IHS Markit™

At a Plateau?

Adapting to an ever-changing light vehicle market …

Federal Reserve Bank of Chicago – December 2, 2016

Michael Robinet, Managing Director, Automotive Advisory Solutions

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- Structural Factors Alter an Industry
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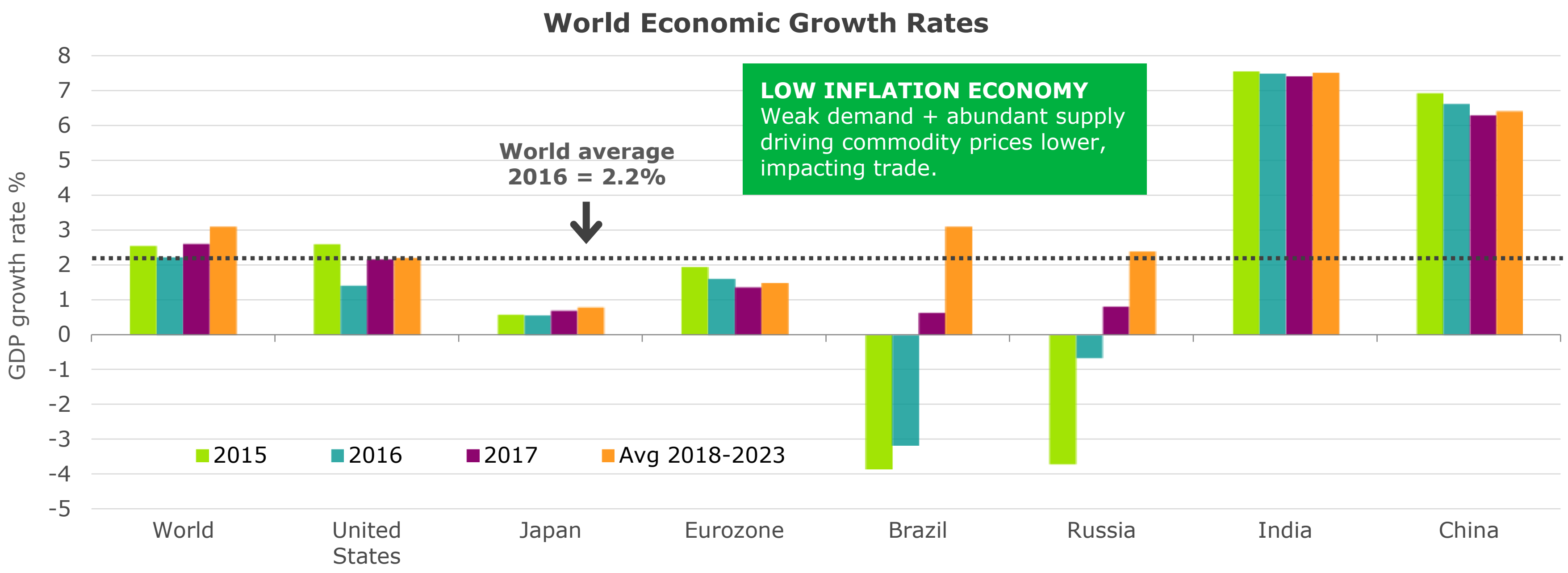
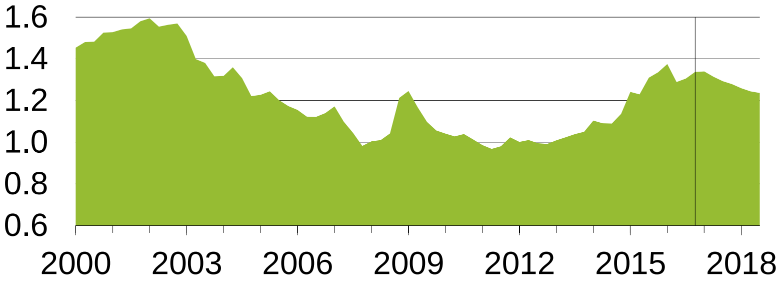
Global growth is expected to rise in 2017 as US/EU economies strengthen and Brazil/Russia start recovery



