IHS **Automotive**
DRIVEN BY POLK

Light Vehicle Production
The Decade of Shifts, Opportunities and Wildcards

Federal Reserve Annual Outlook Symposium

Michael Robinet
Managing Director, IHS Automotive

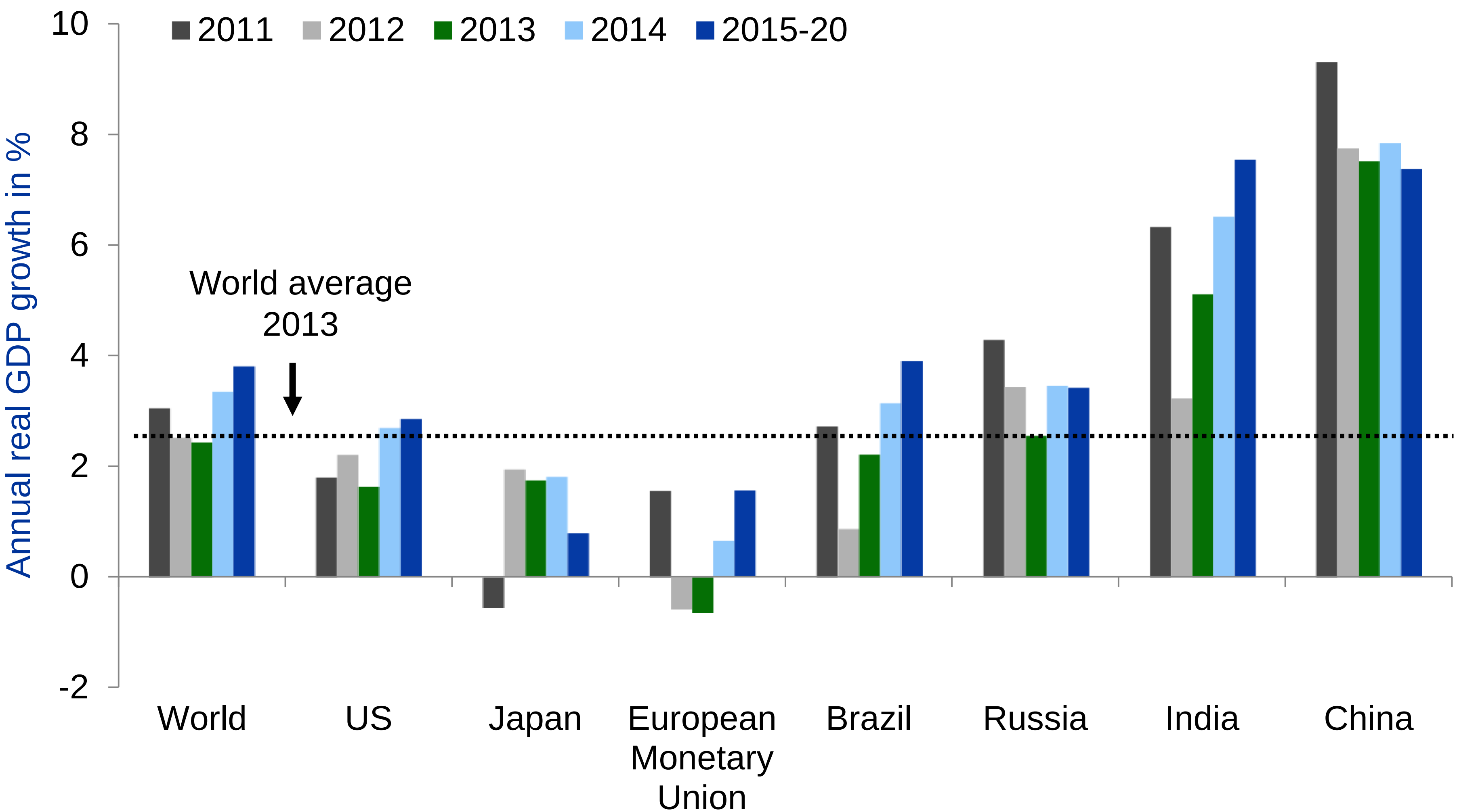
December 6, 2013

