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Presentation

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Lightweighting –
Integral to Future Compliance

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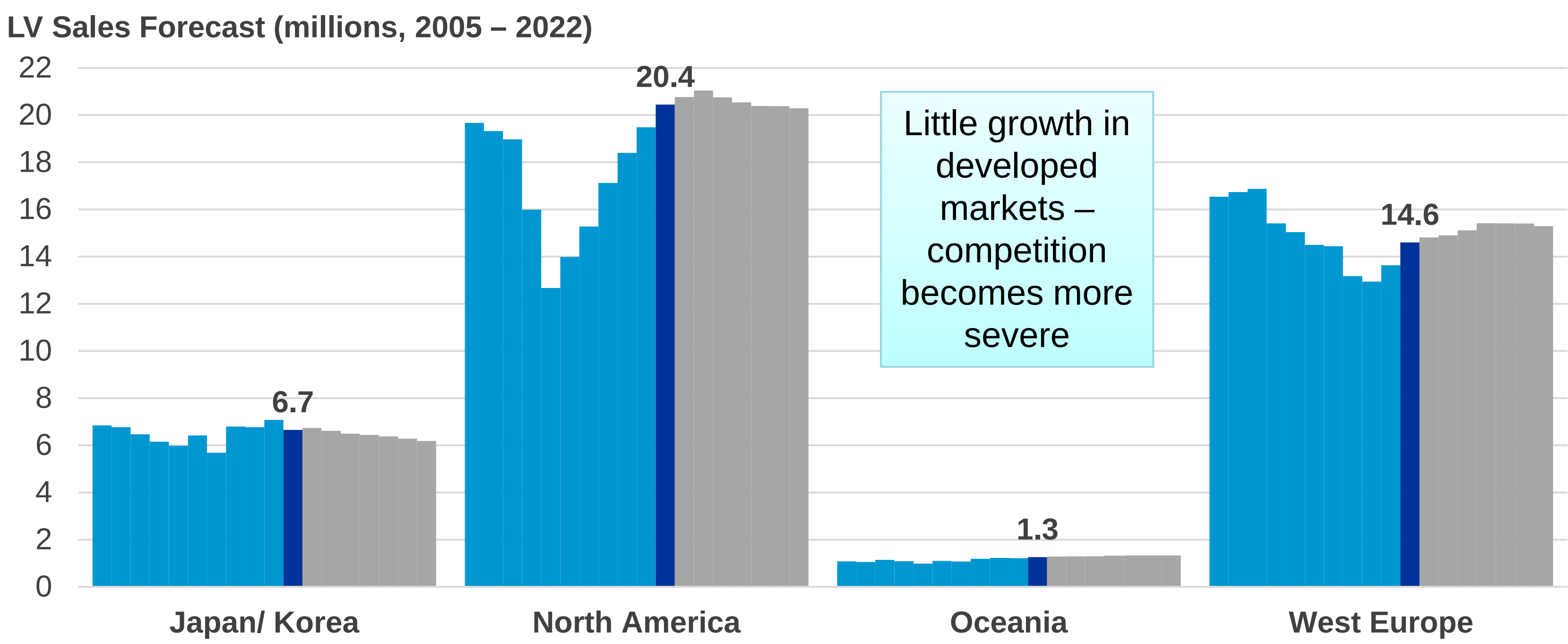
Contents

