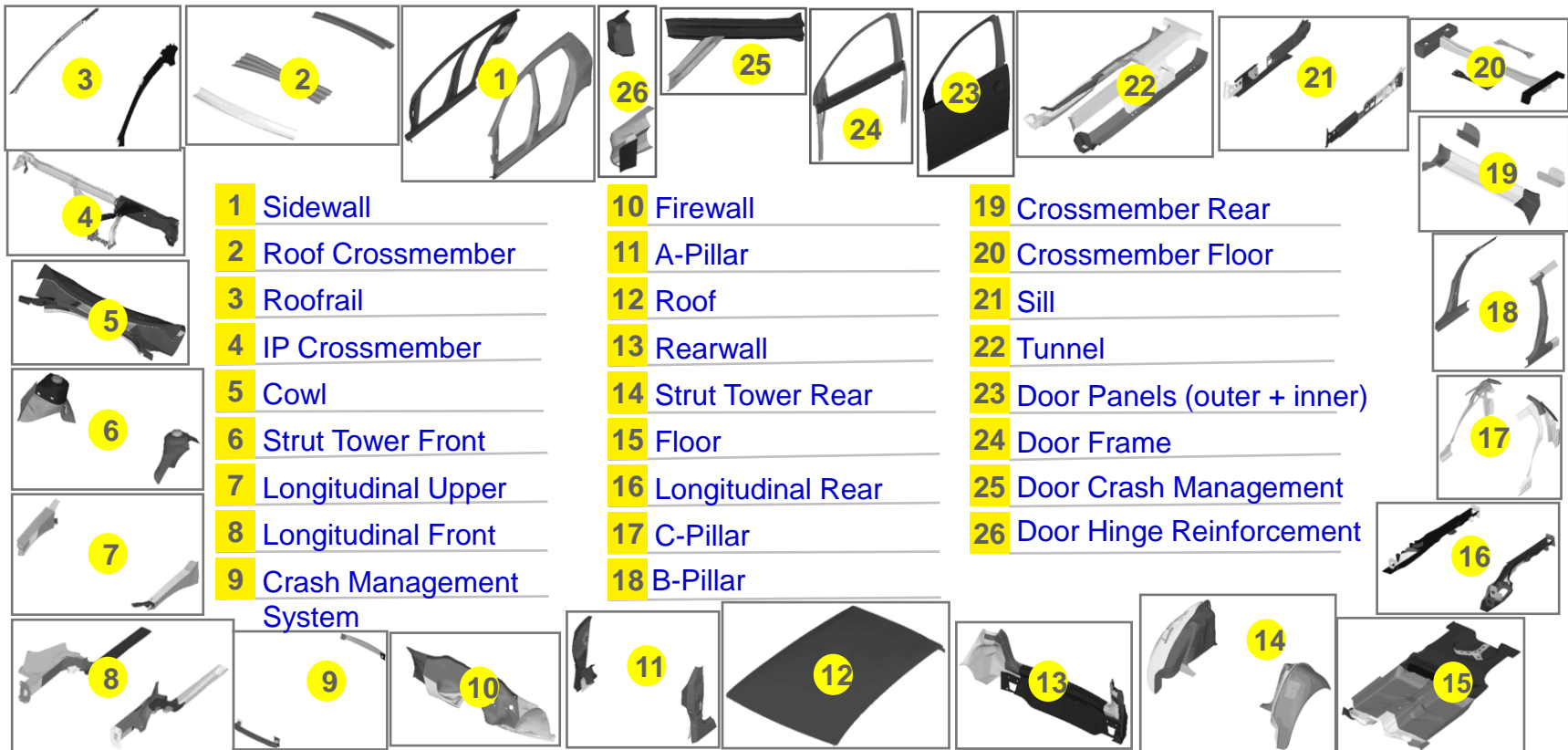
## Aluminum vs. High Strength Steel

A Recent study, to determine maximum weight saving potential of steel vs. aluminum in automotive applications, used a quantitative numerical analysis of a current model baseline vehicle.