Source: IHS Markit

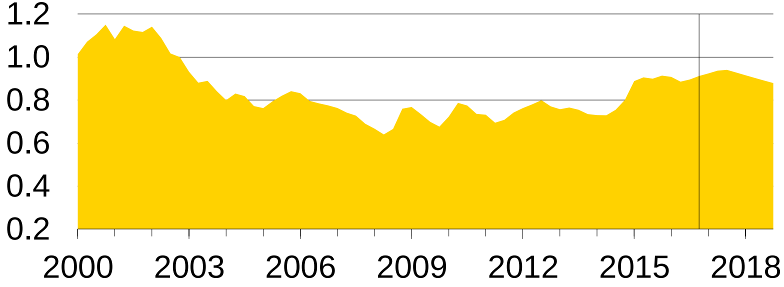
Exchange rates per US dollar

Canadian dollar



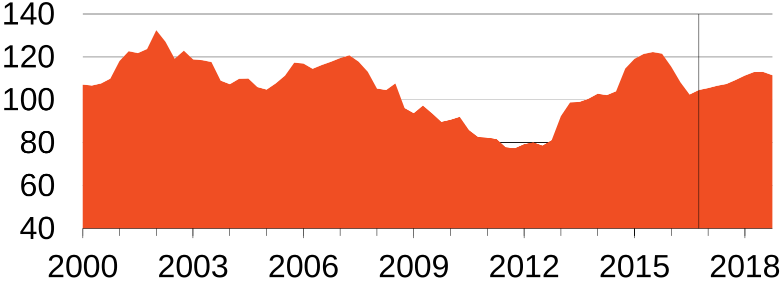
Source: IHS Markit © 2016 IHS Markit

Euro



Source: IHS Markit © 2016 IHS Markit

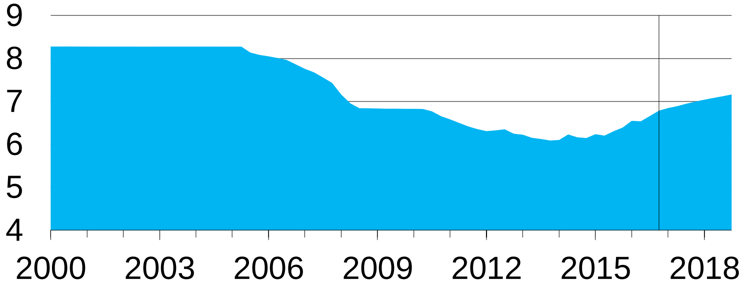
Japanese yen



Source: IHS Markit © 2016 IHS Markit

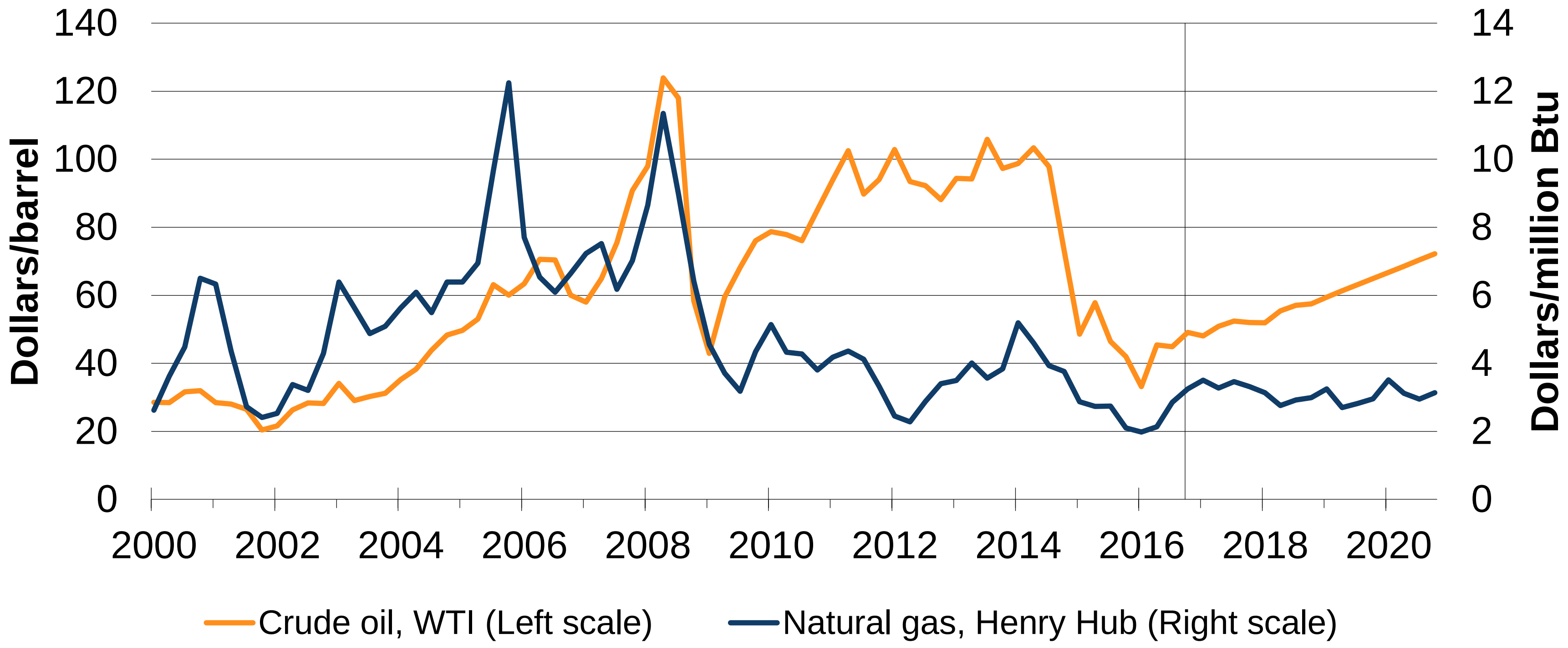
Quarterly averages

Chinese renminbi



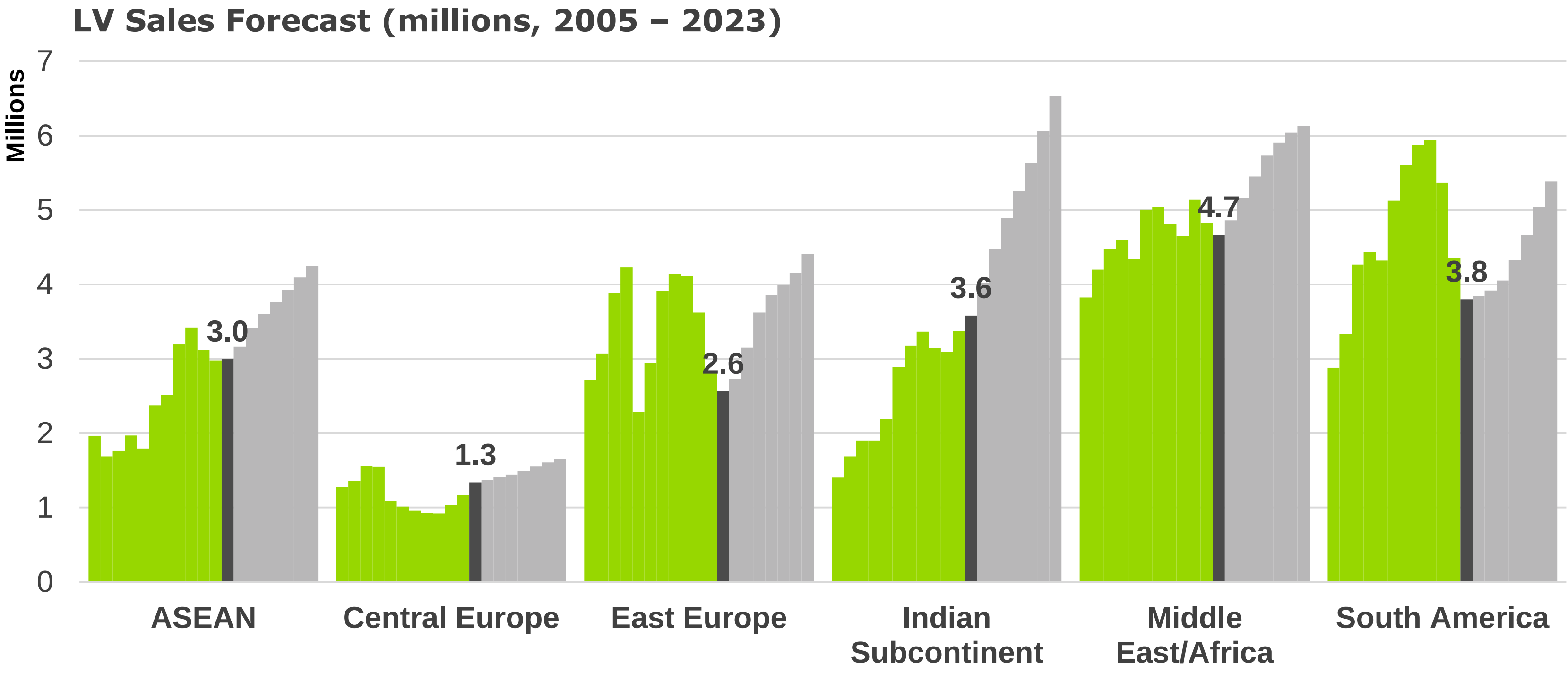
Source: IHS Markit © 2016 IHS Markit

US crude oil prices and natural gas prices



Emerging Markets LV Sales Forecast

Recent declines only temporary – fundamentals remain positive

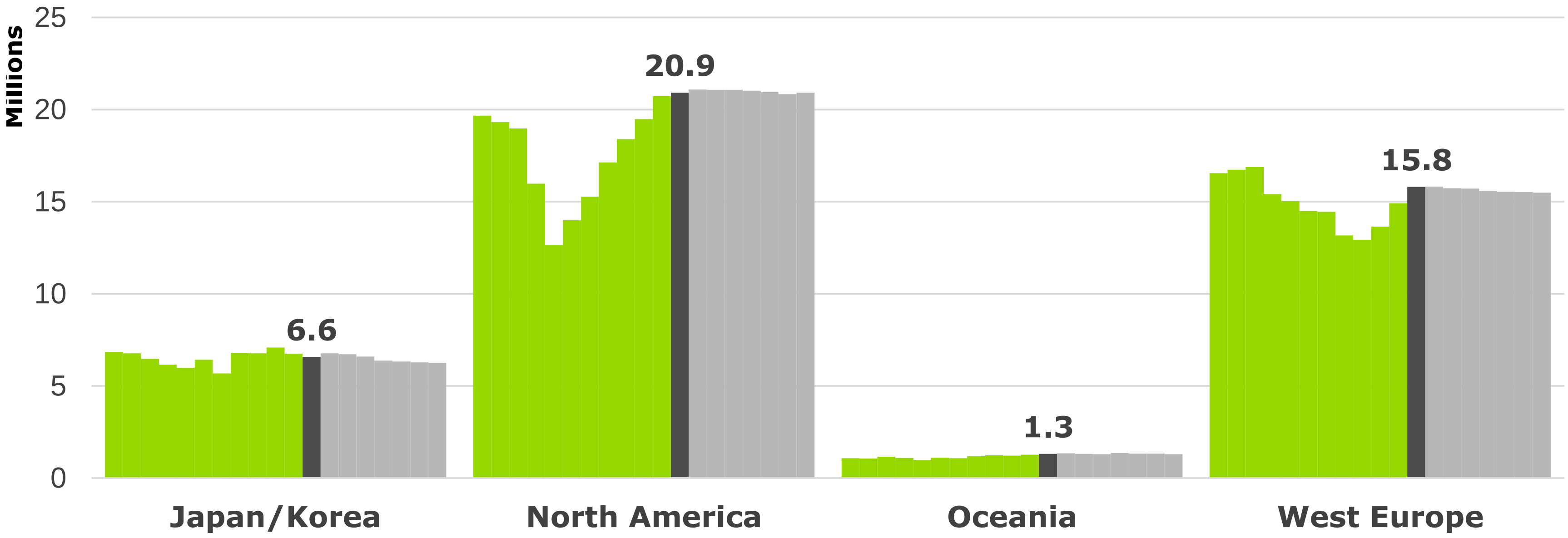


Source: IHS Automotive

Mature Markets LV Sales Forecast

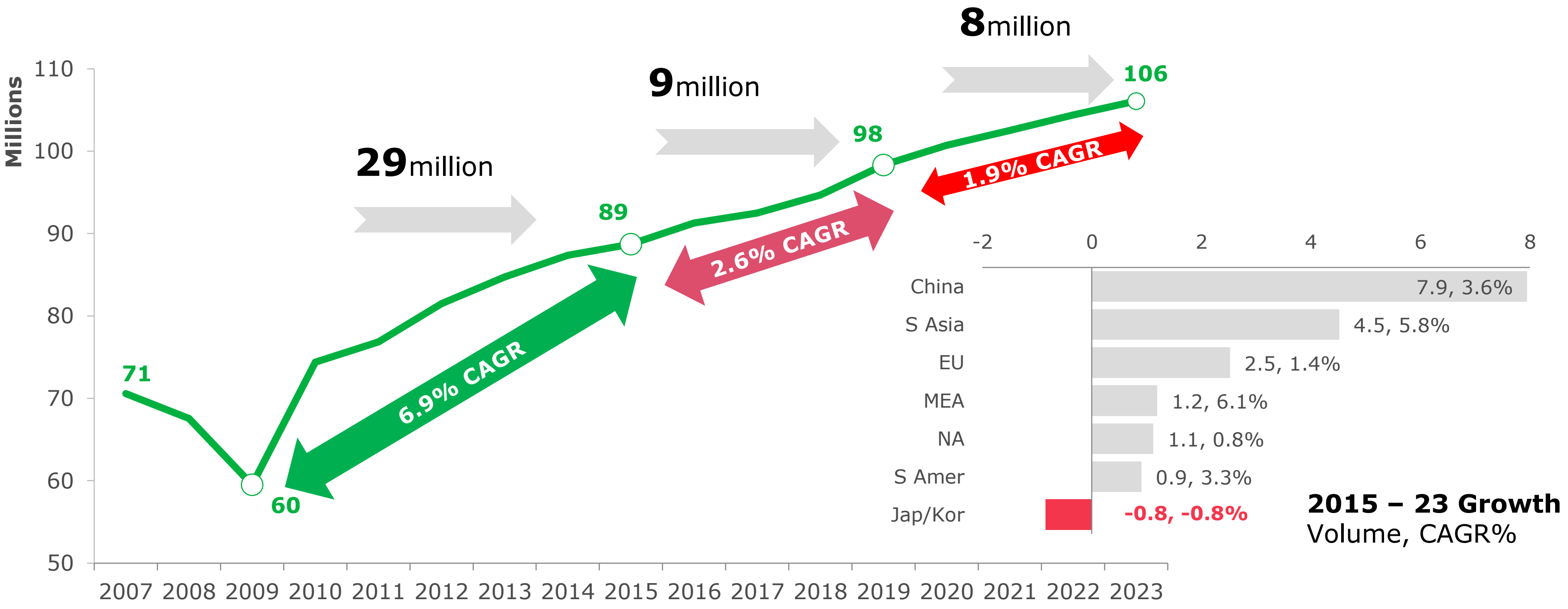
Replacement demand is key driver – loyalty critical to OEMs

LV Sales Forecast (millions, 2005 – 2023)



Source: IHS Automotive

Global Light Vehicle Production
Growth Ratchets Down a Gear

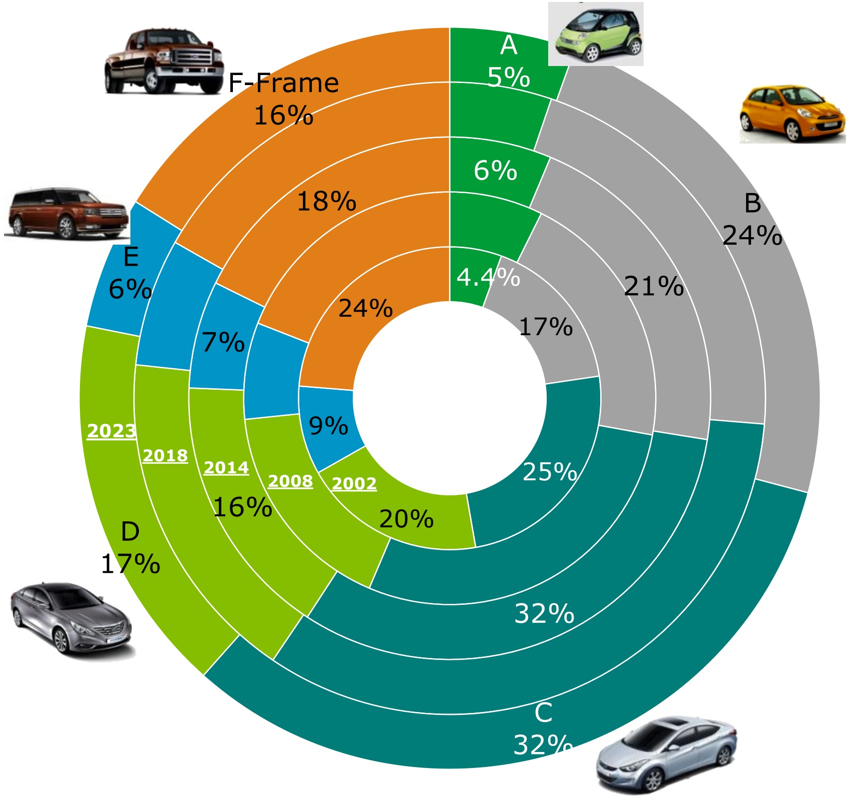


Global LV Production Outlook
Over 70% of Total Growth From Asia

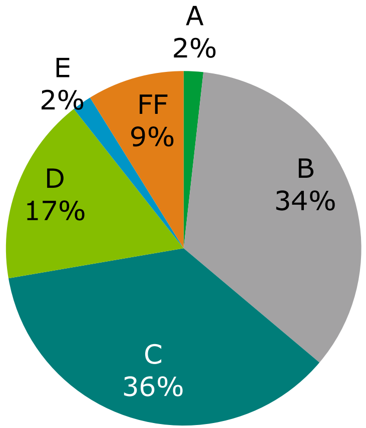
Region	2015	2016	2017	2018	2023	CAGR 2016-23	CTG 2016-23	Notes
China	24.0	25.8	26.1	26.8	32.2	3.2%	**42%**	• Tier 3 & 4 city growth
Europe	20.9	21.5	21.8	22.2	23.5	1.3%	13%	• Slow rebound of Russia and shift from West EU
NA	17.5	17.9	18.0	18.2	18.6	0.6%	5%	• New capacity (Mex), D3 re-alignment
South Asia	8.0	8.2	8.7	9.3	12.6	6.3%	**29%**	• India domestic & export, ASEAN rise
Japan/Korea	13.3	13.0	13.2	13.0	12.6	-0.4%	-3%	• Slow domestic mkts, production co-location
South America	3.1	2.7	2.7	2.8	3.9	5.2%	8%	• Well below 2013 record of 4.5 mil
Middle East/Africa	2.0	2.3	2.4	2.6	3.2	4.7%	6%	• Focus of more attention by OEMs
Total	**88.7**	**91.4**	**92.8**	**94.7**	**106.5**	**2.2%**		