- **Setting The Stage**
- A Decade of Structural Change
- BIW Material Shifts

Mature Markets LV Sales Forecast

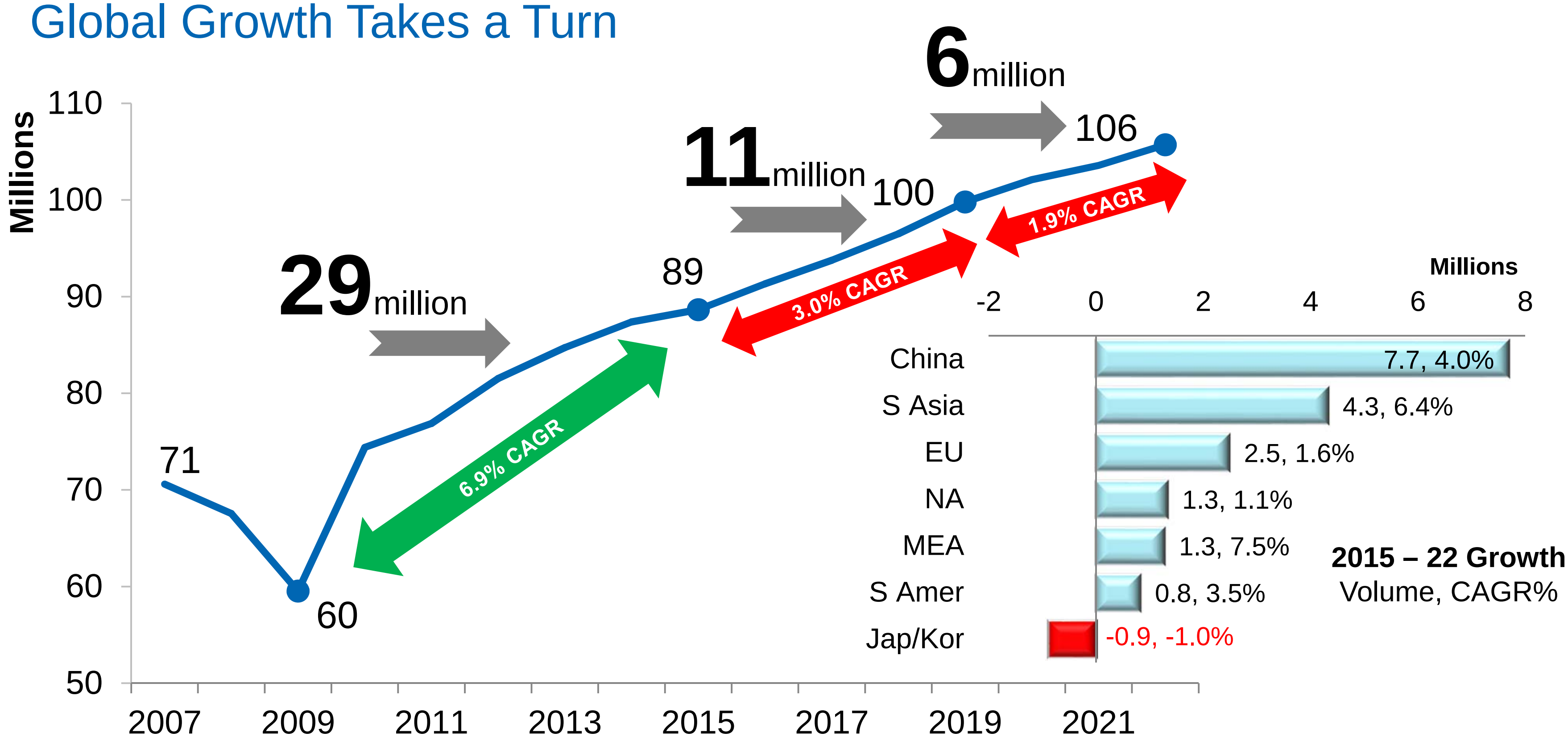
Replacement demand is key driver – loyalty critical to OEMs