Global Light Vehicle Forecast

- **Global Outlook**
- NA Outlook
- Sourcing Dynamics
- Summary

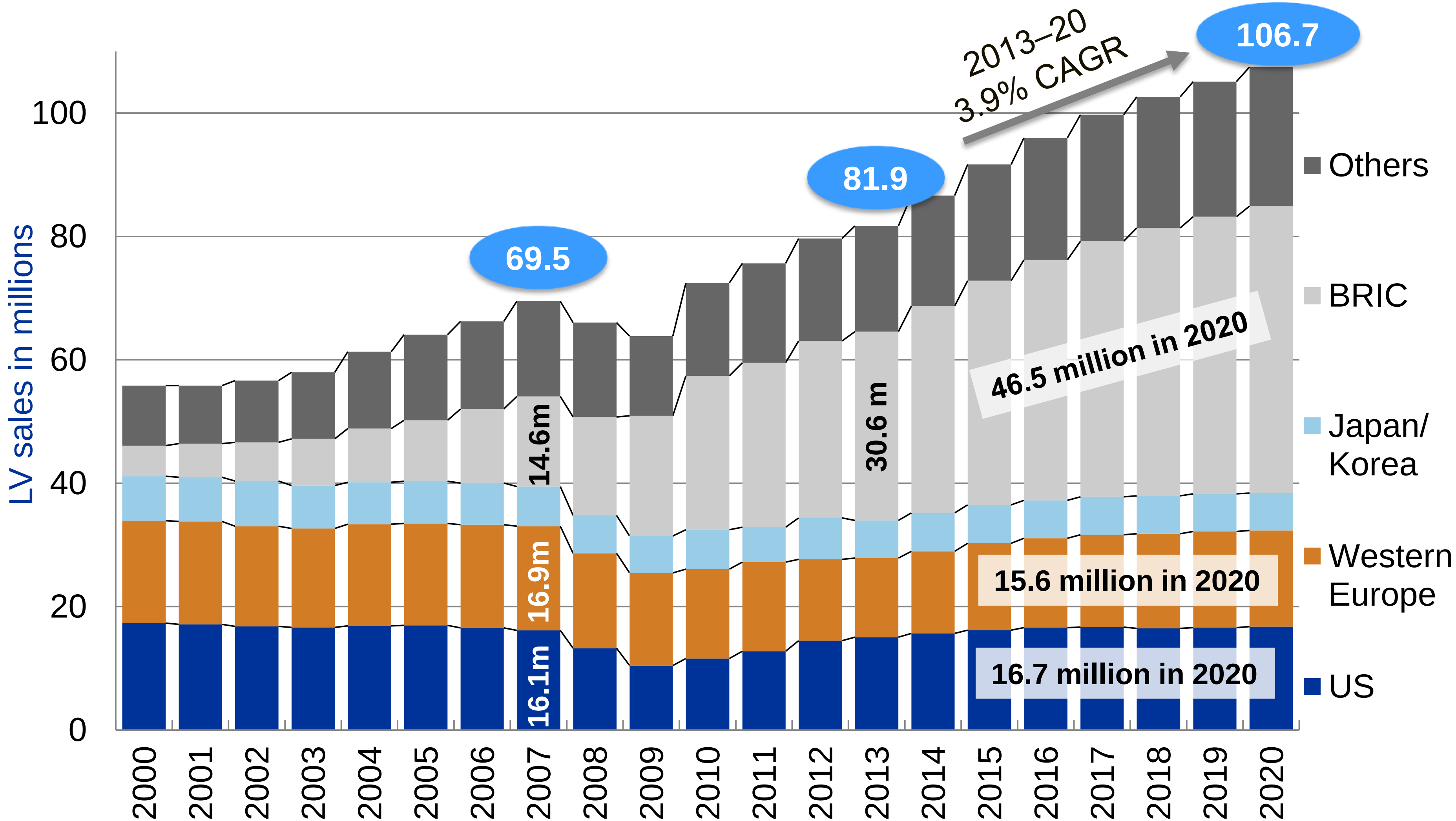
World Economic Growth

Outlook for emerging markets slightly less favorable



Source: IHS Data Insight

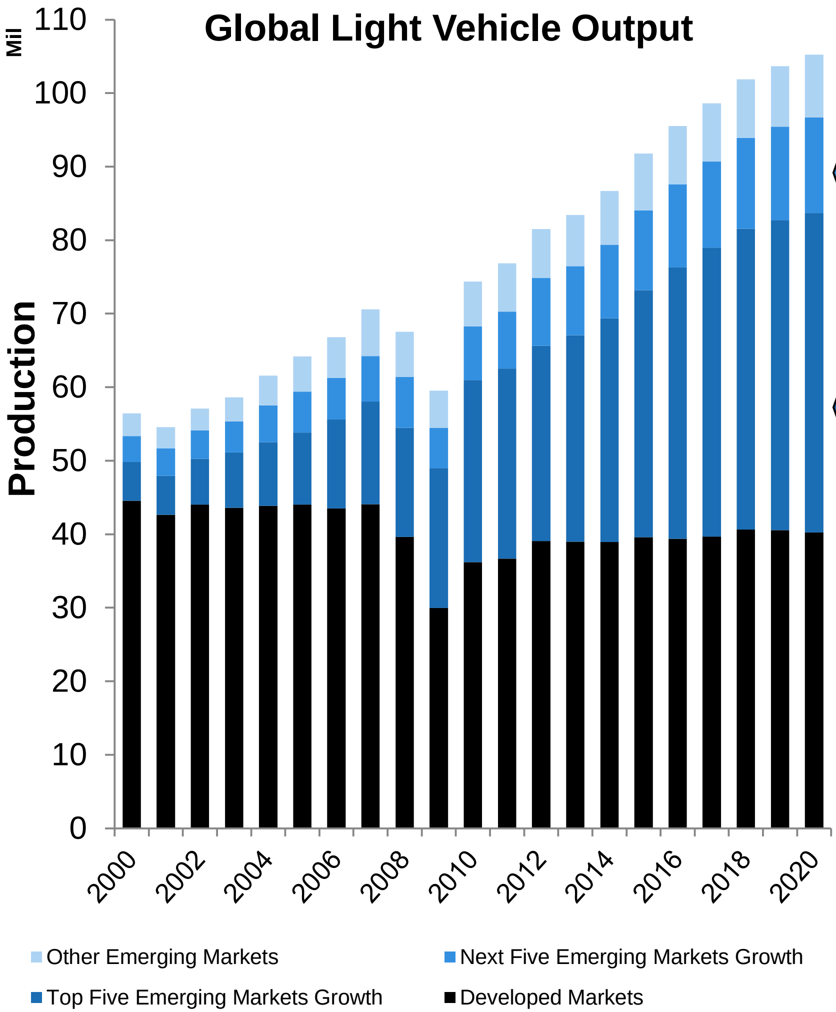
Global Light Vehicle Sales Outlook
By Region



Source: IHS AutoInsight

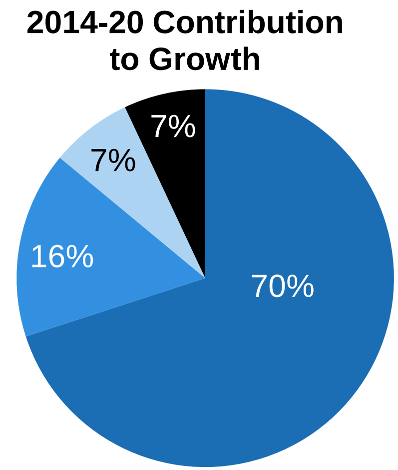
Light Vehicle Global Growth

Domestic and Export Volumes Drive Investment



Next Five Emerging Growth Countries
Malaysia, Indonesia, Thailand, Russia & Brazil