CAGR = Compound Annual Growth Rate, CTG – Contribution to Growth

Global Production by Global Segment



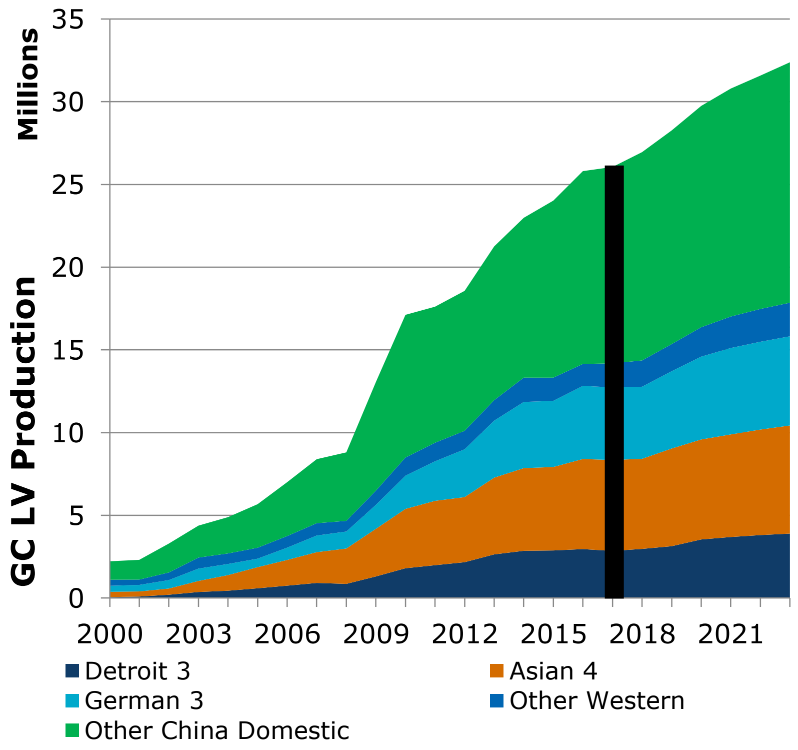
2014-23
Growth Share

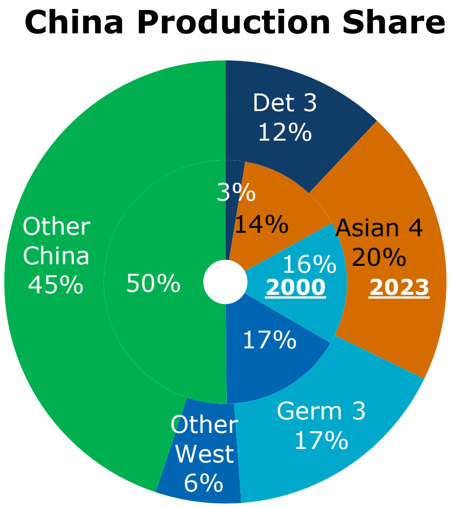


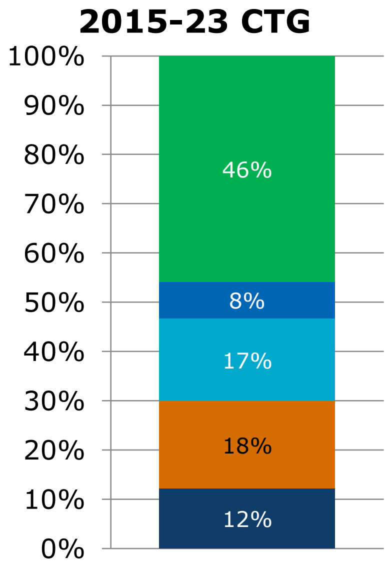
Shift to global structures within B through D segments is apparent at ~70% of global volume

Growth in China, India and NA fed from global B & C segment structures = enhanced scale economies

Greater China Production

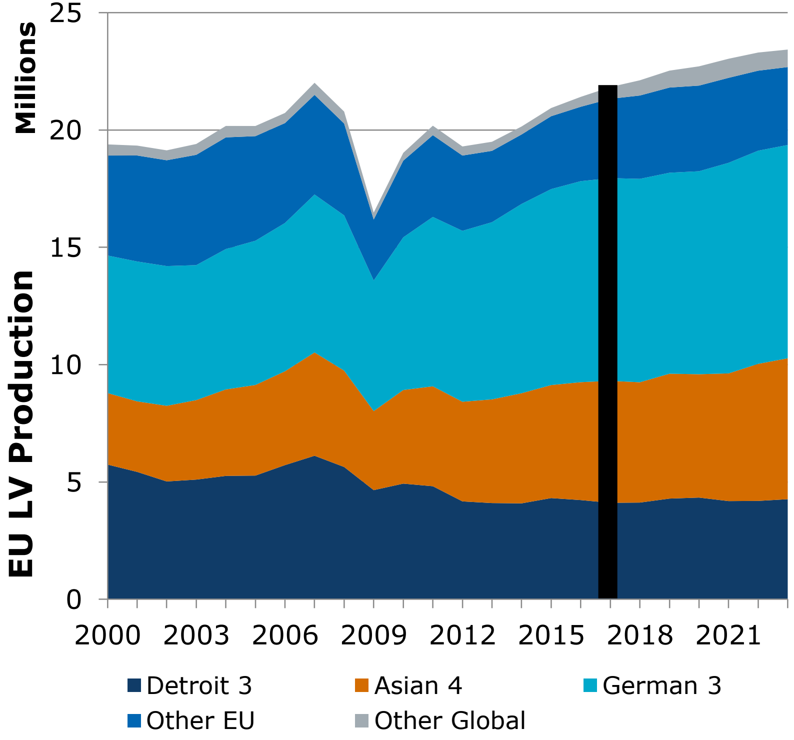


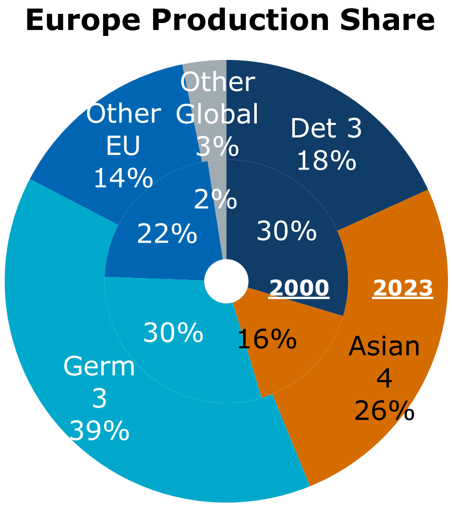


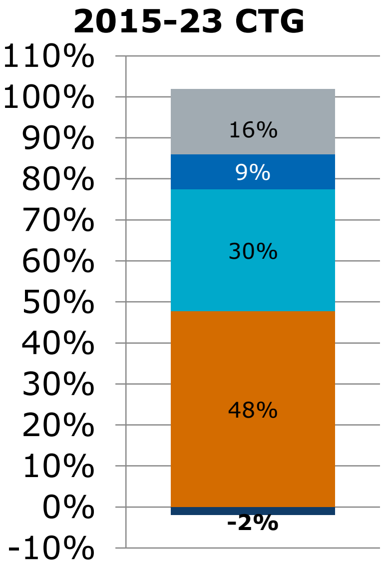


- Asian 4 and Other China OEMs growing faster than German 3, Detroit 3 and “Other Western” OEMs.

Europe Production

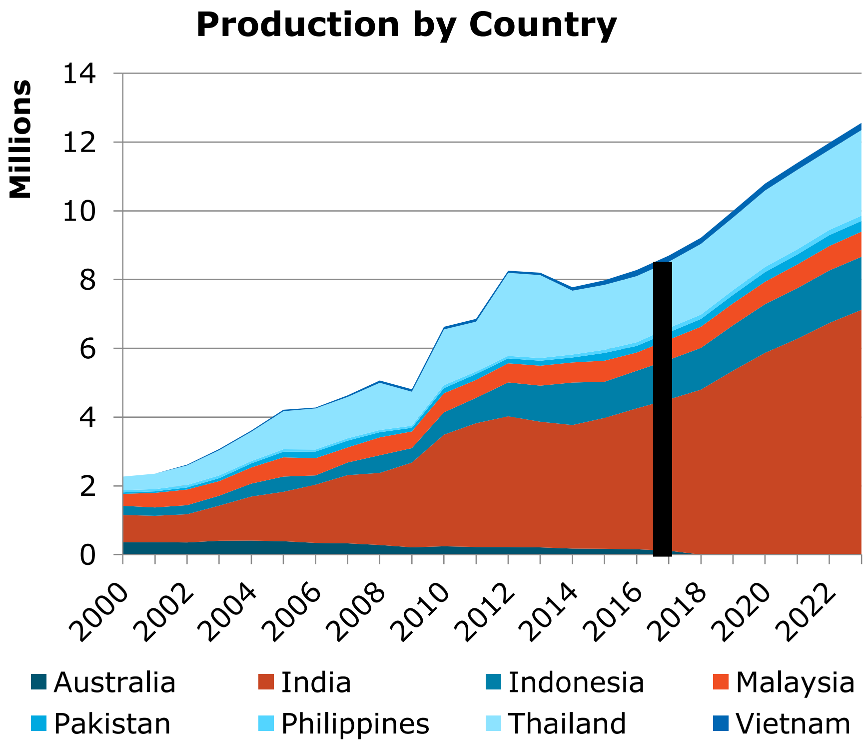


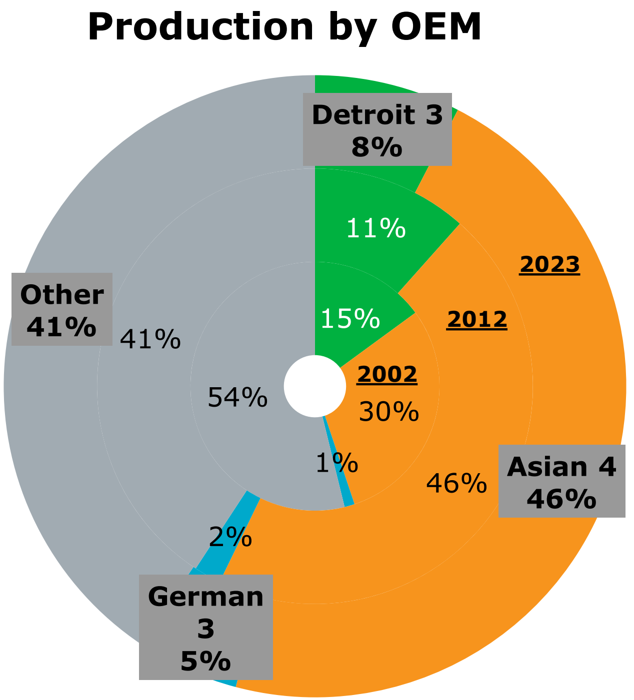




- Other European OEMs growing faster than, German 3, Asian 4, Detroit 3 and 'Other Global' OEMs.
- Russia Production rises to 3.9 Million in 2022 from 2.7 Million Today.