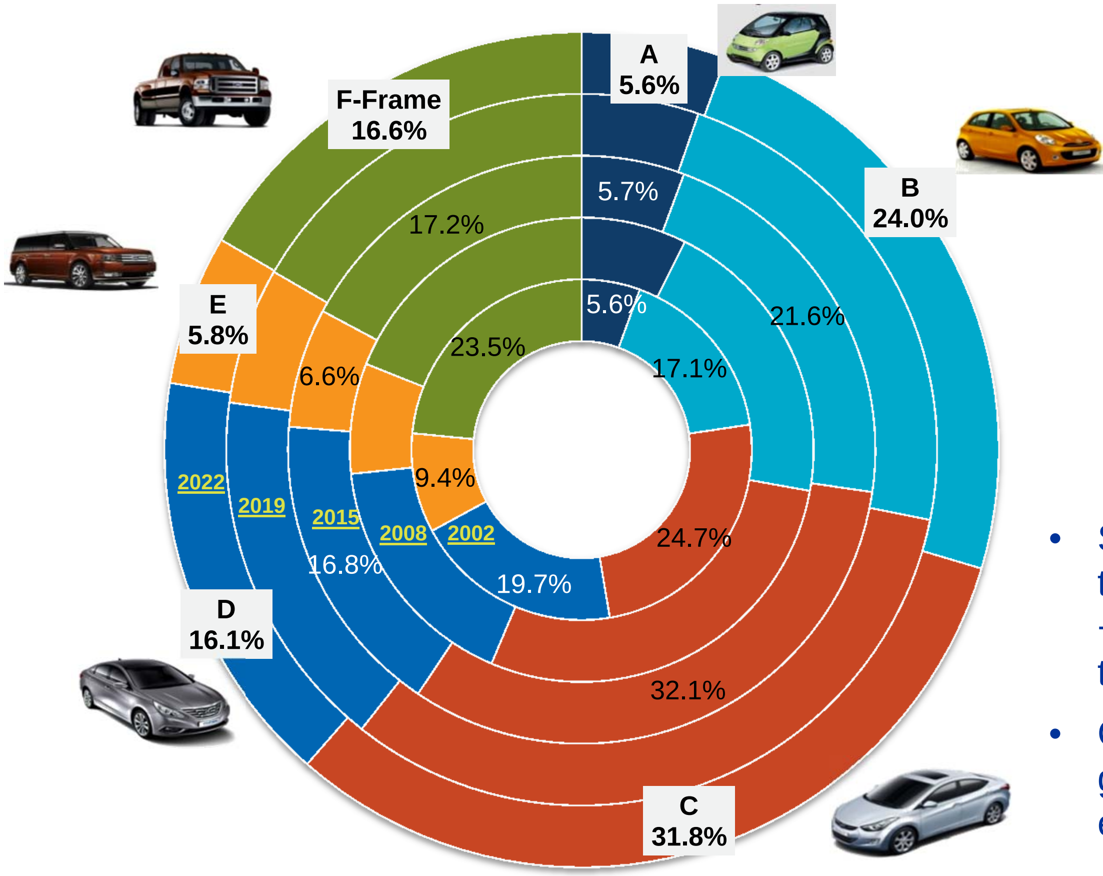
Source: IHS Automotive

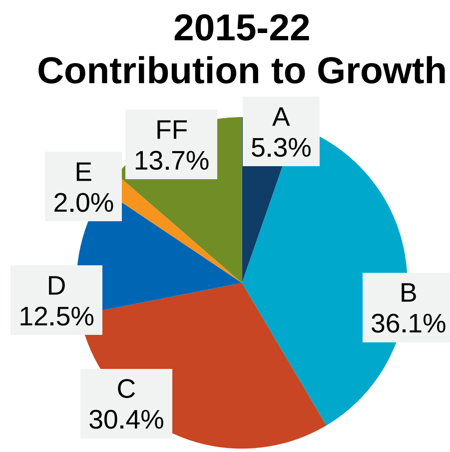
Global Light Vehicle Production

Global Growth Takes a Turn



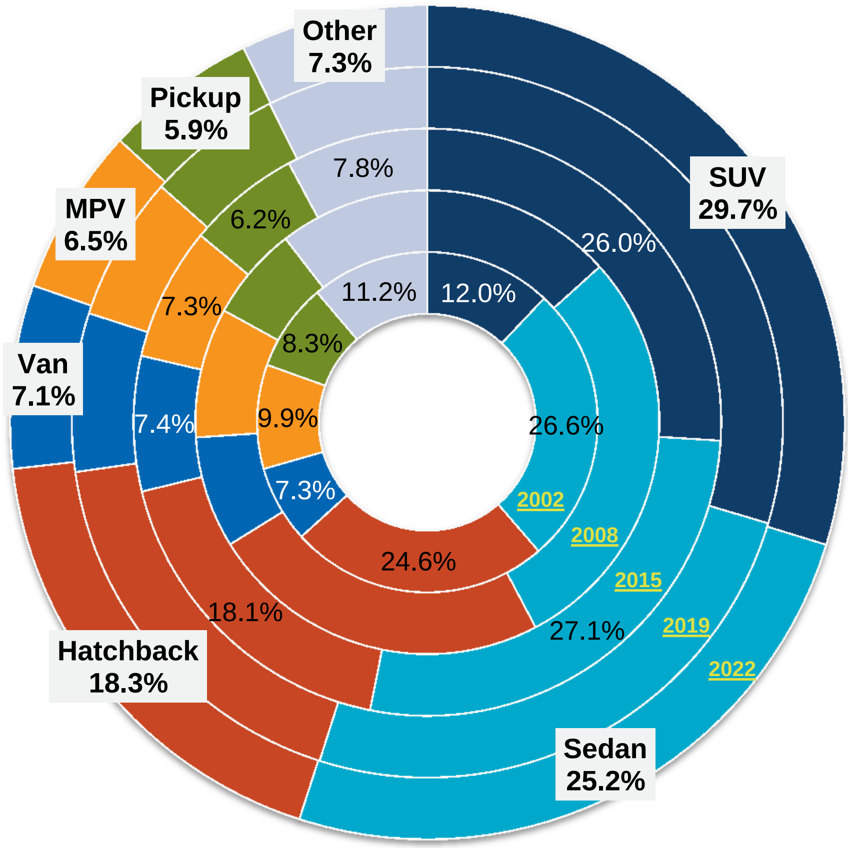
Global Production by Global Segment



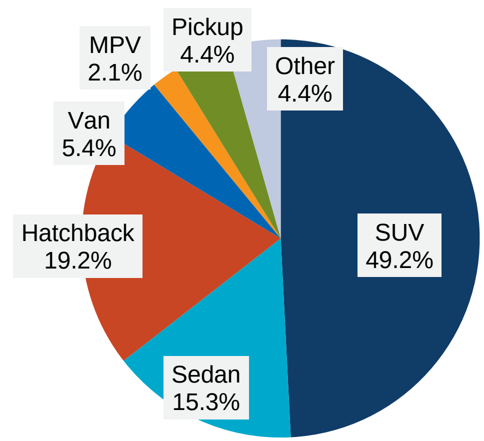


- Shift to global structures within B through D segments is apparent at +72% of global volume with contribution to growth of +79% through 2022
- Growth in China, India and NA fed from global B & C segment structures = enhanced scale economies