Auto body optimization

- Steel / AHSS
- Multi Material Vehicle (MMV)
- AIV potential

# 26 Components for Evaluation



# Lightweight Material Potential

## Key Findings

Weight reduction potential (BIW and closures)

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

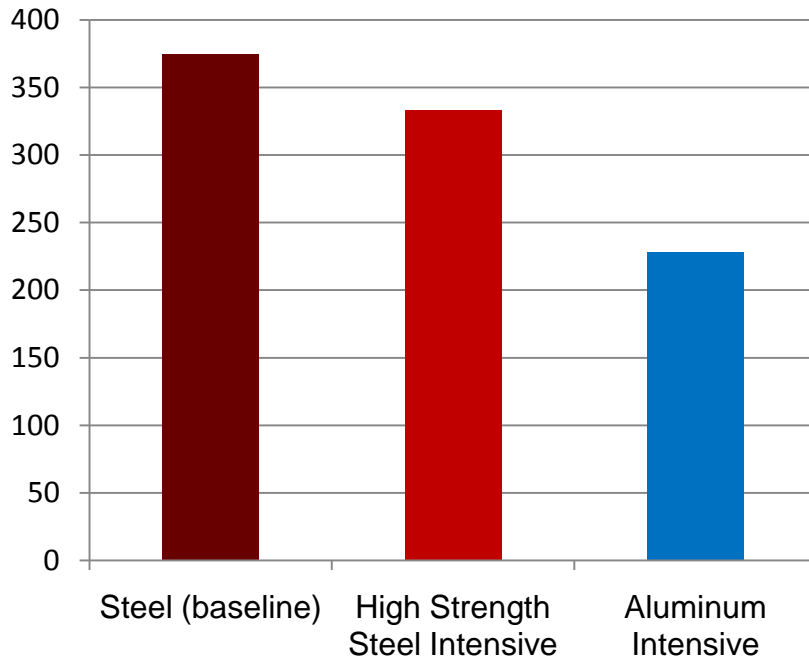
MMV aluminum body component candidates

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

For most of the components, strength is not the limiting factor for substituting aluminum for steel

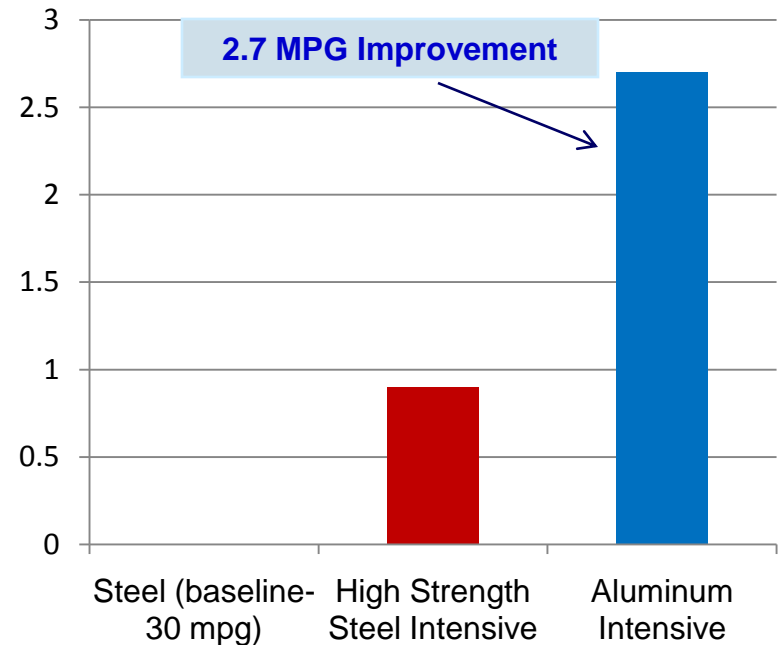
# Weight Advantage Translates Into Fuel Economy Advantage