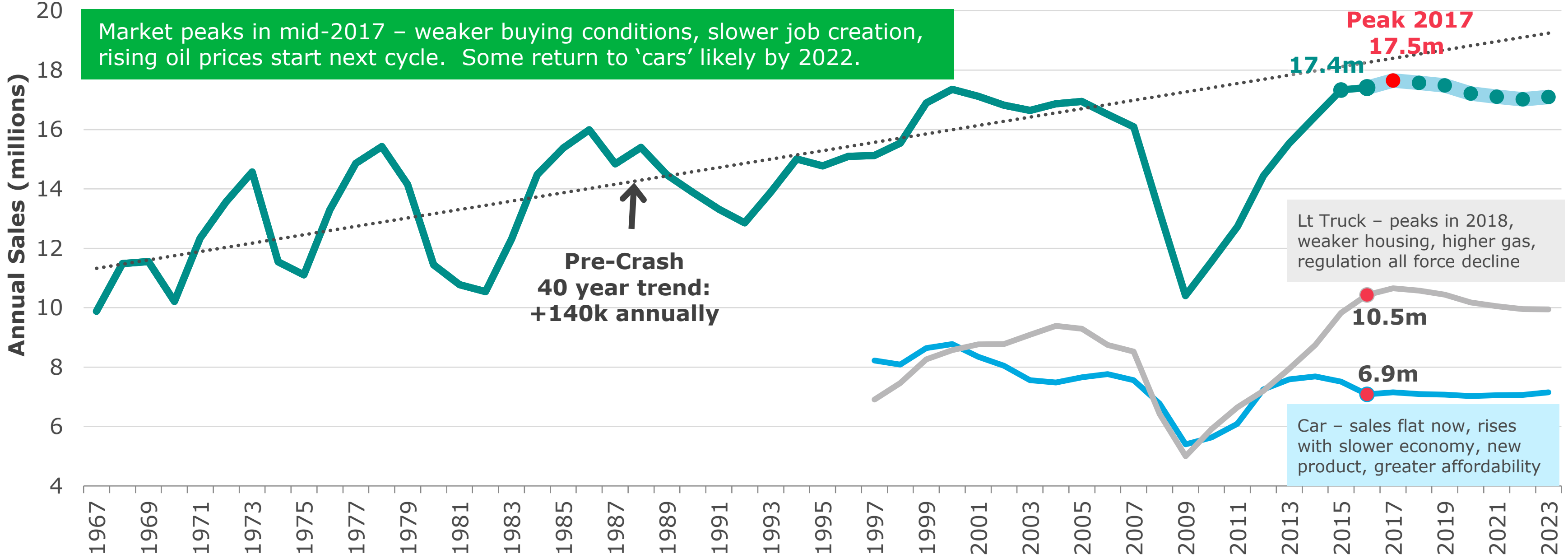
Southeast Asia Production





US: Light Vehicle Sales Forecast

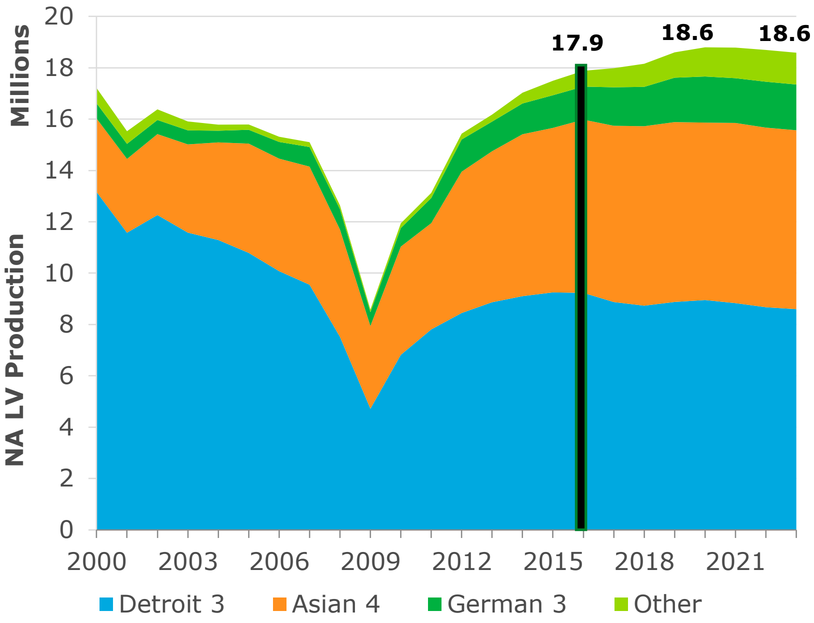
Sales peak here; return to previous long-term trend level possible

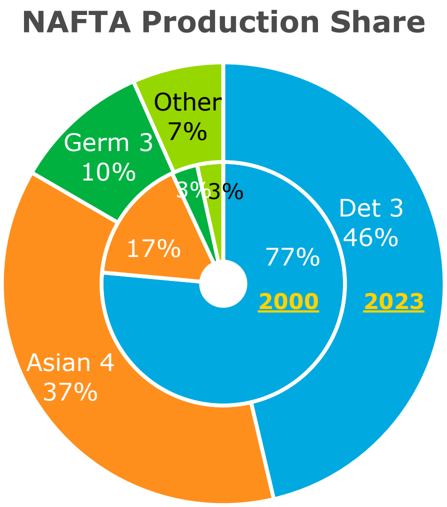


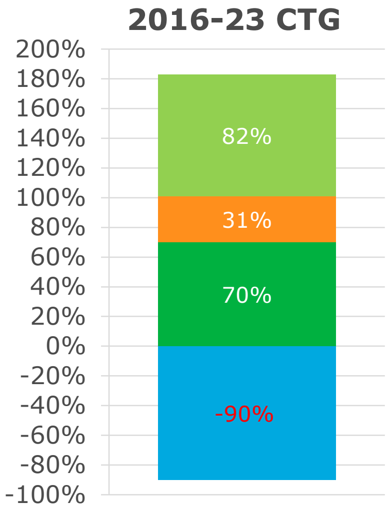
Source: IHS Markit Automotive, current light vehicles sales forecast

NAFTA Production

Customer Dynamics Changing …



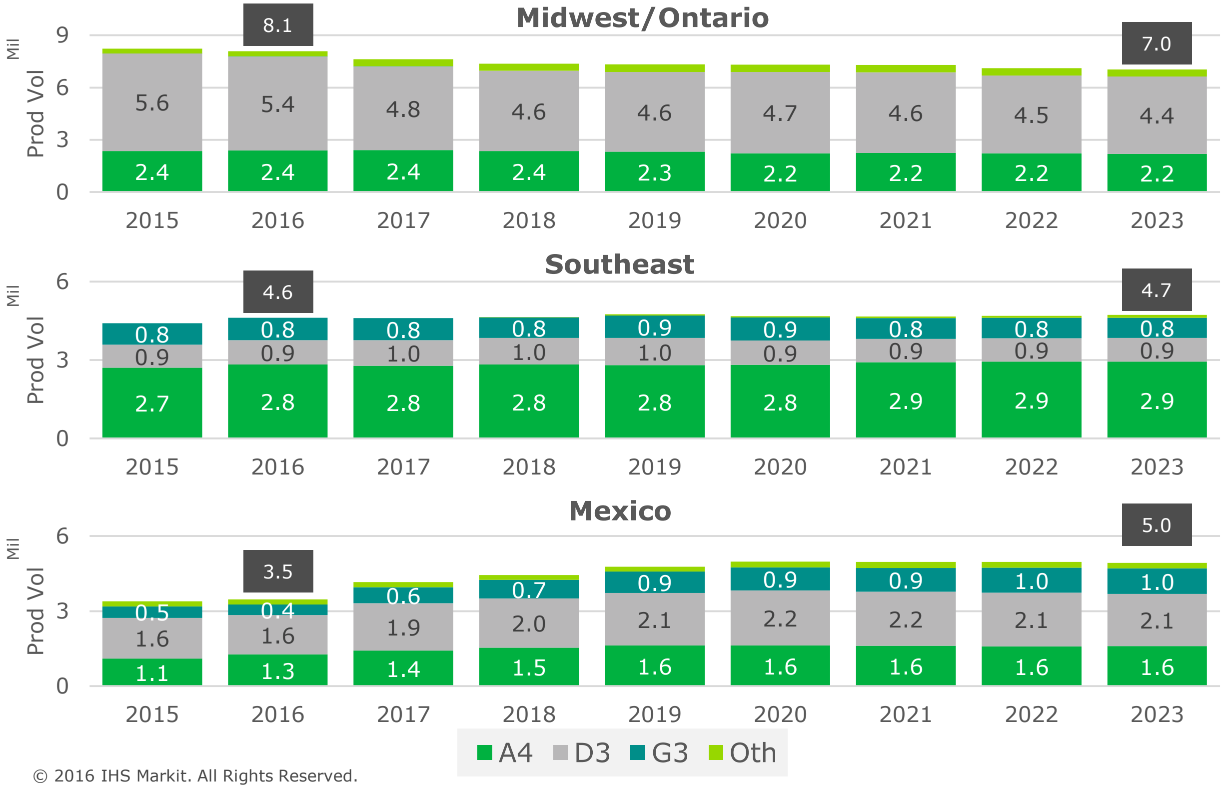




- Rise in Mazda, Fuji Heavy, Volvo and Tesla underscores 'Other' OEM rise – Supply base shifts.
- Detroit 3 output declines due to new competition, comparative lack of exports and longer-term impact of affordability.

NA Regional Shift

Logistics and Supply Structure Under Pressure



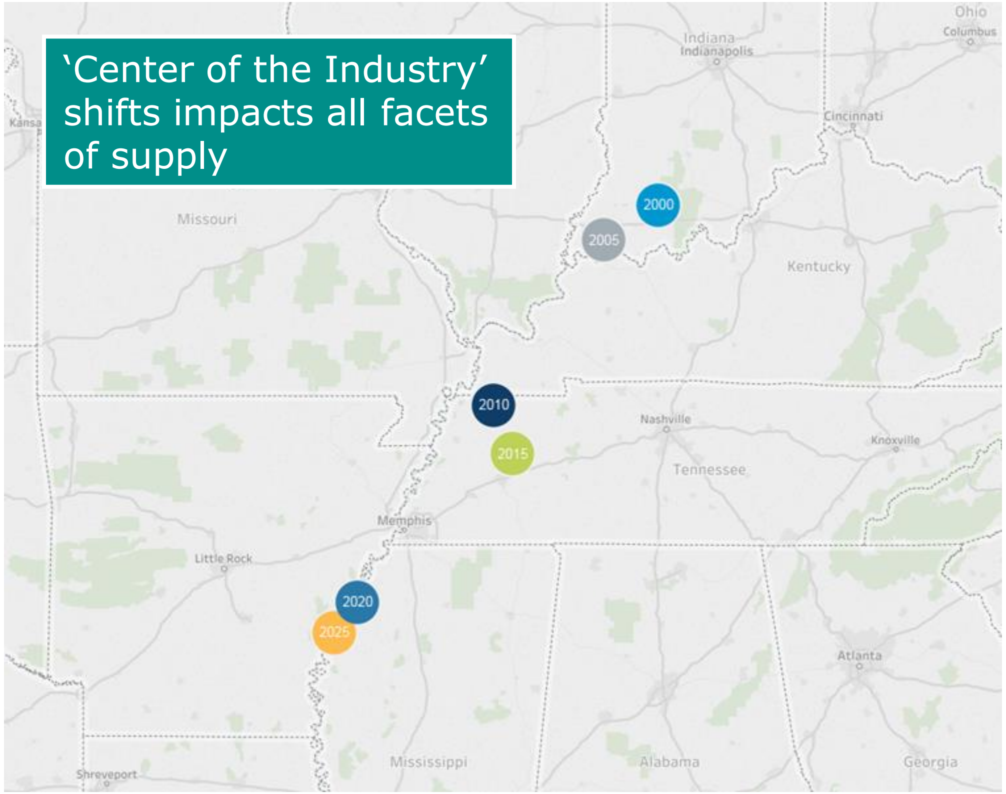
- Mix towards D/E-segment and Full Frame
- Detroit 3 still account for +60 of MW/ONT volume by 2023

- Remarkable stability – newer facilities w/export focus
- Higher concentration on C & D-segment CUVs

- Mid-Mexico now accounts for ~70% of Mex volume
- Rise of B & C-segment products with increasing luxury focus for export