Global Production by Bodytype



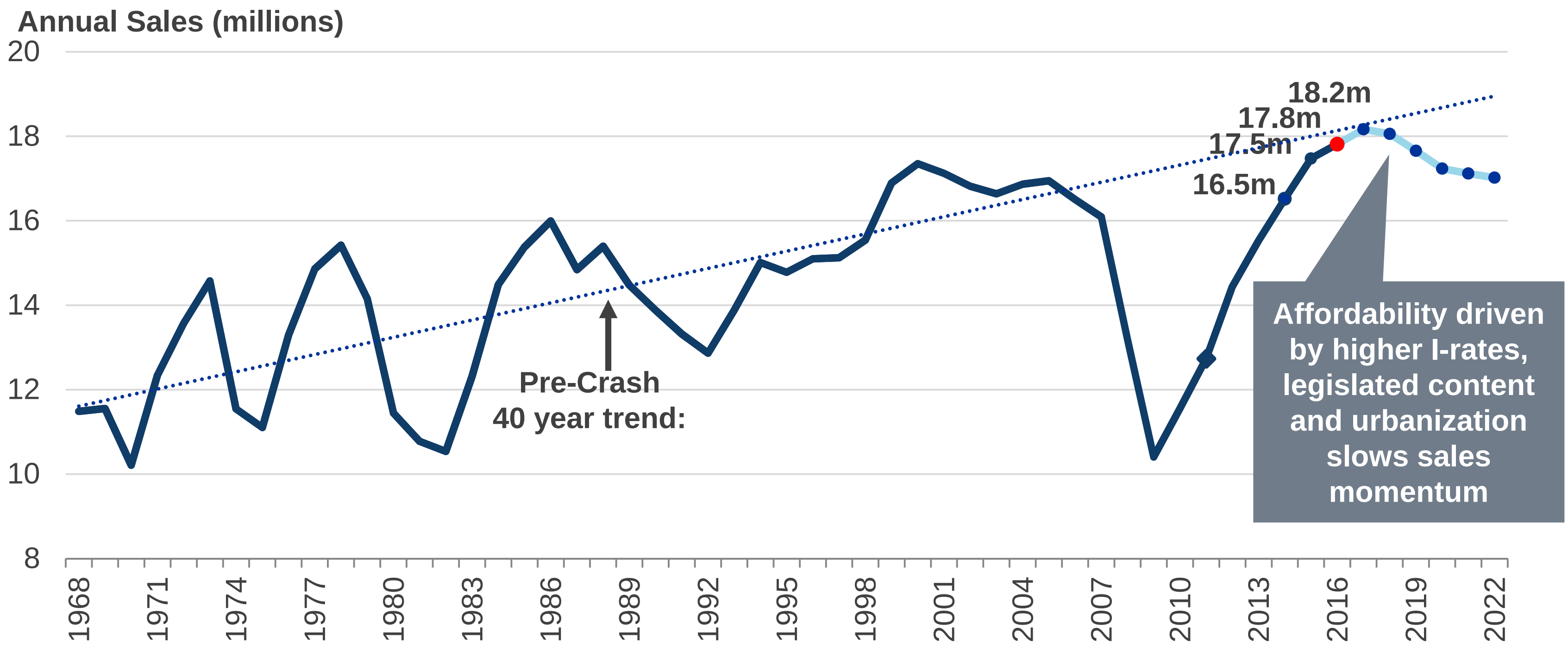
2015-22 Contribution to Growth



- SUV has doubled since 2002 to be the predominant bodytype – global platforms

US: Light Vehicle Sales Forecast

Sales peak approaching; return to previous long-term trend level possible



Source: IHS Automotive, current light vehicles sales forecast

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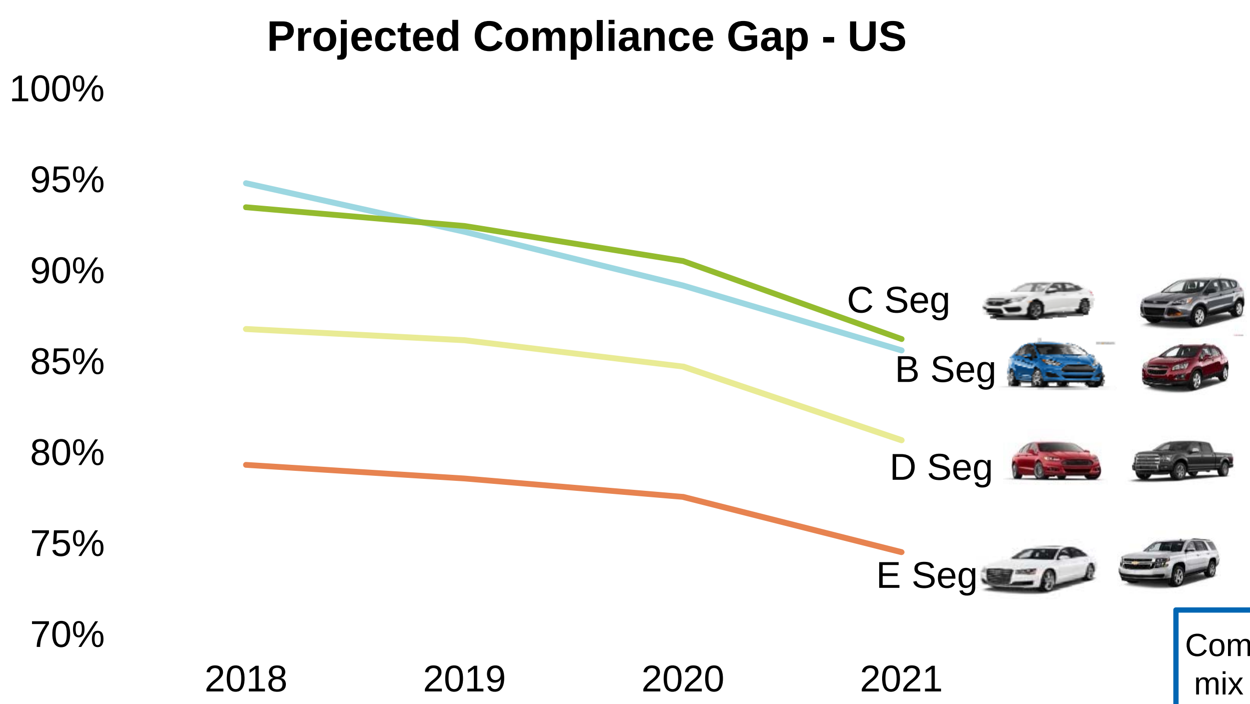
Compliance Gaps Emerge

Without New Technologies, OEMs Will Not Comply



- Extreme focus on larger offerings with substantial gaps
- OEMs will require several costly technologies to comply into the next decade
- Powertrain, Efficiencies, Lightweighting then Electrification

Compliance Gap is expected powertrain mix without incremental technologies – lightweighting, electrification etc.

