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Drivers for Growth in Automotive Aluminum Demand

Jack Pell and JD Rutt

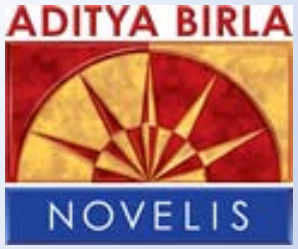
Hydro

on behalf of

The Aluminum Association,

Aluminum Transportation Group (ATG)

The Aluminum Association's Aluminum Transportation Group (ATG)



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Aluminum Growth Factors to Consider:

- Existing aluminum applications
- Impact of federal regulations
- Weight reduction and fuel economy improvement
- Weight reduction and energy consumption
- Benefits to alternative/electric vehicle technology
- A future with automotive aluminum

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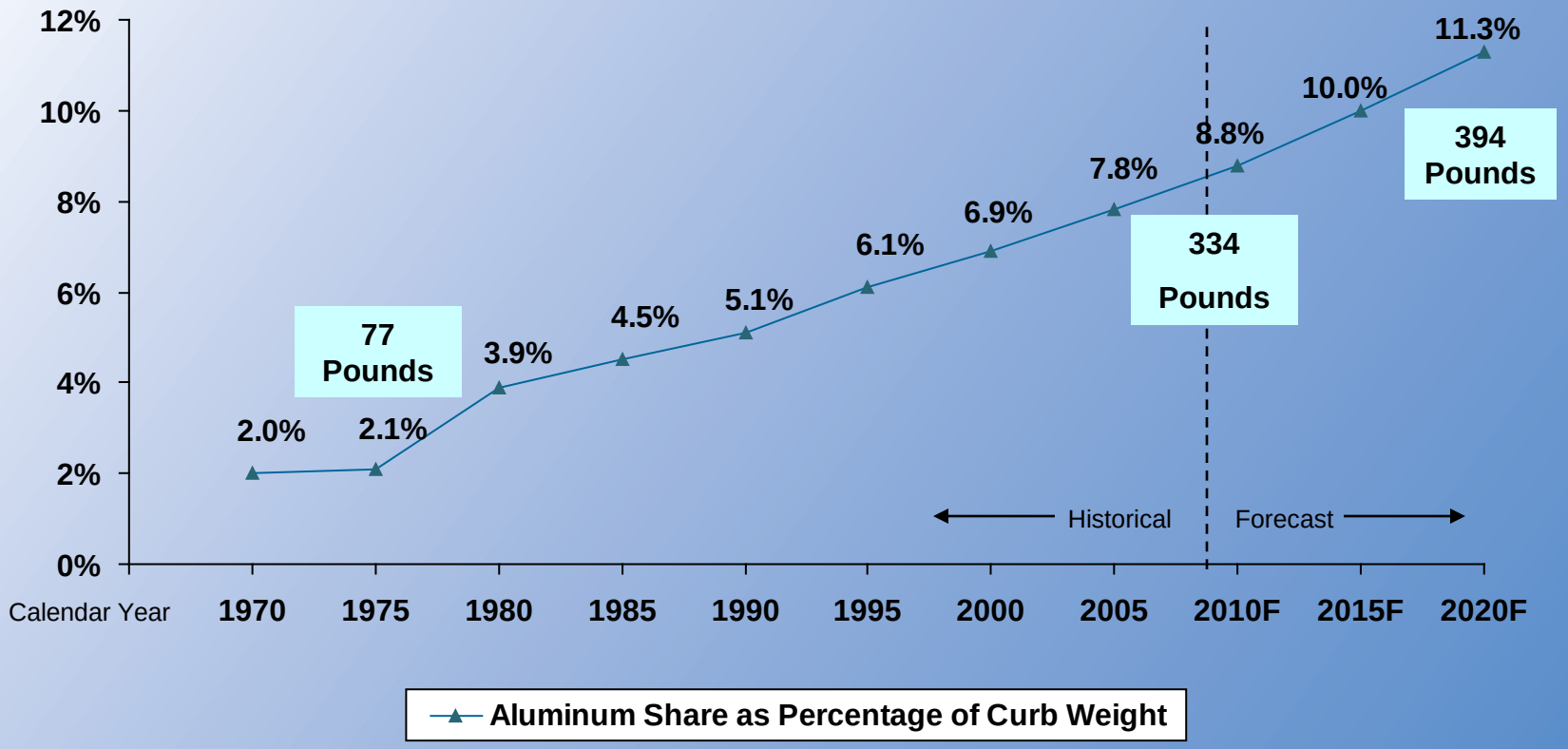
50 Years of Uninterrupted Automotive Aluminum Growth