Top Five Emerging Growth Countries
China, Mexico
India, Poland, Iran

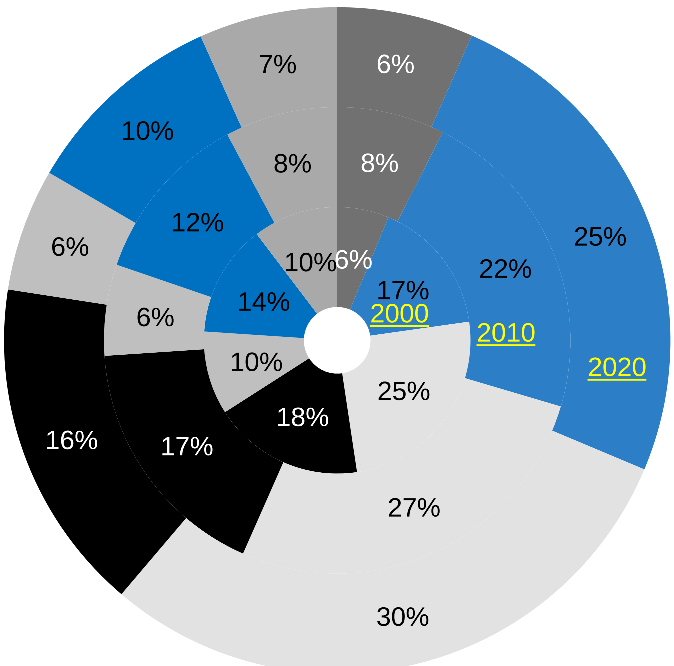


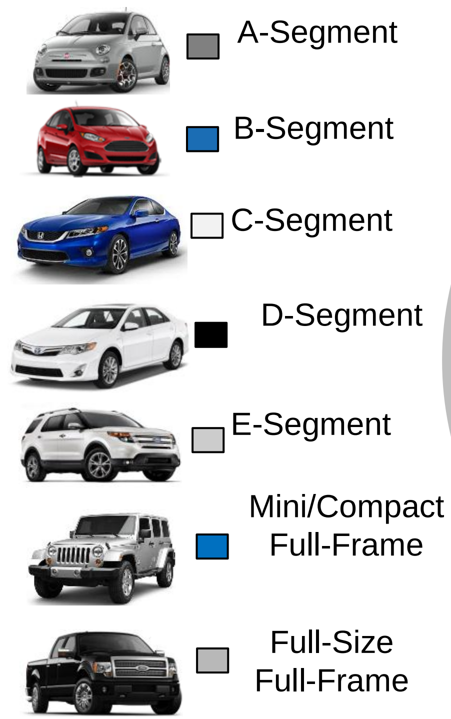
- Five highest growth countries based on 2014-20 volume increases will account for 70% of global
- Over 85% of the growth will emanate from global OEMS – global architectures
- Developed markets in Western Europe, Australia, Japan, Canada and South Korea feel cost and co-location pressure

Global Segment Shifts

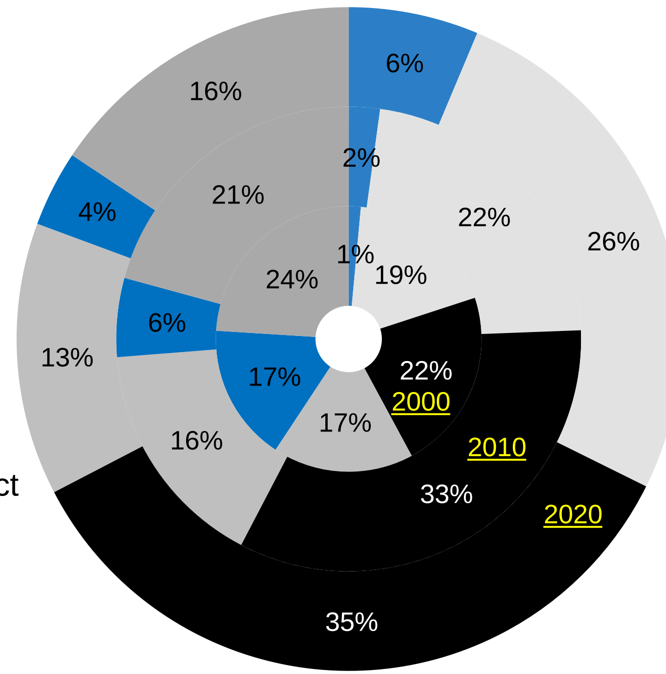
Growing Smaller & Converging ….