Note: Global Sales Segment

Three Disruptive Realities

Industry Participants Adapt *or Die ….*

Electrif-ication

- S/S >> Plug-in Mild Hybrid >> Full Hybrid >> BEV
- Enablers – Legislation, 48V, mass reduction
- Implementation depends on segment, geography, scale, infrastructure and customer purchase capability
- How does the ICE and accessories adapt through this process? What about transmissions and driveline?

Automated Driving

- Speed of implementation depends more on legislation versus technical capability
- Several disruptors enter with little patience for automotive timelines, processes and structure
- Will the lack of driver intervention alter content and structure of the powertrain?
- Areas of the vehicle materially altered by automated driving: Interior, Powertrain, Electrical & Chassis

Shared Mobility & Connected Car

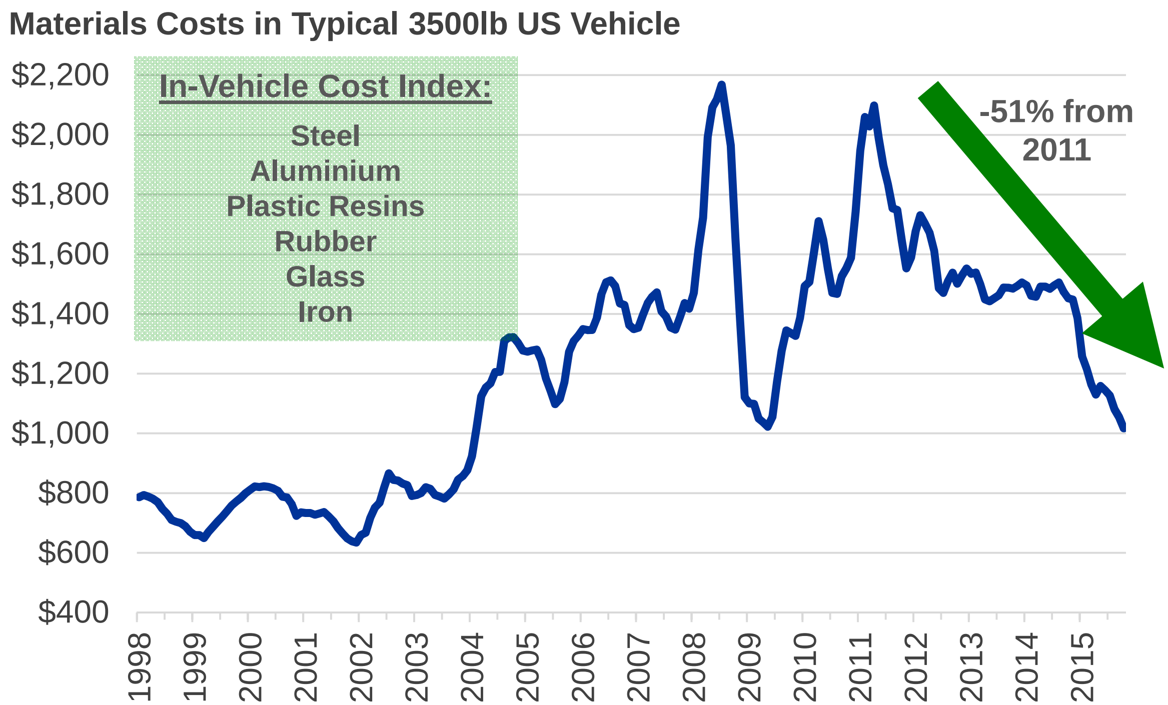
- New generations live in a more global, urban and environmentally-friendly world
- Ride sharing and reduced/limited driver input changes ownership, maintenance and use structures
- Impact on municipalities, healthcare, dealer/service infrastructure, need for a license
- How does shared mobility alter the vehicle cycle, supply base, insurance, aftermarket and safety?

What timeline is your organization expecting? What are the optimal strategies?

2015-2020	2020-2025	2025+
•PHEVs •Level 2 >> 3 Driving •Uber/Lyft	•Increased Electrification •Level 3 >> 4	•BEVs & Infrastructure •Level 3&4 >>> 5

World: Automotive Materials Cost Index

Falling commodity prices reducing production costs – profit margins strengthen for now



Impending Cost Cliff?