Auto Aluminum Content
North America - Percent of Curb Weight

DUCKER worldwide

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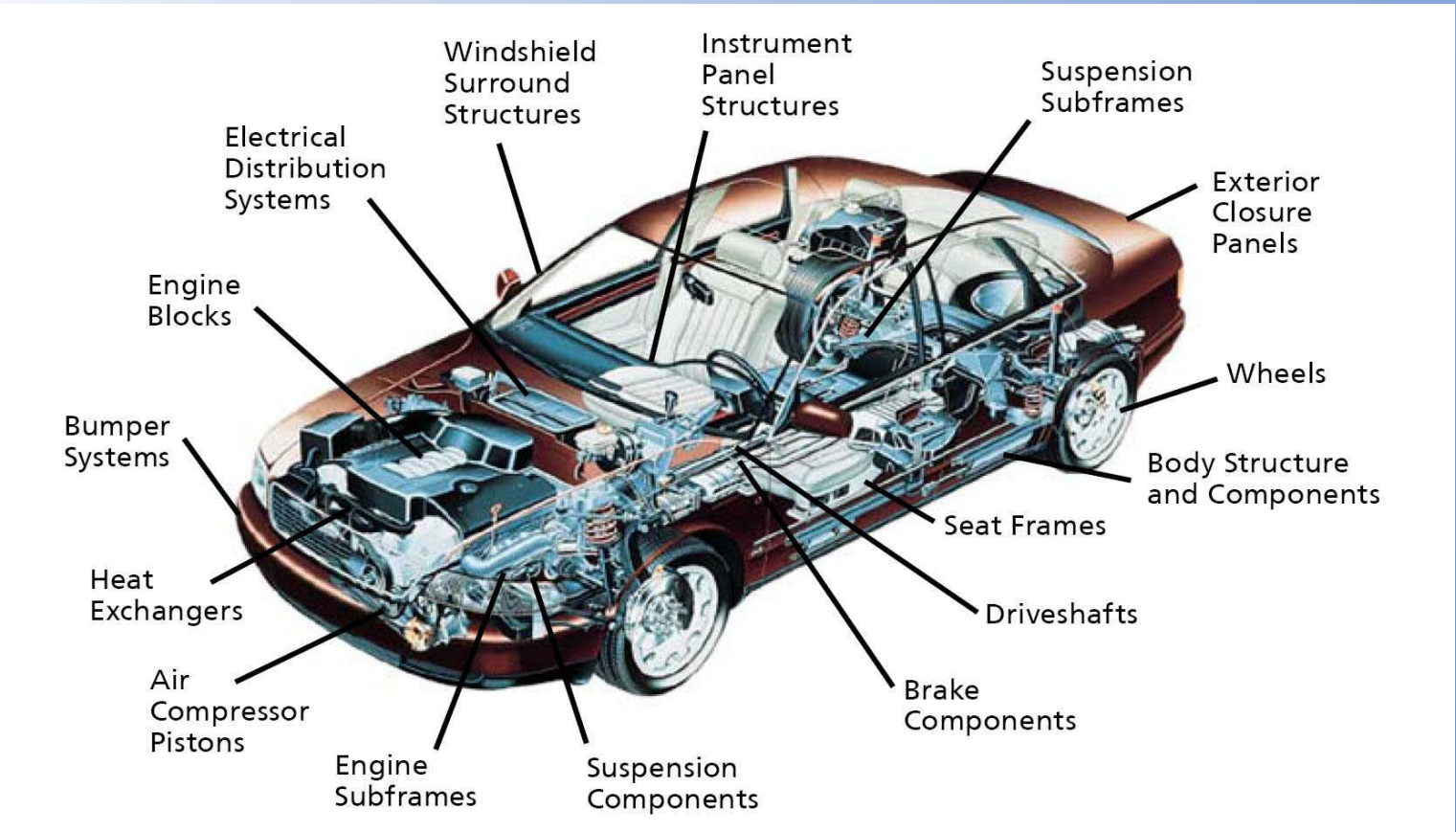
Existing Aluminum Applications



