Automotive Aluminum – Part of the Solution

DRIVEALUMINUM

Automotive Megatrends USA
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Aluminum Transportation Group (ATG)

ALCOA

KAISER ALUMINUM

Novelis

ALUMINUM PRECISION PRODUCTS

Aleris

HYDRO

Rio Tinto Alcan

Pennex ALUMINUM COMPANY

sapa:

Aluminum – Part of the Solution

Discussion Outline

- Vehicle Efficiency Improvement Alternatives
- Aluminum Growth – 2025
- Aluminum Sheet Availability
- Questions

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Vehicle Efficiency Technologies (NAS)

36 Leading Technologies

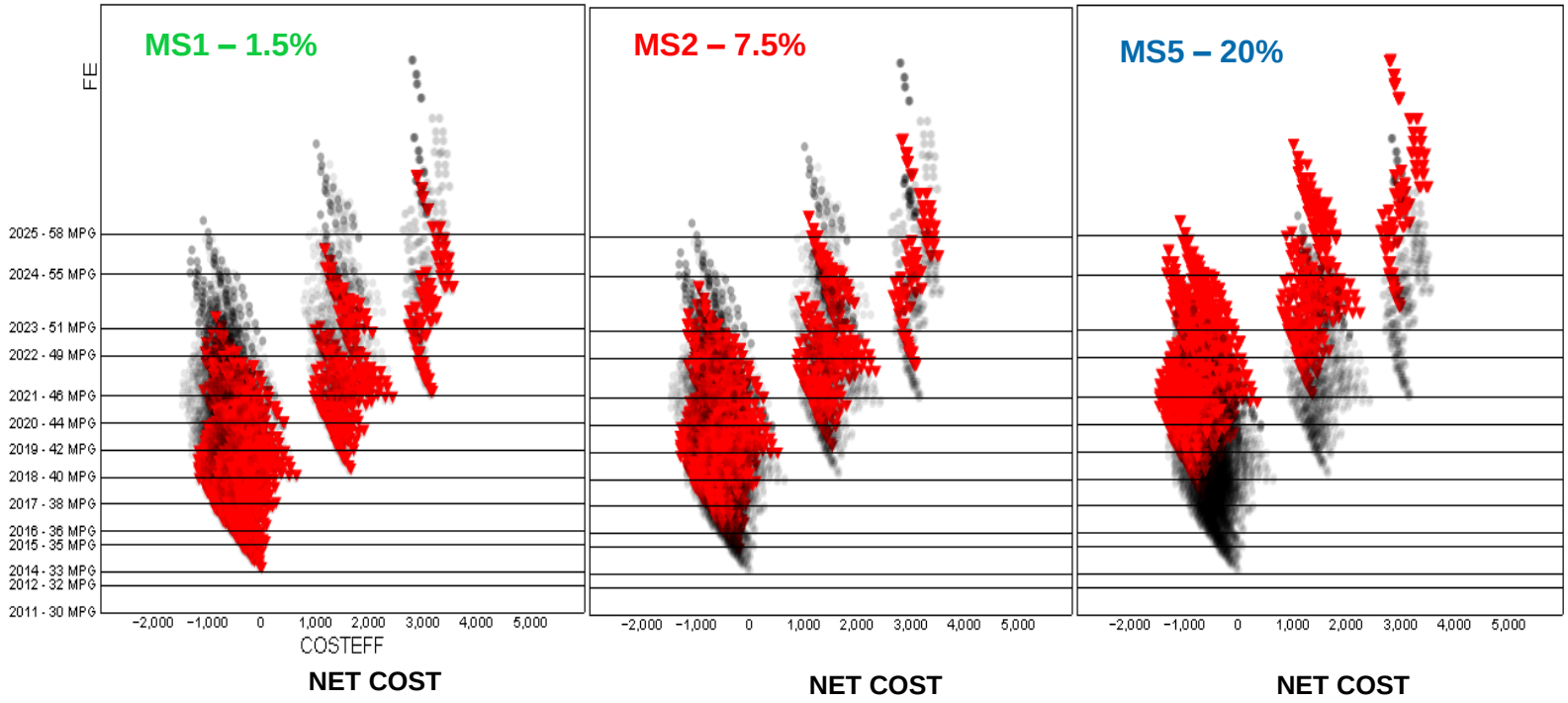
Technology Group	Group Members
Engine Technology Group (EngMod)	Low Friction Lubricants (LUB)
	Engine Friction Reduction (EFR)
	Variable Valve Timing type • VVT Coupled Cam Phasing on SOHC (CCPS) • VVT Couple Cam Phasing on OHV (CCPO) • VVT Intake Cam Phasing (ICP) • VVT Dual Cam Phasing (DCP)
	Cylinder Deactivation • on SOHC (DEACS) • on DOHC (DEACD) • on OHV (DEACO)
	Variable Value Lift & Timing • Discrete Variable Valve Lift [DVVL] on SOHC (DVVLS) • Discrete Variable Valve Lift [DVVL] on DOHC (DVVLD) • Continuously Variable Valve Lift (CVVL) • Discrete Variable Valve Lift [DVVL] on OHV (DVVLO)