- Rise of lightweighting raises material, joining and capital costs
- Electrification drives battery, motor and control costs
- Faster cadence reduces amortization schedules
- Safety regulations are not abating
- Increased demand for ADAS, infotainment and connectivity content

Source: IHS Automotive Material Cost Index of combined commodities, monthly data

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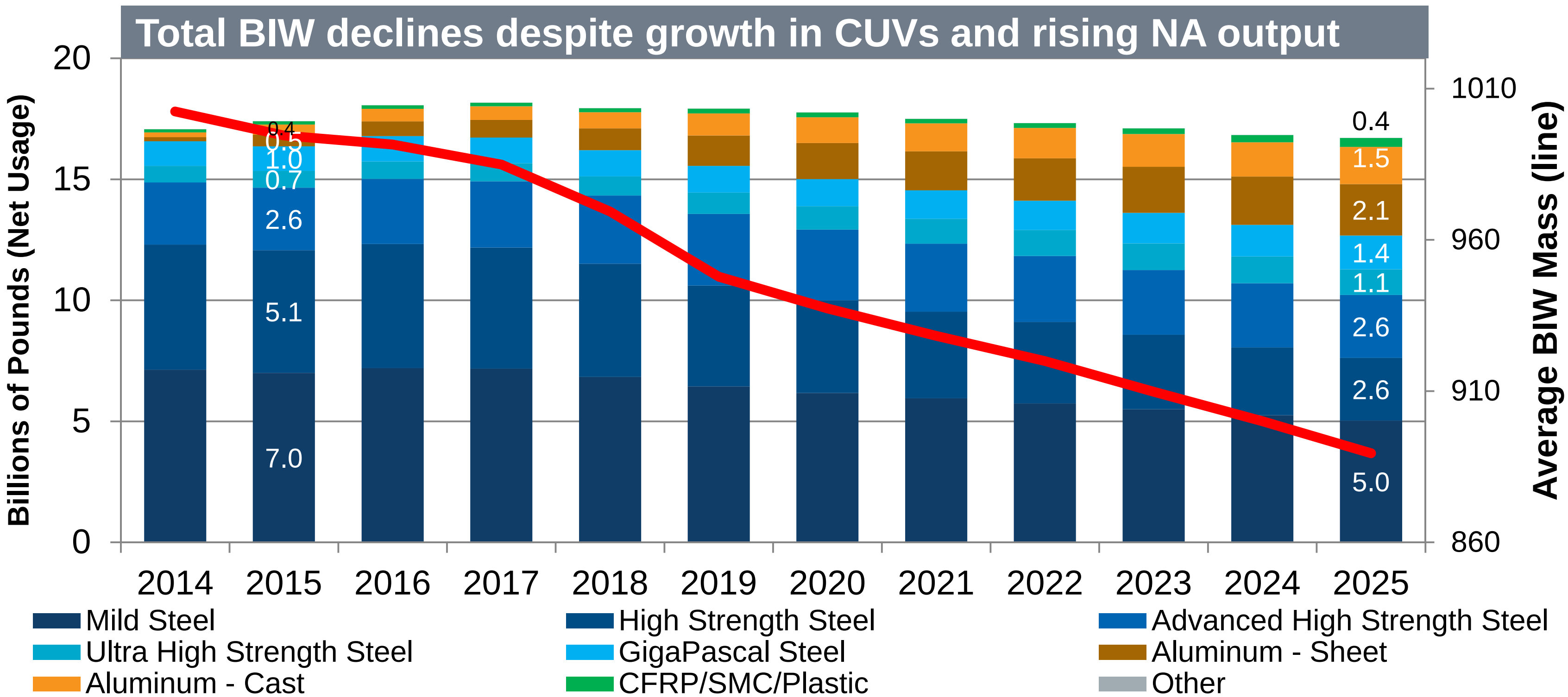
Material Change Priority by System/Location in BIW

- Dependent upon OEM, Segment, Cost/Availability & Compliance Gap
  - Material Shift by importance Assumptions (By Segment)
    - Hood
    - Decklid
    - Closures
    - Fenders
    - Shock towers
    - Crossmembers, rockers, rad supports, tunnels & pillars
    - Apertures (Mixed Materials)
    - BIW bodies (Mixed Materials)

Source: Honda

BIW Structure (Above)
IHS BIW analysis also includes hood, fenders, closures, roof and decklids