Mass of Body-in-White



Source: ika - University of Aachen /European Aluminium Association

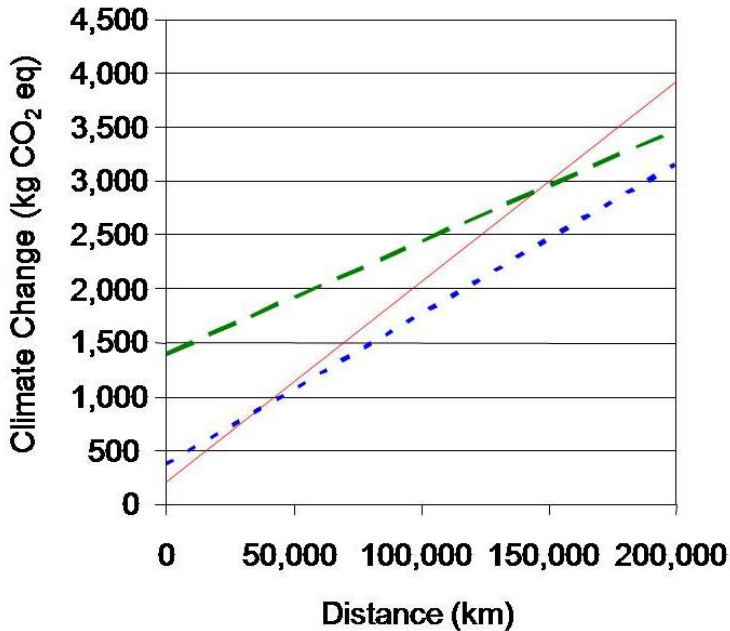
Fuel Economy Improvement



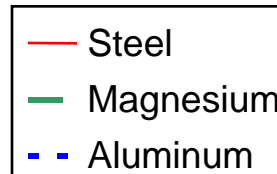
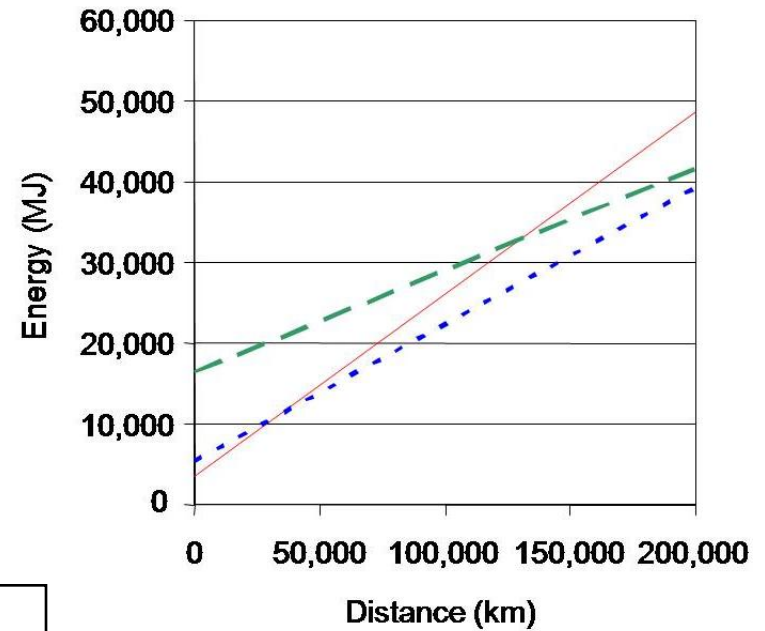
Source: Aluminum Association calculated based on ika mass reduction data; assumes 23% secondary weight savings

# Aluminum Produces Less Emissions and Uses Less Energy

Lifetime Emissions Output



Lifetime Energy Output



# Aluminum Key to Meeting CAFE

- Improves fuel economy more than steel
- Allows step-function powertrain downsizing
- As safe as steel
- No compromise to vehicle function
- Compatible with existing capital base
- Secondary weight savings make it cost effective
- Aluminum is a big part of the CAFE solution

For more information, referenced research  
or to download a copy of this  
presentation, visit us online at:

**[www.aluminumtransportation.org](http://www.aluminumtransportation.org)**