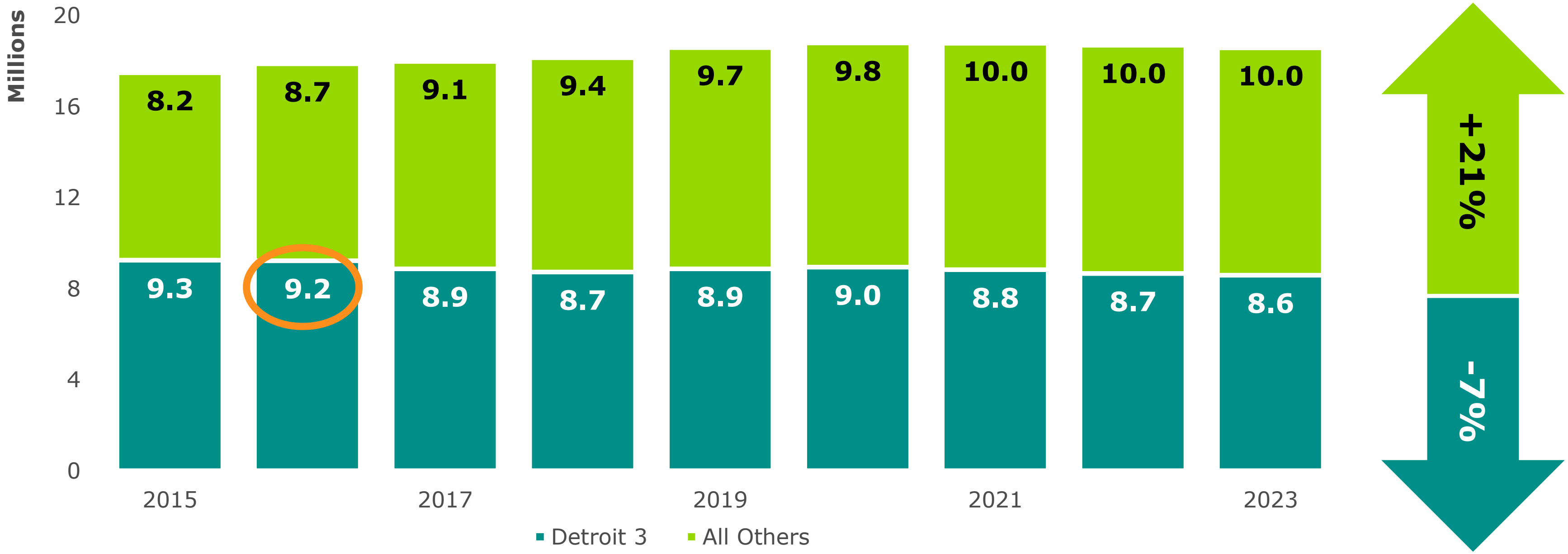
Shifting Geography Matters

- Logistics cost and risk reduction is focal to OEM cost reduction initiatives
  - Key at GM, Nissan and VW
- Massive shift from 2015 (Jackson, TN) to 2020 (Oneida, AR) at 31 miles/yr
- Alters locational strategies, competitiveness etc.
- US South and Mexico customers growing faster than other markets

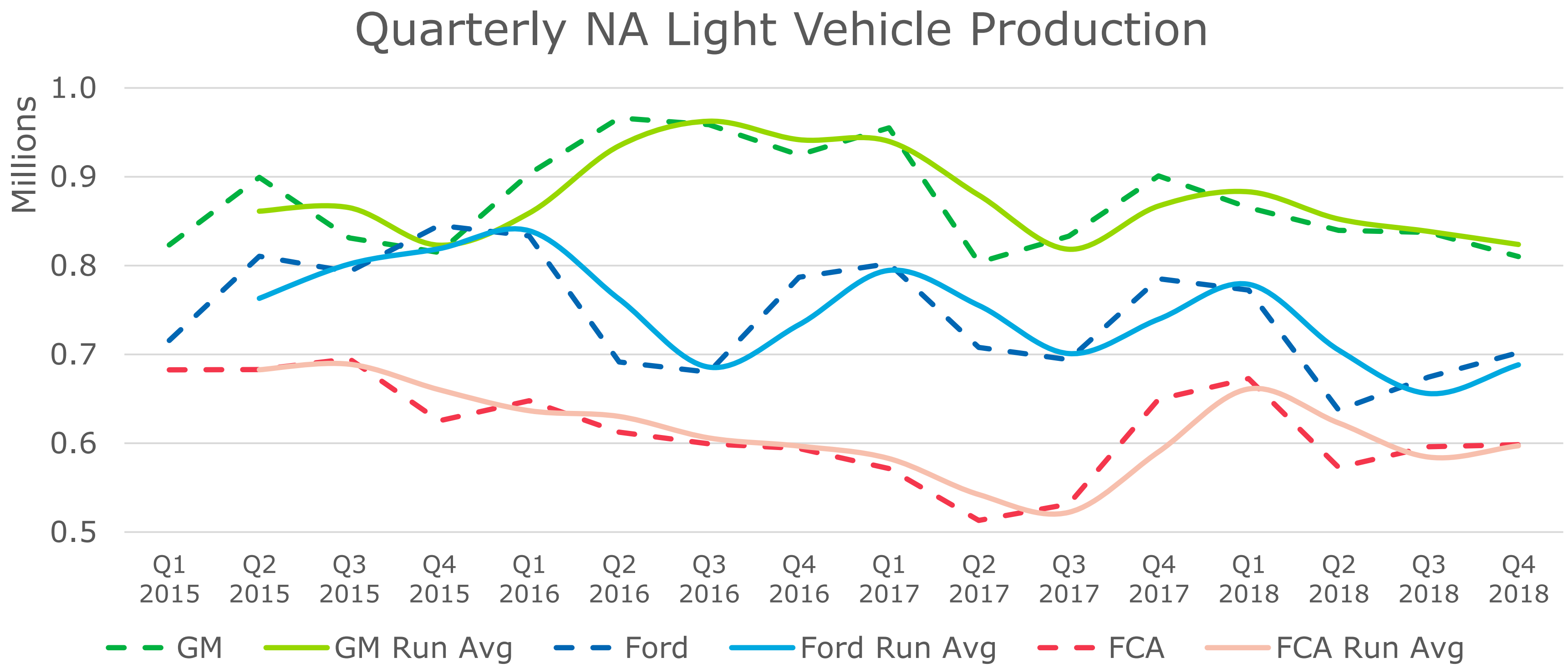


Divergent Trajectories – NA LV Production

Detroit Three Reaches an Apex in 2016

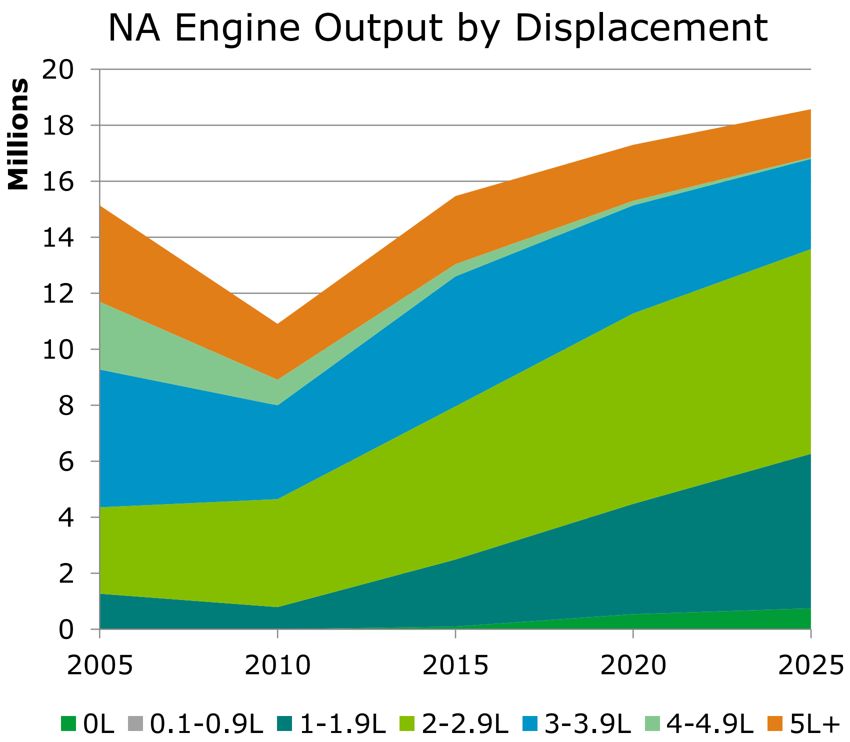


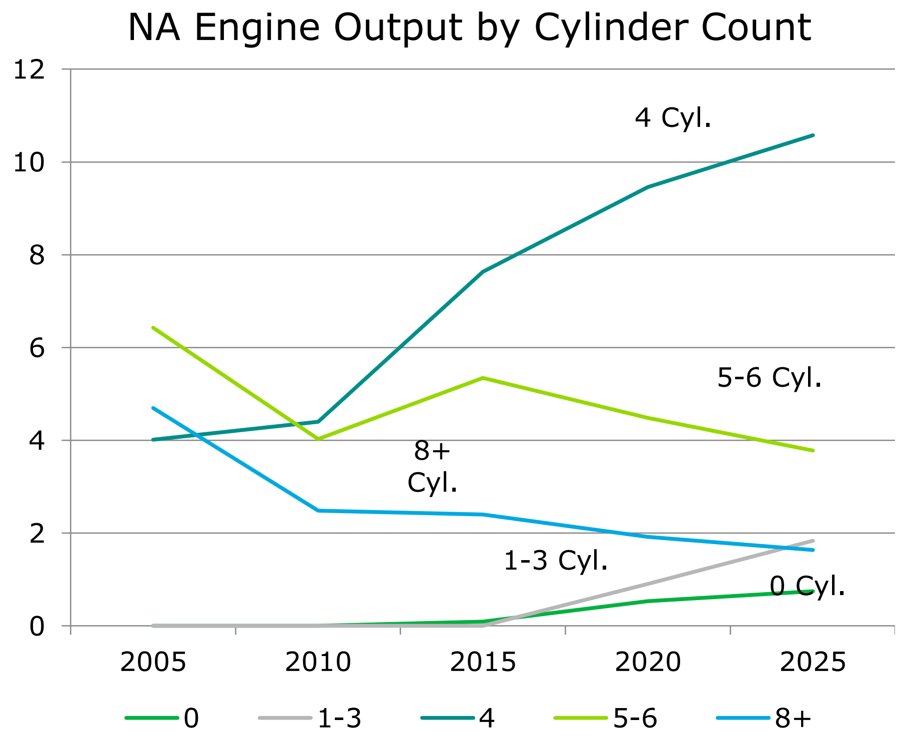
Detroit Three Volumes Peak …..