- Today's vehicle contains about 10% by weight
- Many vehicles in the U.S. fleet use 400-500 pounds of aluminum
- More than 95% of automotive aluminum is recycled

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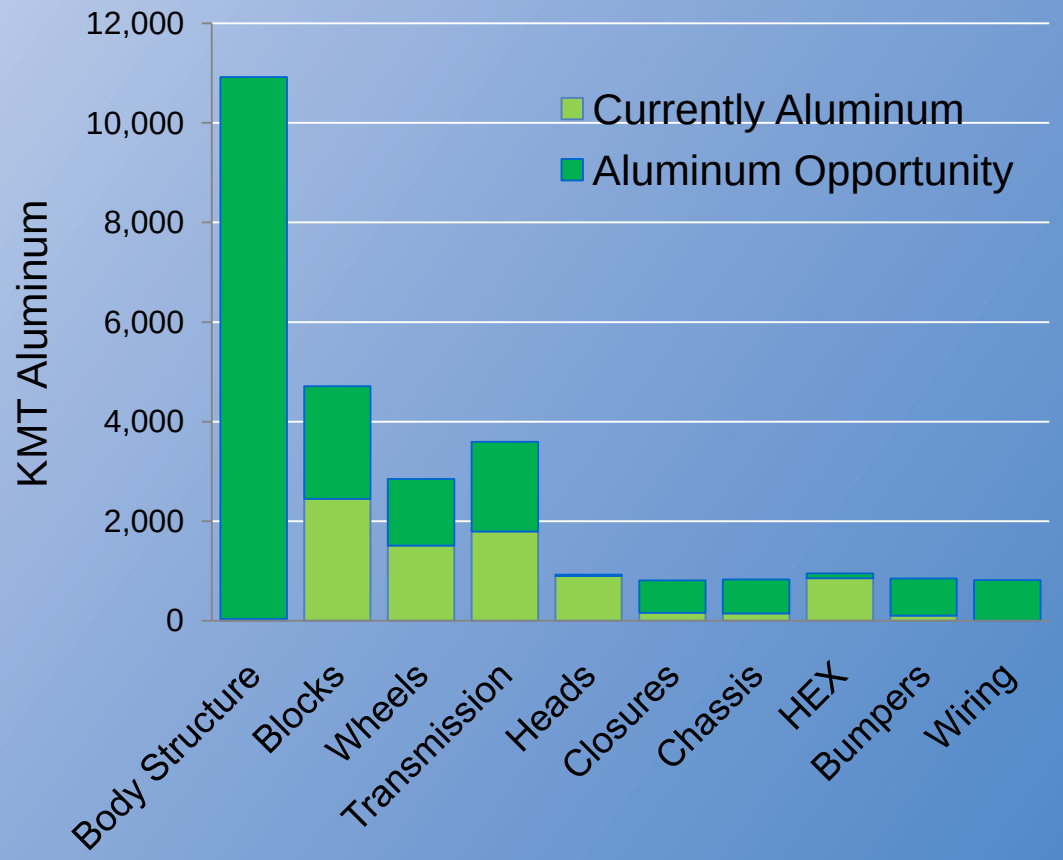
Body Holds the Largest Weight Reduction Opportunity

- Shift to aluminum saves 550 lbs. direct and secondary weight
- 10% better fuel economy
- No compromise to safety
- No downsizing required
- Better performance
- Lower lifetime CO_2



***Source**: The Aluminum Association*

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U.S. Faces Stricter Fuel Economy Regs

- *April 2010*: the Obama Administration established regulation that, starting with 2012 model year vehicles, requires automakers to reduce fleet-wide greenhouse gas emissions by approximately 5% every year and strengthen fuel economy each year, reaching an estimated 34.1 mpg for the combined industry-wide fleet for model year 2016

- *October 2010*: the Obama Administration announced next steps toward establishing tighter fuel economy and emissions standards for 2017 through 2025 model-year vehicles

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Down Weighting Key to Solution

- Weight reduction will be part of the solution to meet the new regulation bench marks
  - Nissan recently announced plans to start reductions at 15%
  - GM recently announced plans to trim 500 lbs. from its light trucks by 2016, and by the early 2020s, may cut as much as 1,000 lbs. per truck