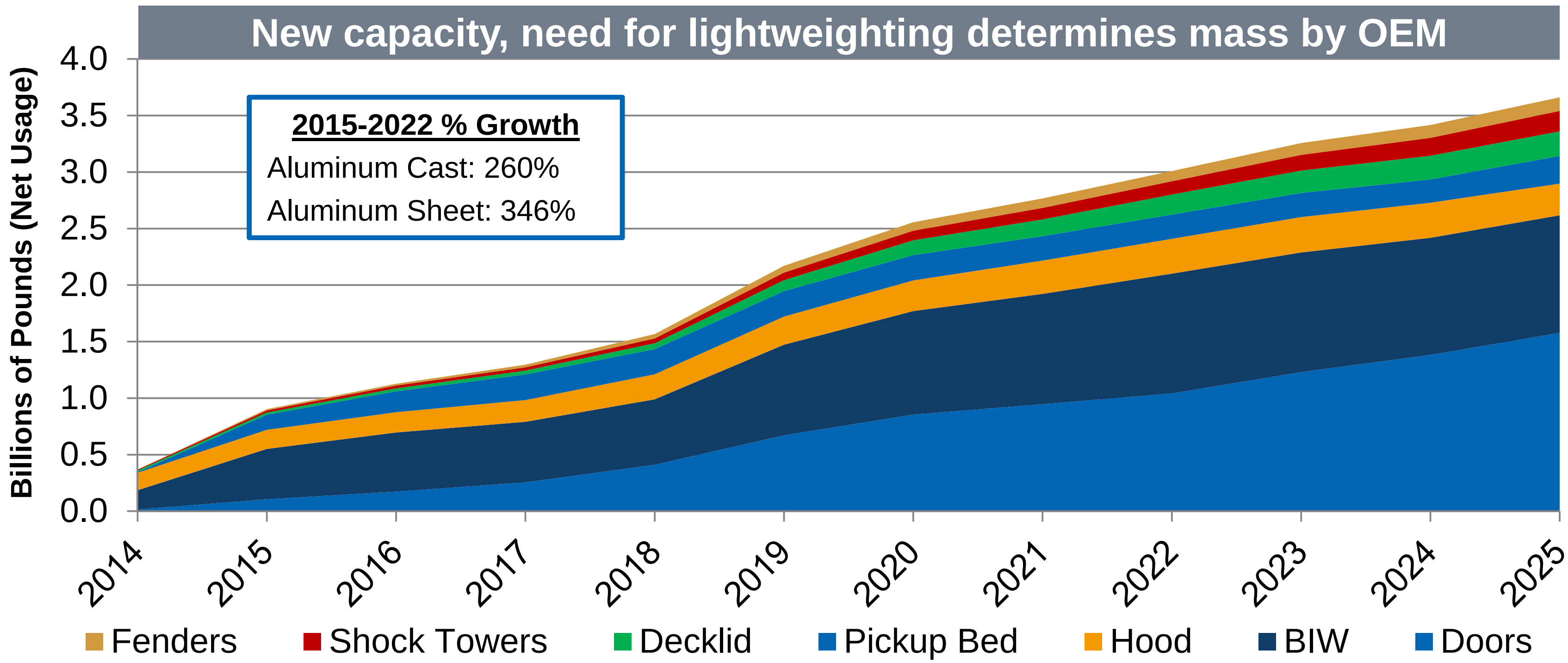
Material Forecast Analysis
Total NA LV Industry By Pounds



Source: April 2016 Material Forecast

Material Forecast Analysis

Aluminum Sheet & Cast/Extrusions by Component



- Closures (Hood, Decklid, Doors) accounts for over 55% of all Aluminum volume by 2025

Source: April 2016 Material Forecast

Summary

- Nearing the end of the current sales cycle though NA production is bolstered by import substitution and export growth.
- Several factors will lead to impending cost pressures – how the industry adapts to new tradeoffs and competitive pressures will determine success.
- Body-in-white (BIW) structures will significantly alter during the coming decade, depending upon segment, region, cost and other factors.
- While aluminum sheet will gain in utilization - first in mature vehicle markets with aggressive legislation, aluminum cast/extrusions will rise to replace steel in engine structure and applications.
- Material adoption will be transitionary; compliance requirements, capital structures, competitive realities, I/P and supplier relationships will all be critical.

Suppliers need to adopt a proactive stance to planning.