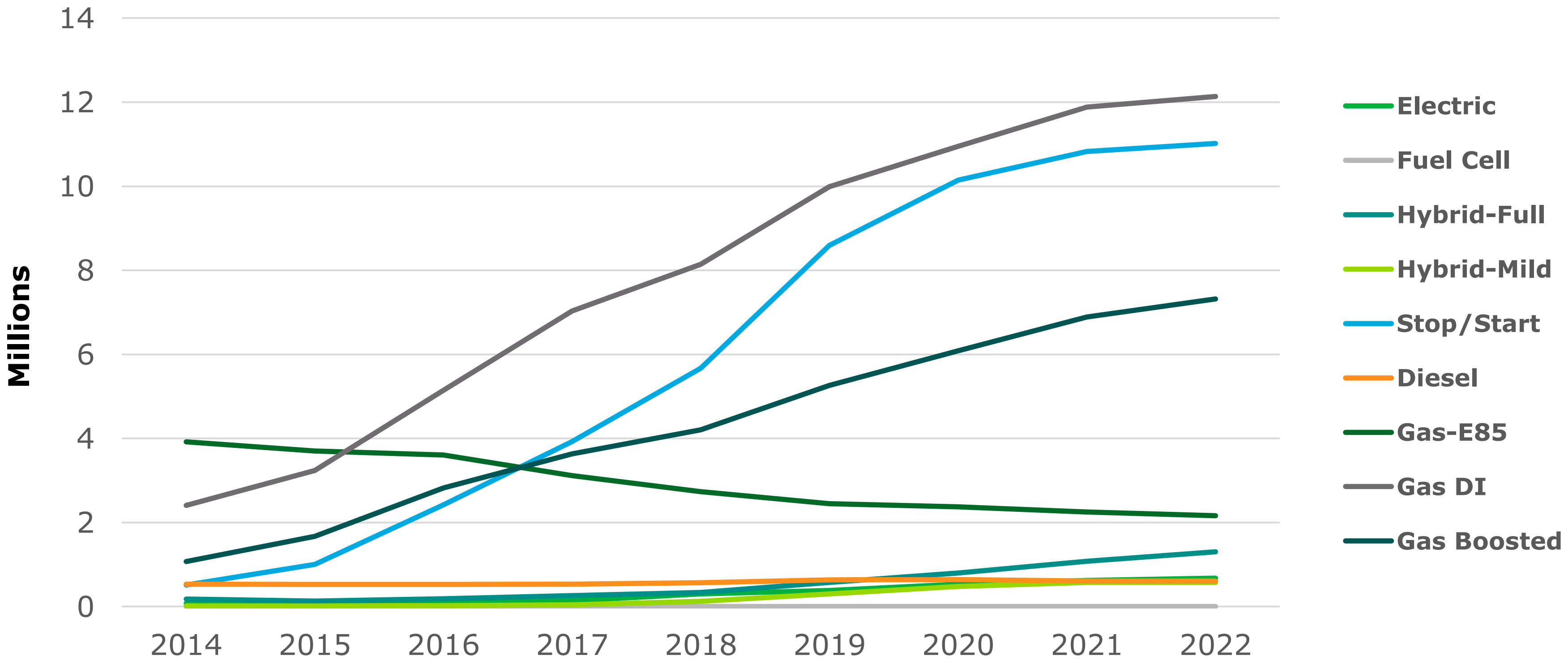
North America Engine Output

Sub 3.0L totals to 73% of the Market





North America Engine Technology Trends



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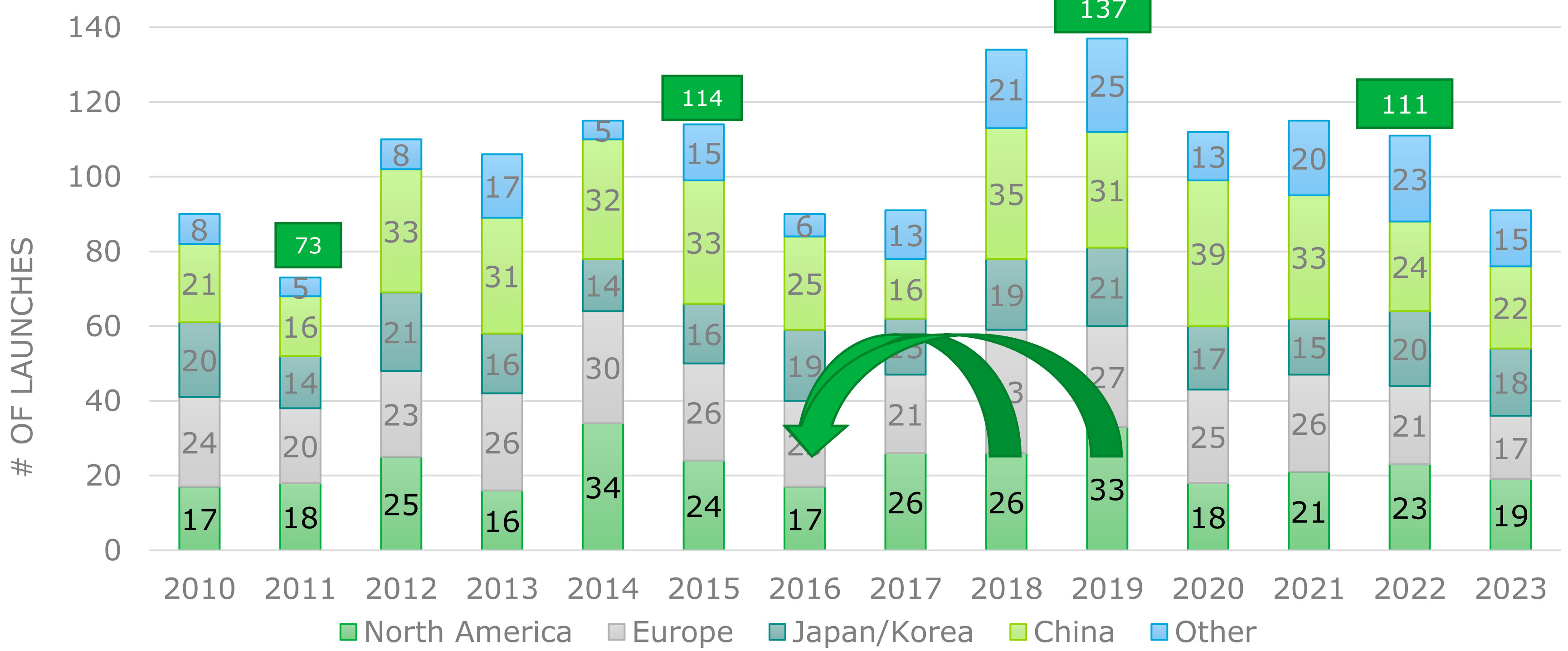
    - Autonomous Vehicles, Lightweighting, Powertrain Shifts and Regulations
- Summary

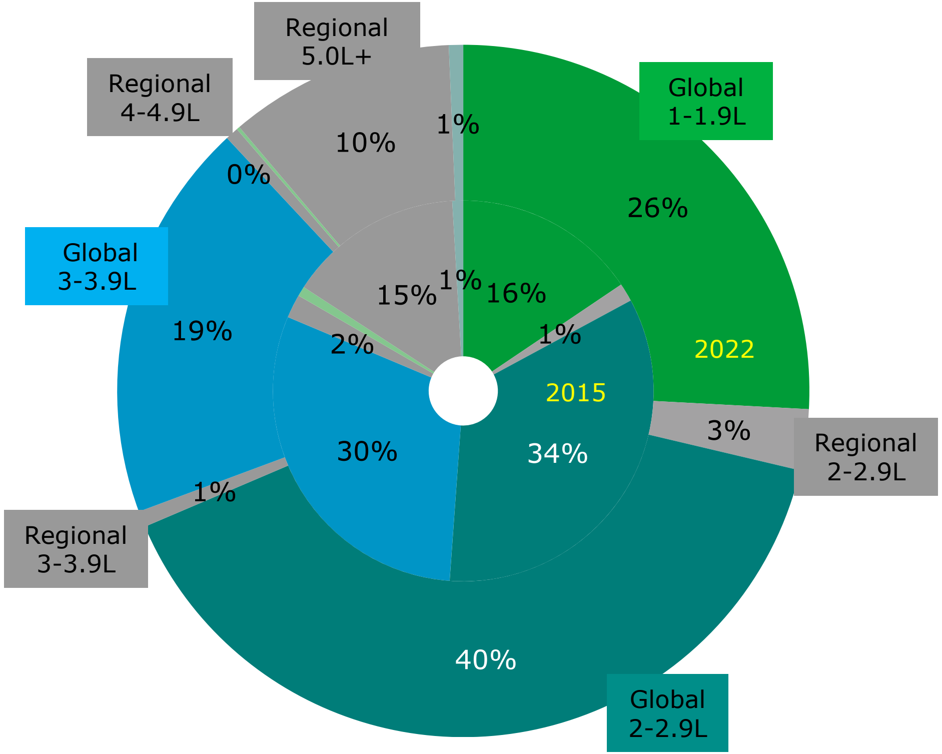
Global Vehicle Program Launches by Region
Increased Launch Activity Raises Risk

Increased industry pace places pressure on talent, resources and infrastructure.



Region	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Other	8	5	8	17	5	15	6	13	21	25	13	20	23	15
China	21	16	33	31	32	33	25	16	35	31	39	33	24	22
Japan/Korea	20	14	21	16	14	16	19	[illegible]	19	21	17	15	20	18
Europe	24	20	23	26	30	26	[illegible]	21	[illegible]	27	25	26	21	17
North America	17	18	25	16	34	24	17	26	26	33	18	21	23	19

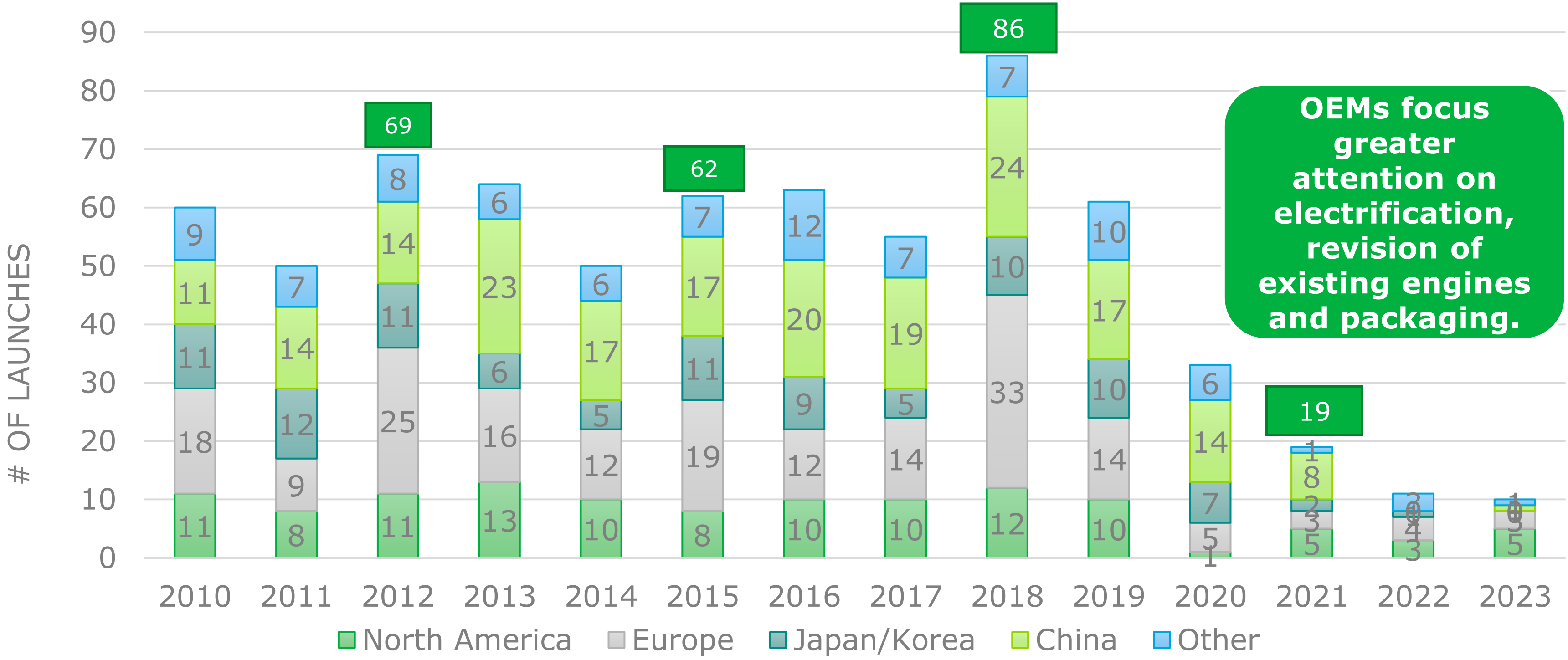
North American Engine Production
Global vs. Regional Engines