- Aluminum already offers great weight saving for less CO_2 than competing materials

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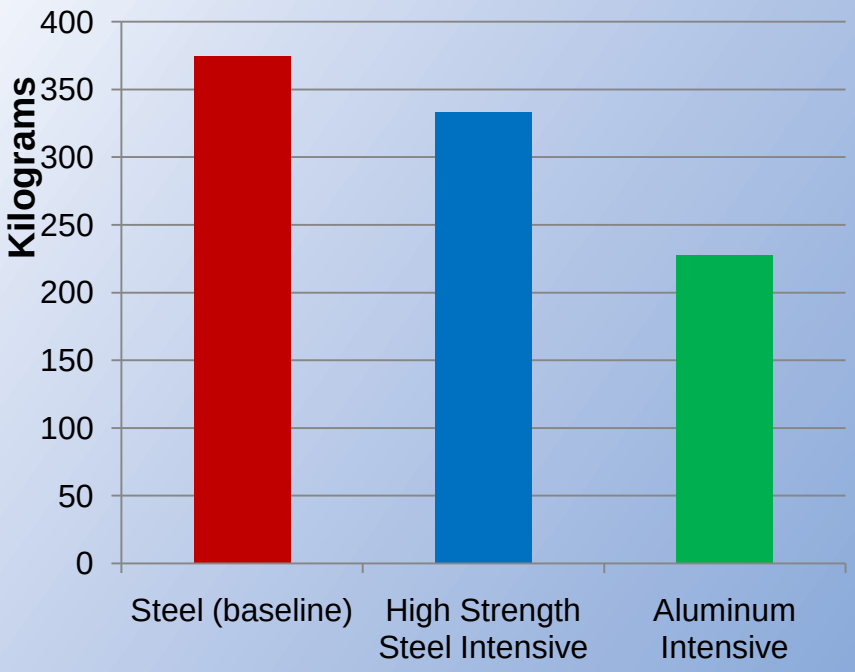
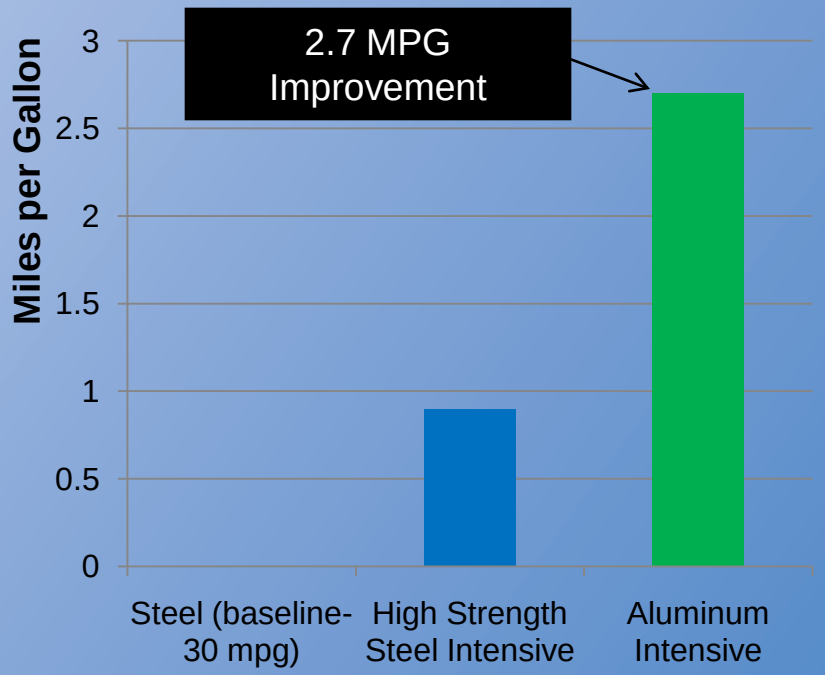
Weight Savings Translates to Fuel Economy Improvement