	Conversion to DOHC with DCP (CDOHC)
	Stoichiometric Gasoline Direct Injection (SGDI)
	Combustion Restart (CBRST)
	Turbocharging and Downsizing (TRBDS)
	Exhaust Gas Recirculation [EGR] Boost (EGRB)
	Dieselization[3] (DSLC, DSLT)
Electrical Accessory Group (ELEC)	Electric Power Steering (EPS)
	Improved Accessories (IACC)
	12 Volt Micro-Hybrid (MHEV)
	Belt Mounted Starter Generator (BISG)
	Crank Mounted Integrated Starter Generator (CISG)
Transmission Technology Group (TrMod)	6-Speed Manual/Improved Internals (6MAN)
	Improved Auto. Transmission Controls/Externals (IATC)
	Continuously Variable Transmission (CVT)
	6/7/8 Speed Transmission With Improved Internals (NAUTO)
	Dual Clutch or Automated Manual Transmission (DCTAM)
Material Substitution Technology Group (MSM)	Mass Reduction 1.5% (MS1)
	Mass Reduction 3.5 – 8.5% (MS2)
Hybrid Technology Group	Power Split Hybrid (PSHEV)
(HEV)	2-Mode Hybrid (2MHEV)
	Plug-in Hybrid (PHEV)
Dynamic Load Reduction Technology Group (DLR)	Low Rolling Resistance Tires (ROLL)
	Low Drag Brakes (LDB)
	Secondary Axle Disconnect (SAXL)
Aerodynamic Reduction Technology Group (AERO)	Aerodynamic Drag Reduction (AERO)