- Over ¼ of NA engine production volume will be <2.0L and based upon global platforms
- Shift towards 48V will further solidify growth of smaller 4 & 3 cylinder engines as (turbo and super) charging efficiency rises
- Upwards of 66% of volume will be <2.9L and global in nature
- V6s are increasingly being squeezed from the top by ‘vocation V8s’ and bottom by turbo I4s
- Regional engines account for only 15 of NA production volume
- V8s are only ~10% of the market by 2022

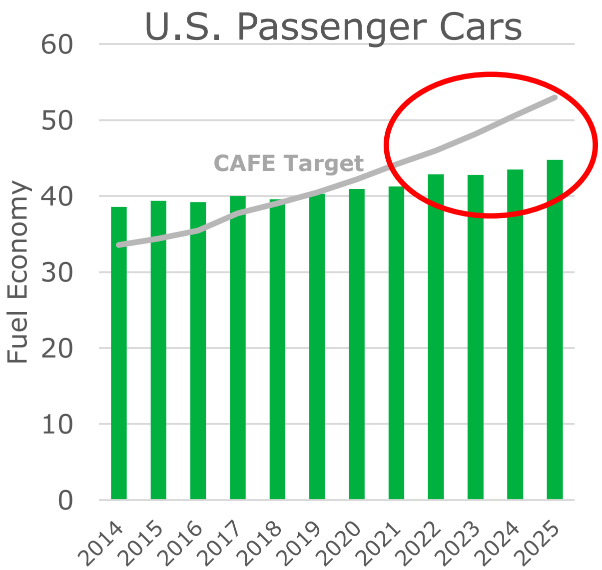
Global Engine Family – Built in 2 or more regions

Global Engine Program Launches by Region
New Powertrains pulled forward to 2018/19

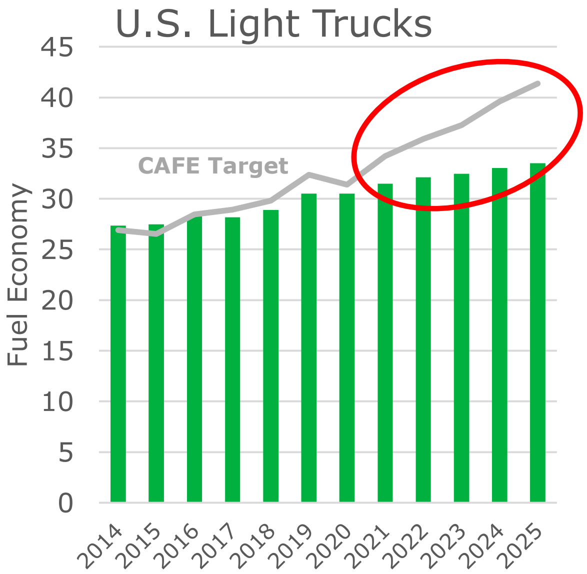


U.S. Midterm Evaluation – Highlighting the Compliance Gap

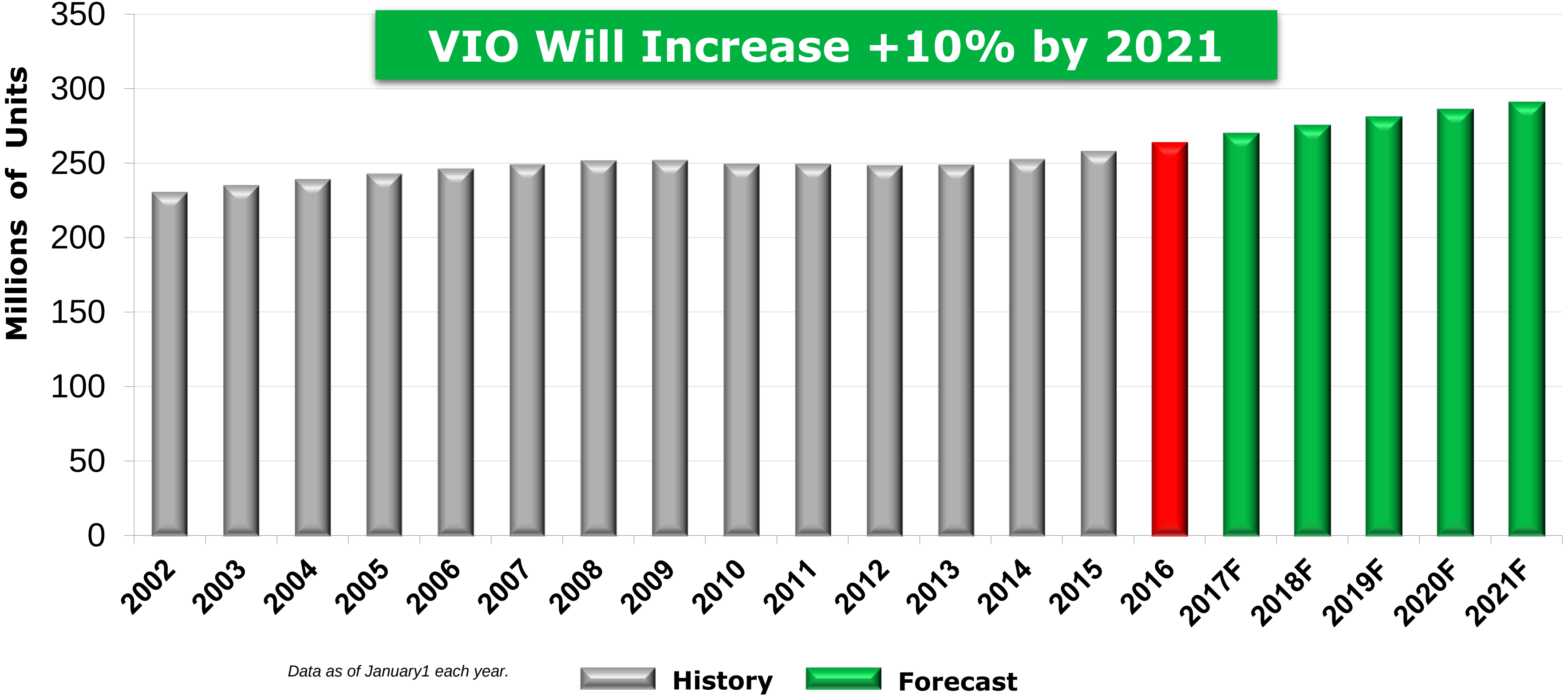
- OEMs are girding for widening compliance gaps – Direct BIW lightweighting will play a critical role to reducing primary and secondary mass to close these gaps.



Compliance gaps are increasing in NA, Europe and China



U.S. Light Vehicles in Operation

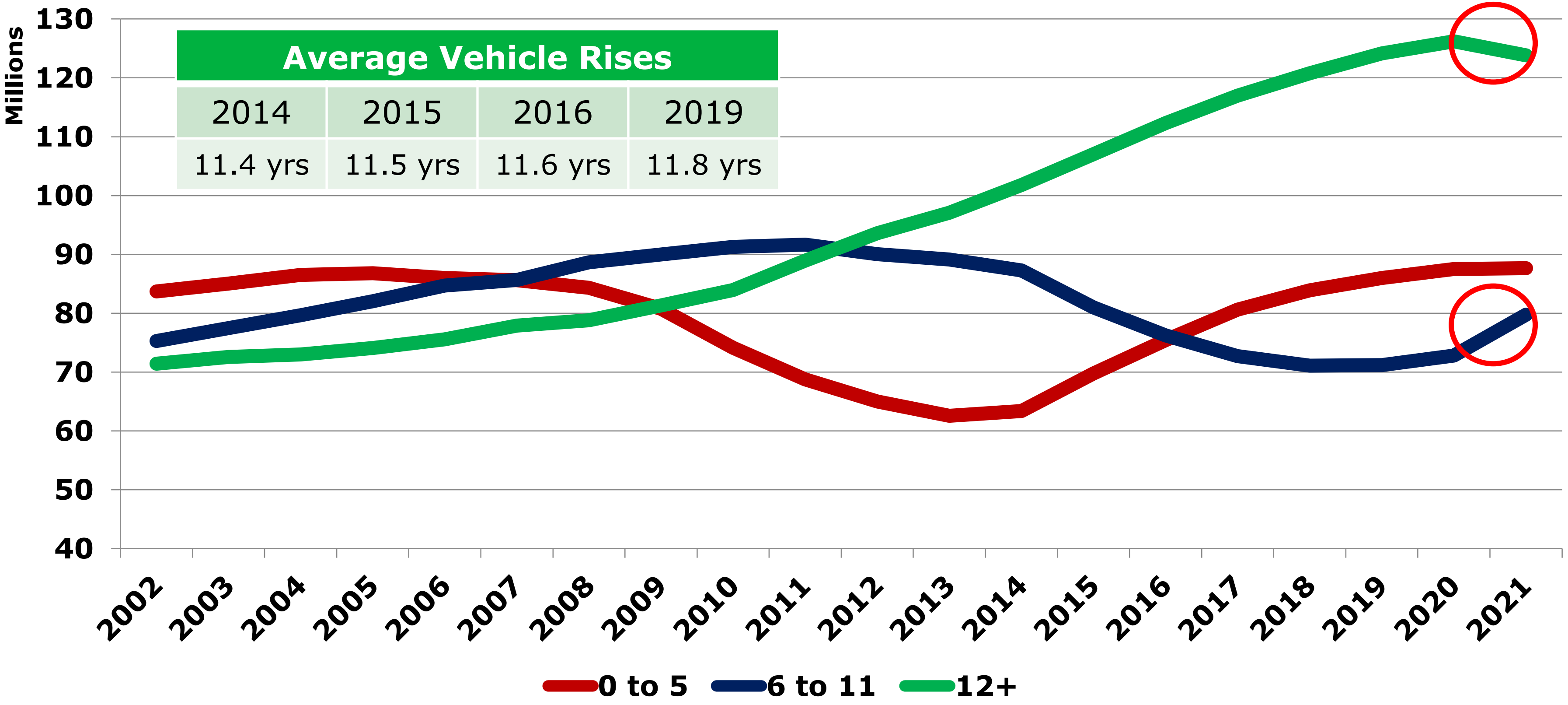


Data as of January1 each year.