Mass of Body-in-White



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

Fuel Economy Improvement



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

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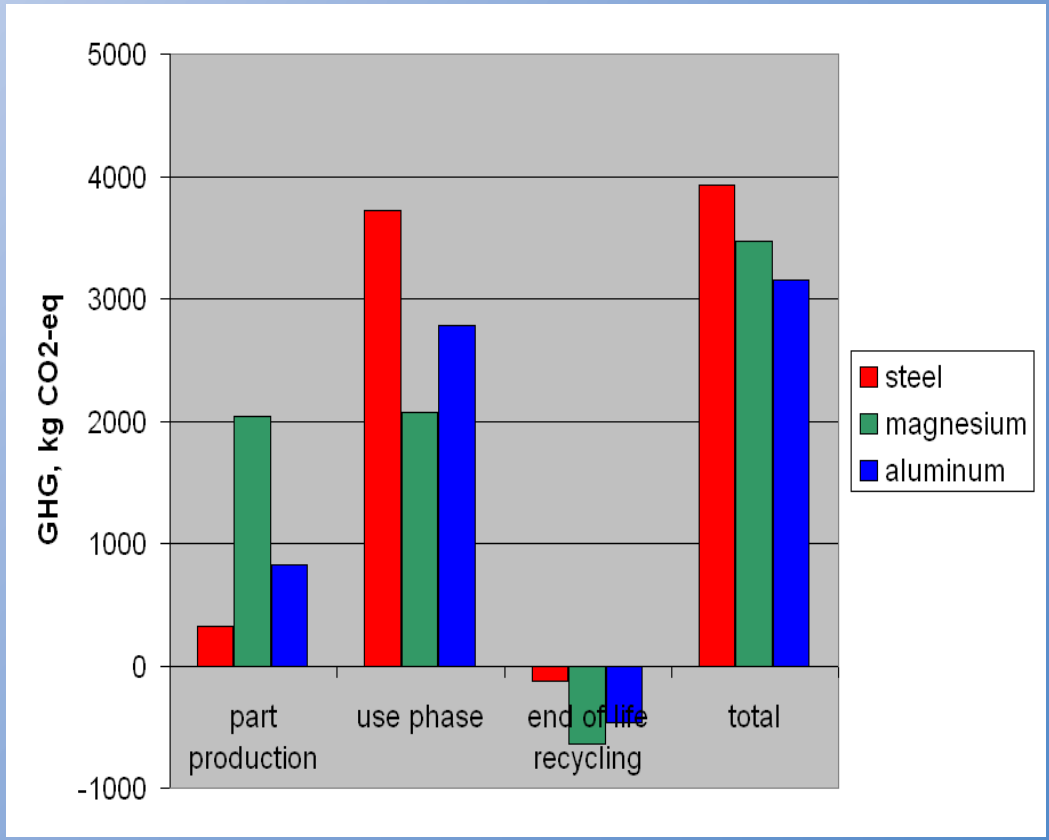
Greatest Potential with Smallest CO_2 Footprint

- The aluminum industry has cut greenhouse gas factory emissions per ton of aluminum produced by 30% since 1990, and aims to be carbon neutral by 2030
- Aluminum has lower life cycle CO_2 emissions than steel or high strength steel
- 20 lbs of CO_2 is saved for every pound used