Source: Seneria Inc.

Mass Reduction with Aluminum

Mass Reduction

- Part of optimum solution – all FE targets
- Higher FE targets – greater mass reduction



Source: Seneria Inc.

Why Automotive Aluminum?

Mass Reduction - Aluminum

1 Lb. Al replaces 1.5 - 2 Lb. Iron, Steel

Average vehicle:

Closures	24 – 120 Lbs.
BIW	350 – 450 Lbs.

OEM 2025 Mass Reduction Objectives (Re; 2012)

2025 vehicle average mass reduction: 300 - 400 Lbs.

FE: + 2 MPG

CO2: - 6.5 %

Other benefits of mass reduction

Safety, Emissions, Corrosion Resistance, Ride, Handling, Braking, NVH

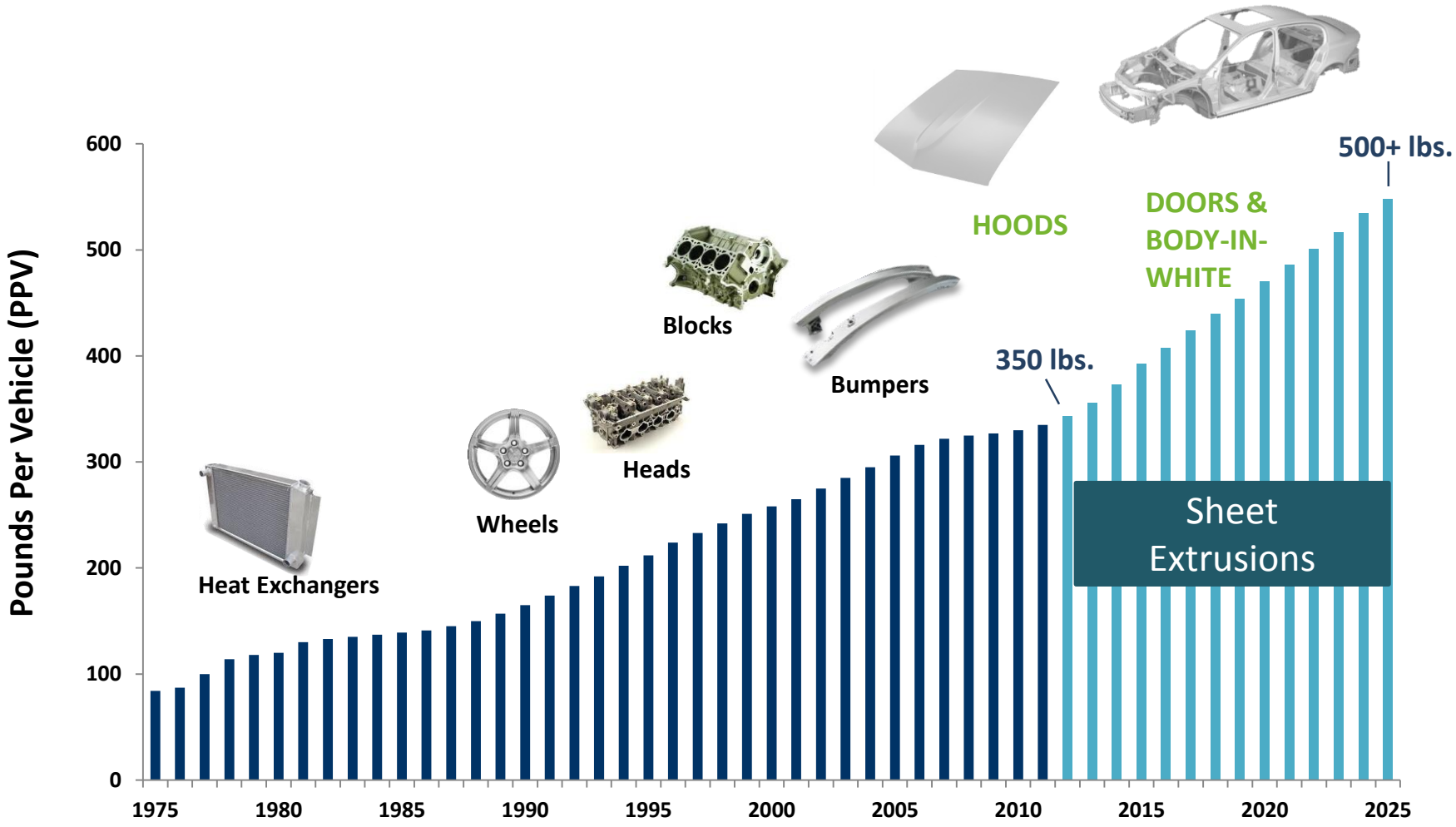
Cost Premium – Aluminum

Typical Net - $1/Lb. weight saved

Net of secondary savings (engine, wheels, tires, brakes)