Source: IHS Automotive

Average Age Rise Impacts VIO Units

Average Vehicle Rises			
2014	2015	2016	2019
11.4 yrs	11.5 yrs	11.6 yrs	11.8 yrs



Source: IHS Automotive
Fed Reserve of Chicago/ December 2016

Self-Driving Car Evolution

L5: Self-driving Only

L4: Full Self-driving

Self-Driving Car Only

Self-Driving & Human-Driven Car

L3: Limited Self-driving

Auto Pilot: Parking

Auto Pilot: Highway

L2: Partial Autonomy

Park Assist

Adaptive Cruise Control

Lane Keep Assist

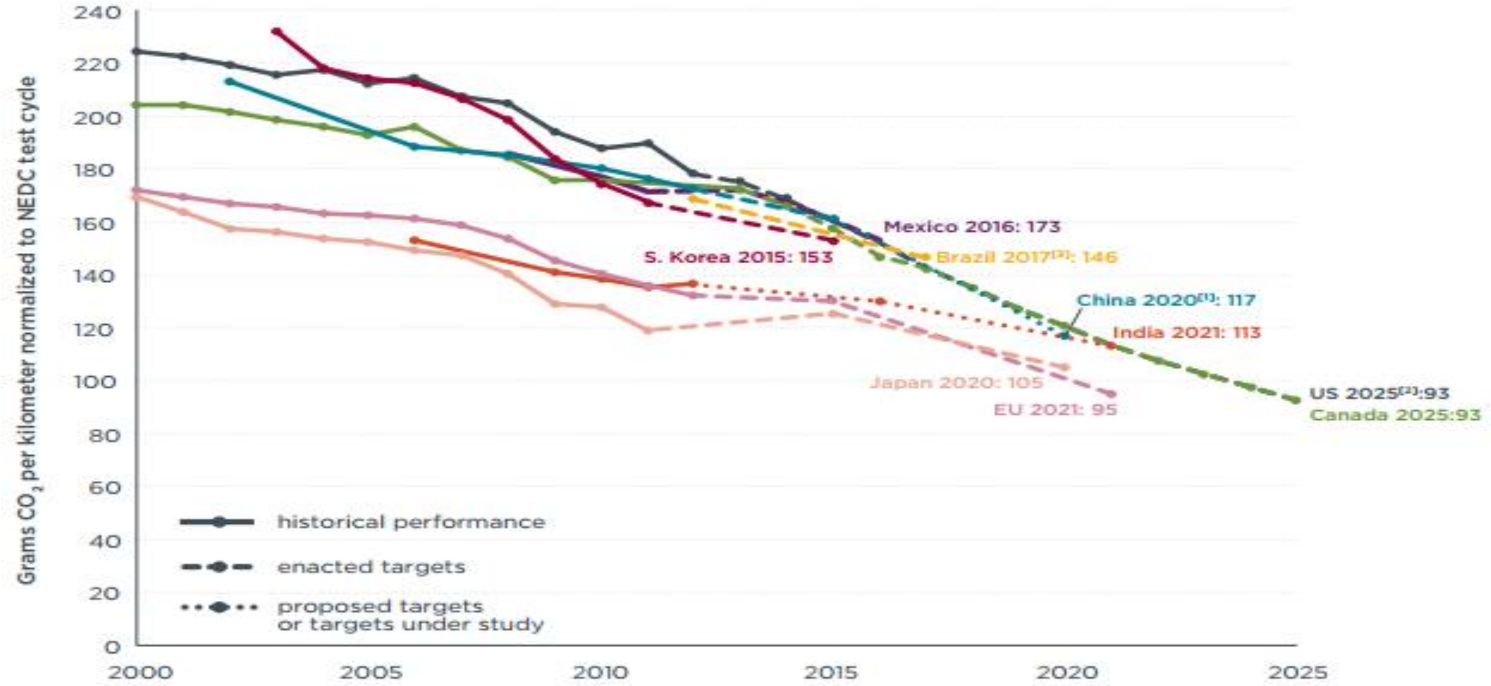
L1

Autonomous Braking

Adaptive Cruise Control

2010 2015 2020 2025 2030

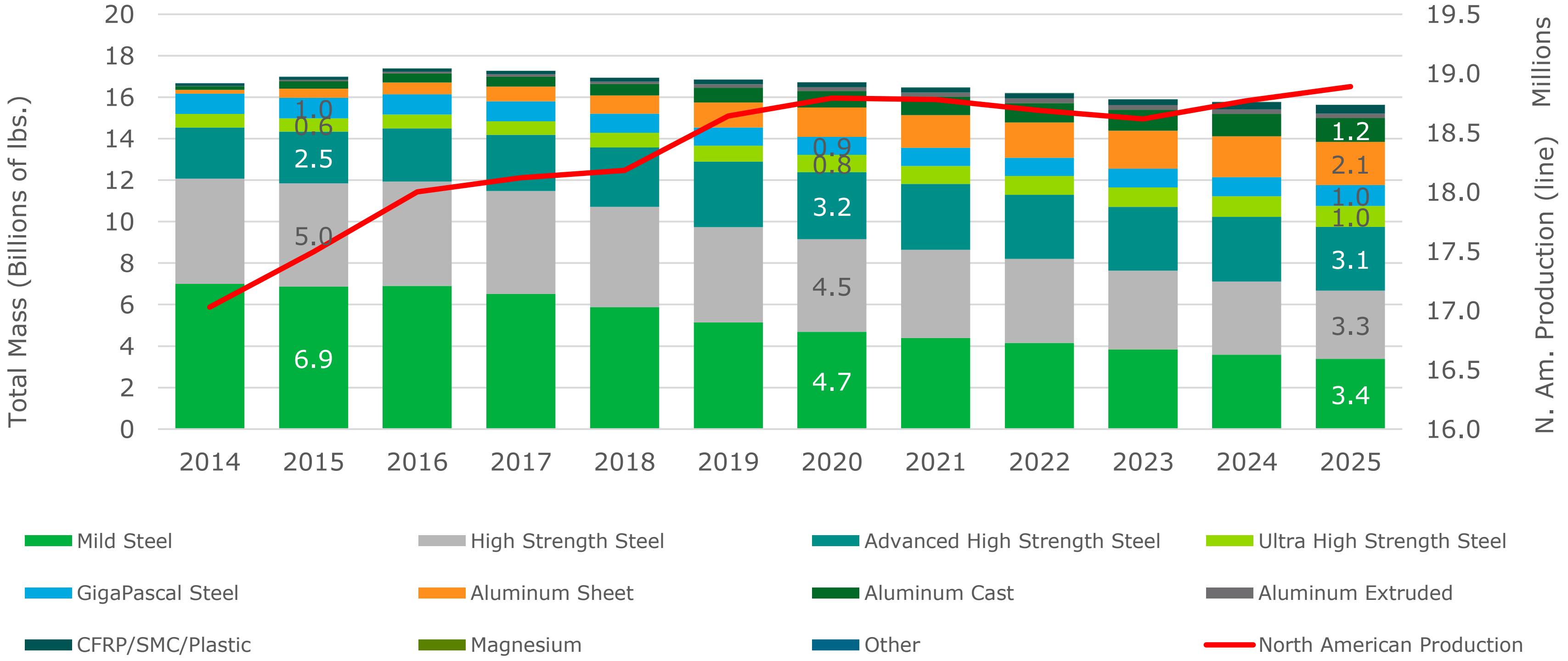
Global CO_2 Targets Are Swift and Aggressive



- Reduced CO_2 emission equates to improved fuel efficiency
- Global convergence toward 2025

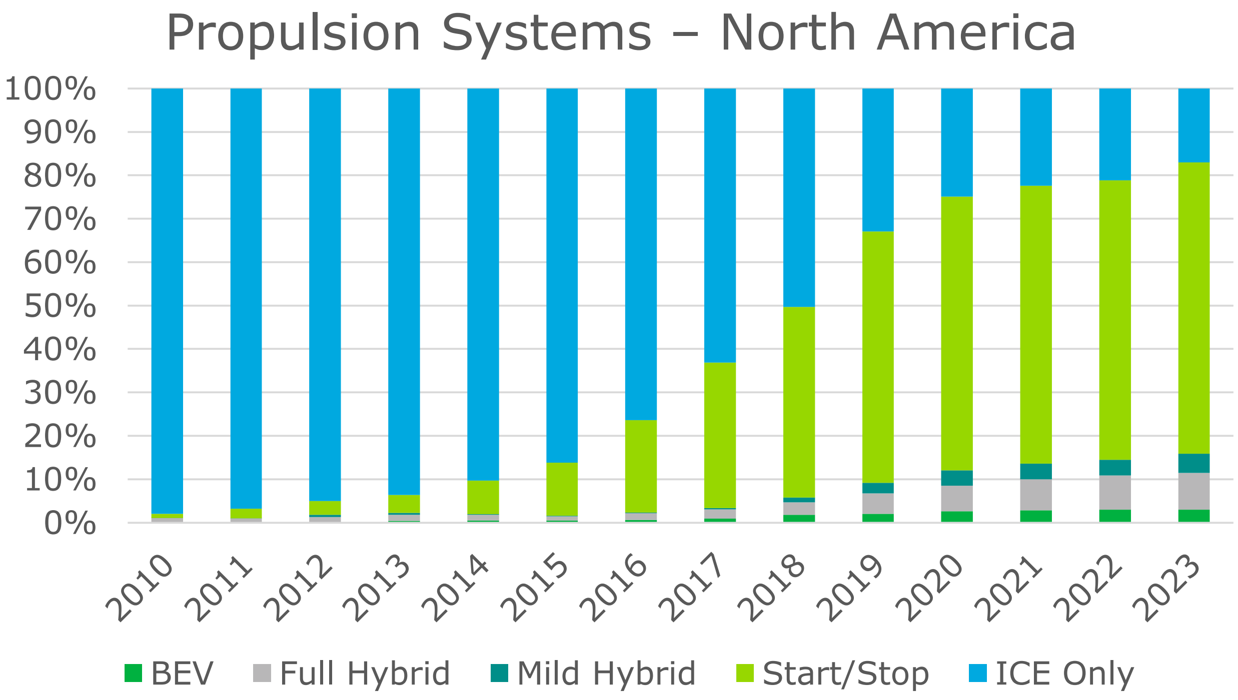
Material Forecast Analysis

NA LV Material Consumption (Net Usage)



Electrification Takes Hold

Shift From S/S to Mild/Full Hybrids Starts Next Decade



Electrification is Required

- Larger D & E segment offerings require several solutions
- Fewer options into the next decade
- 48V is an enabler though a learning/cost curve ensues
- Low oil environment complicates
- CARB electrification mandate complicates

Electrification =Stop/start, MHEV, FHEV & BEV

Three Disruptive Realities

How Do Industry Participants Adapt ….

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, standardization and safety?

2015-2020	2020-2025	2025+
•PHEVs •Level 2 >> 3 Driving •Uber/Lyft	•Increased Electrification •Level 3 >> 4 •Expanding Mobility Solutions	•BEVs & Infrastructure •Level 3 & 4 >>> 5 •Vehicle Park Reflects Shifts

A Looming Cost Cliff Alters The Market

OEMs, Suppliers, Regulators and Customers Are All Impacted

~2025
- L3/4 Autonomy, Global influences, System Profit Pools Shift
- Full Hybrid, BEV and Alternative Drive Formats Rise
- Integration of 'Non-Standard Materials' & Joining Methods

~2020
- L3 Autonomy, More ADAS Content, Warranty Visibility
- Mild Hybrid Rise Starts in Larger Segments, 48V
- Mass Reduction Shifts Beyond The 'Edge Segments'

Today
- ADAS & Connectivity Content Rises, Warranty Costs
- Down Displacement, Multi-speed Trans & S/S
- BIW & Chassis System Lightweighting Begins

Success in a Rising Cost Environment

- *Understand your costs, markets & risk profile*
- *Diversify customers, segments and cadence*
- *Hedge technologies*
- *Smart vertical integration*
- *Proactive engagement*
- *Today's differentiators are not tomorrow's*

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- **Summary**

Shifts in Supplier/OEM Relationships

- Plateauing volumes alter the landscape
  - > OEMs feeling the pressure of increased incentives
  - > Existing suppliers begin to cannibalize business
- Looming cost cliff drives urgency into system cost reductions
  - > Share of ‘value’ devoted to hard parts decline – the pie slices thinner
  - > Increased evidence of incremental cost transparency driven by OEMs
  - > Likelihood of regulatory relaxation are in play – Select OEMs and California
- Supplier strategies to combat vary by system
  - > Vertical integration to offer enhanced capability to maintain margins
  - > Marketable technology, cost efficiency and customer/regulatory solutions

Summary
Foresight Reigns ….

- Volumes plateauing in several markets and segments
  - Japan/Korea, North America and Europe grow below global trend
- Cadence is faster – challenging for Tier 2 & 3 regional suppliers
  - Increased complexity coupled with shorter cycles
- Meeting the legislative mandates difficult on the edges
  - Electrification/ Lightweighting/ Reducing parasitic losses/ Aerodynamics/ Optimization
- The New Differentiators
  - Innovation, cost reduction and strategic patents protect margins
  - Ability to anticipate and benefit from major shifts – electrification, automated driving, lightweighting, packaging efficiency and the hard/soft part shift

Thank You

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