Source: *Magnesium Industry Life Cycle Study*

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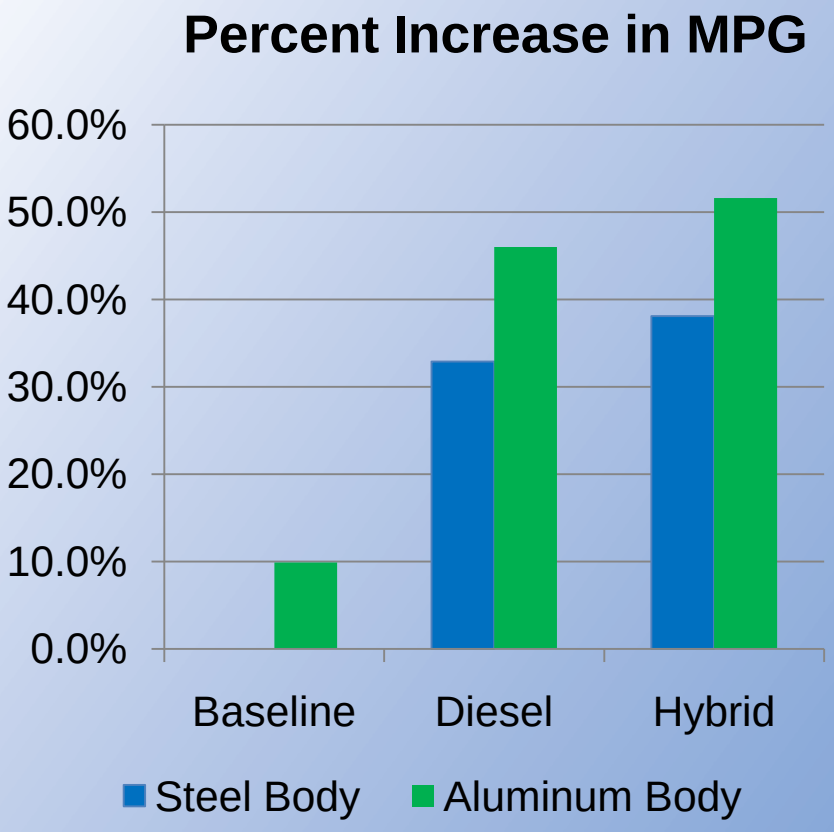
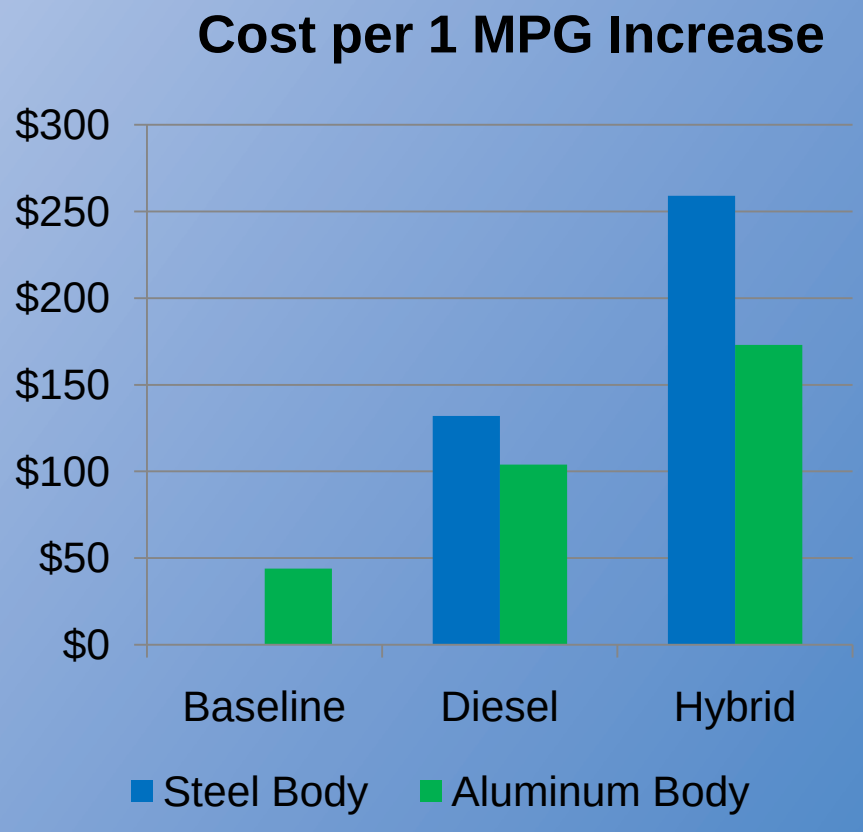
Down Weighting Creates Value for Alternative Powertrains





***Source**: IBIS Associates*

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PEV and PHEV Study

$3 Battery Cost Savings Per $1 Invested in Electric Vehicles

Objective:

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

Results:

- Reduced battery cost: **$900 - $1,950** (@ $750/KWh)
- EV weight reduction potential: **19%**
- 10% mass reduction: **4 - 6%** reduction in battery size
- Expected aluminum structure cost premium: **$630**

20% reduced vehicle mass yields a 20% range increase

***Source**: Ricardo*

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Time for Down Weighting is Now

- A necessity in the holistic approach to meeting U.S. and global regulations without sacrificing safety or functionality
- The only fuel saving technology that complements advanced powertrains
- Offers more CO_2 and fuel savings than other materials
- Transition can happen faster than alternative powertrain breakthroughs while preserving U.S. jobs

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Thank You

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