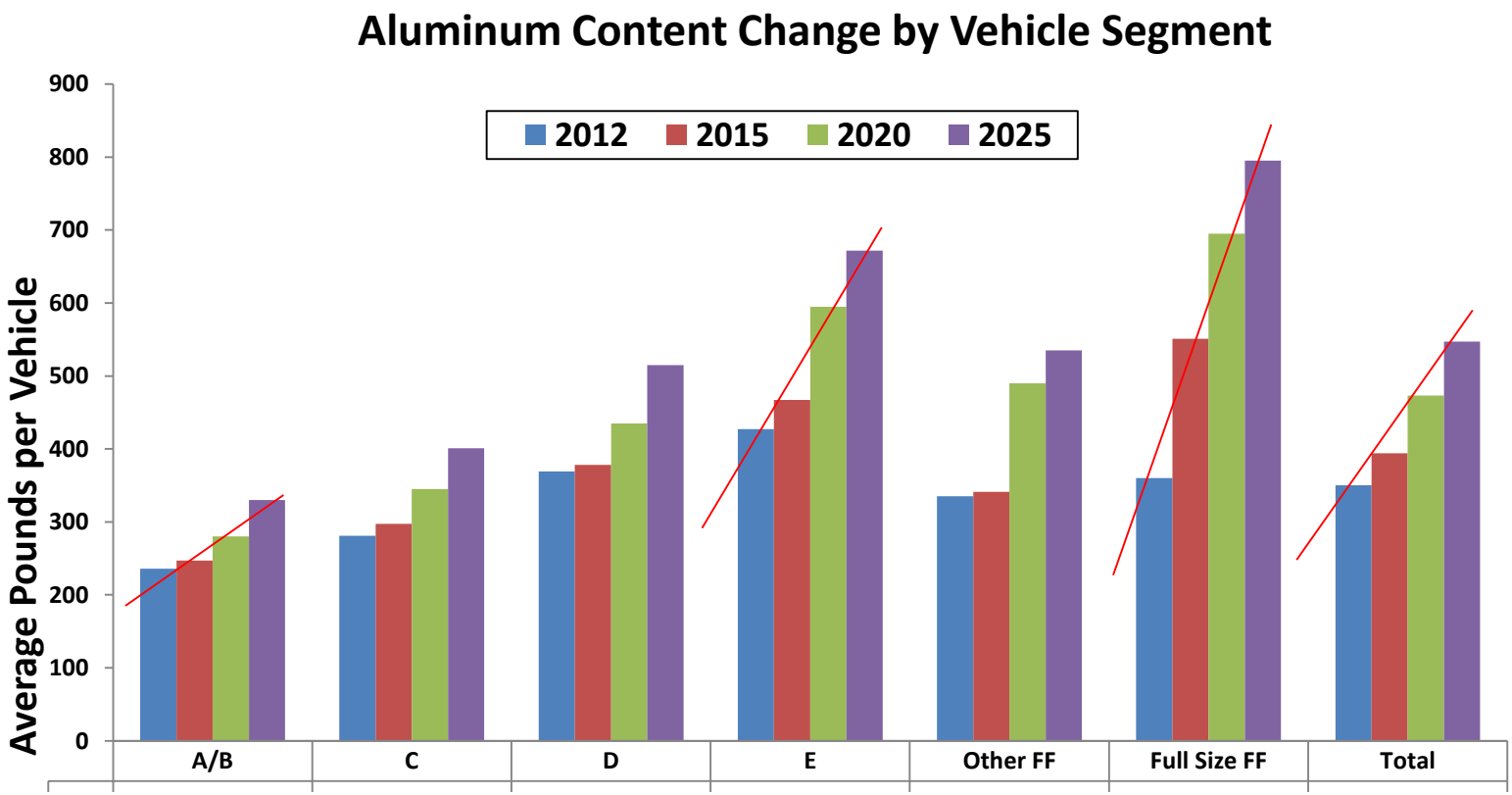
Closed loop recycling – down-stream process

50 Years of Automotive Aluminum Growth



Source: Ducker Worldwide

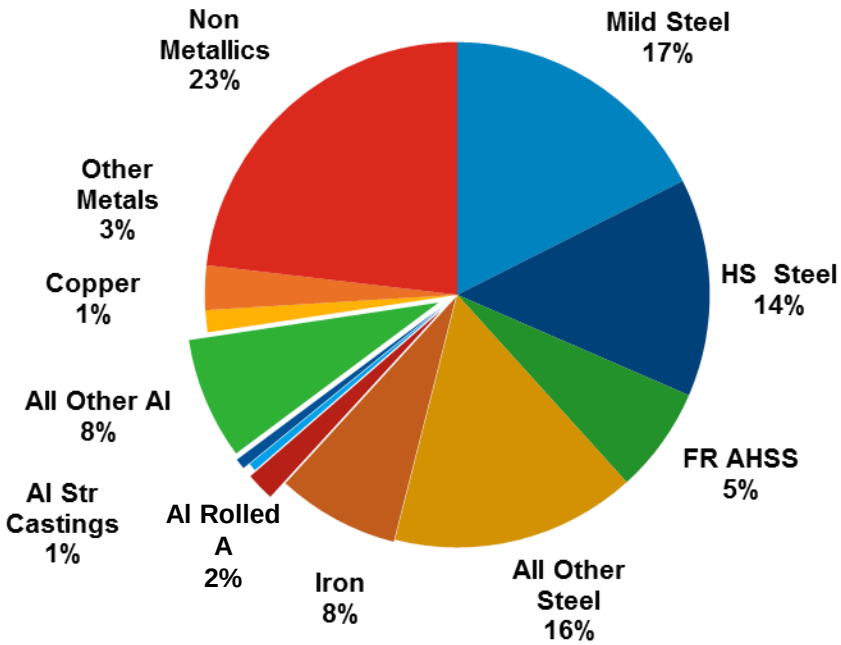
Vehicle Segment Analysis



Source: Ducker Worldwide

Automotive Material Distribution – 2015:2025

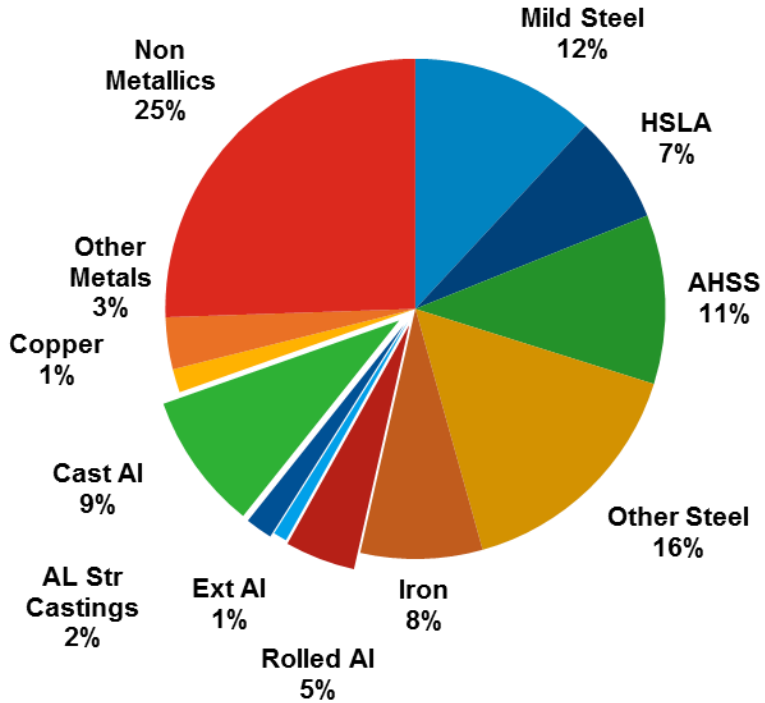
2015



Aluminum 10%

3700 lbs.

2025



3427 lbs.

Aluminum 16%

Source: Ducker Worldwide

Aluminum Auto Body Sheet Meets Demand

Auto Sheet Demand Growth (NAFTA) – 2015:2025

+ 4 B Lbs. Sheet

Aluminum Demand 2014

All markets, all forms	24 B Lbs.
Transportation	7.5 B
Sheet, Plate	10.6 B
Auto Body Sheet	0.3 B

Sheet, Plate Supply 2014

NAFTA Capacity	11 B Lbs.
Imports	2 B

Source: USGS Minerals Yearbook and Ducker Worldwide

Aluminum Availability – Body Sheet 2025

Market Growth - supported by primary production

Primary Aluminum Production:

Processes: mine, refine, smelt

Global demand (2014)	**105 B Lbs.**	
Global capacity (2014)	**145 B**	**(idle: 12 B)**

Roll (NAFTA cast, hot roll, cold roll)

2025 demand	**14.6 B Lbs.**
2014 capacity + imports	**13.0 B**
2025 Short	**1.6 B**

Finishing NAFTA Body Sheet (level, heat treat, coating)

2025 demand	**4.0 B Lbs.**	
2014 capacity	**1.1 B**	**(2014: + 0.7 B)**
2025 Short	**2.9 B**	

Source: USGS Minerals Yearbook and Ducker Worldwide

Aluminum – Automotive Sheet Commitments

Company	Operational	Capacity (Lbs.)	Accum.
Novelis	2015	0.2 B	0.2 B
Alcoa	2015	0.2 B	0.4 B
Alcoa	2015	0.3 B	0.7 B
Constellium	2016	0.2 B	0.9 B
Aleris	2017	0.5 B	1.4 B
Constellium	2018	0.2 B	1.6 B
ASA	TBD	1.2 B	2.8 B
Kobe Steel	TBD	0.3 B	3.1 B

Note: As of February 2015
All new US capacity
Capacity lead time: 3 years

Source: Pacific Coast Research

Automotive Aluminum Joining Manual

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Automotive Aluminum Joining Manual - January 2015

Chapters:

- Introduction to Joining
- Fusion welding
- Arc welding
- Beam welding
- Resistance welding
- Brazing
- Solid state welding
- Mechanical joining
- Adhesive joining
- Hybrid joining techniques
- Joining of dissimilar materials

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