Global Production by Segment





NAFTA Production by Segment

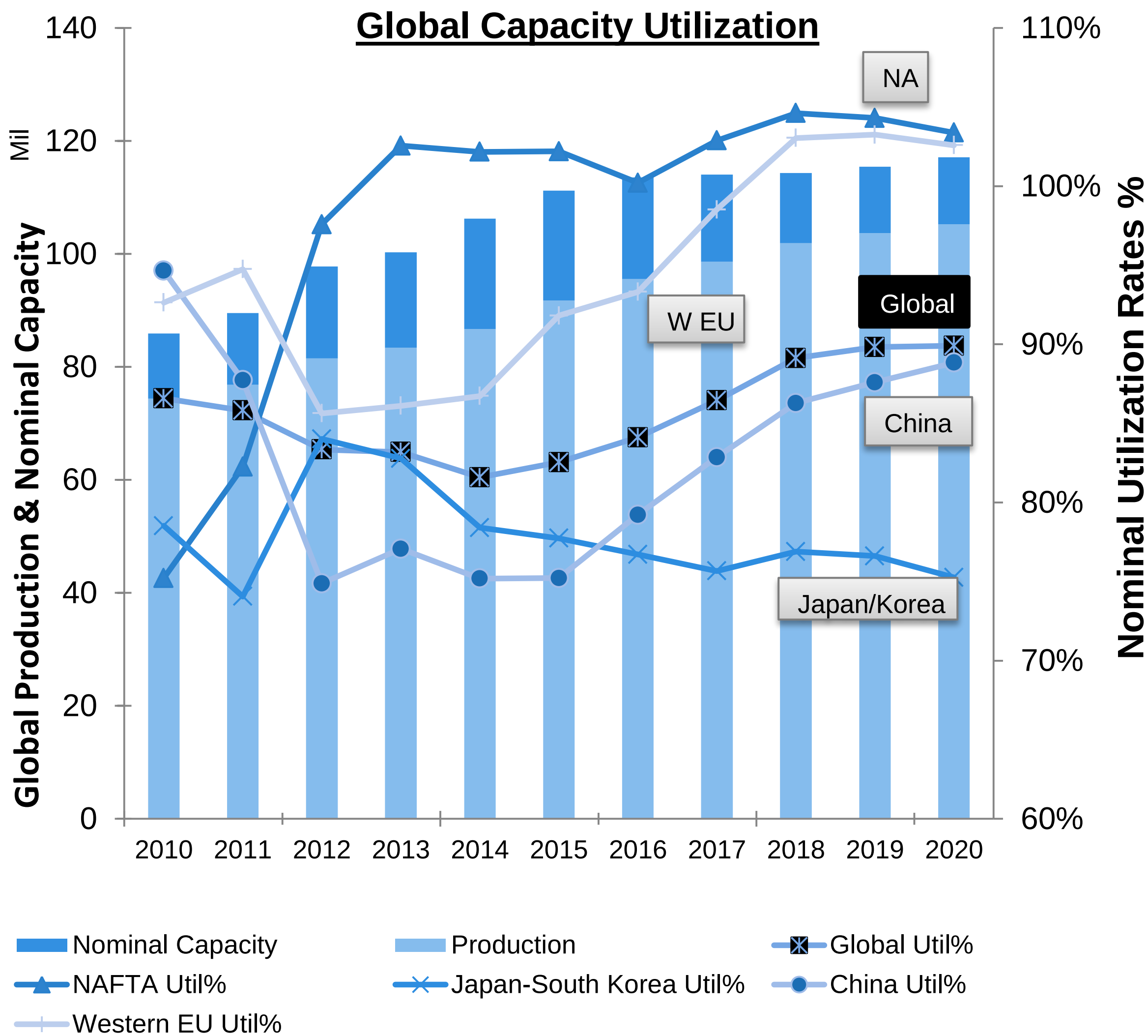


- NAFTA begins to converge with global trends in the mid-segments (B, C & D)
- Greater than 60% of global volume is C-segment or smaller by 2020
- In NAFTA, more than 75% of volume is D-segment and smaller by 2020

Light Vehicle Global Growth

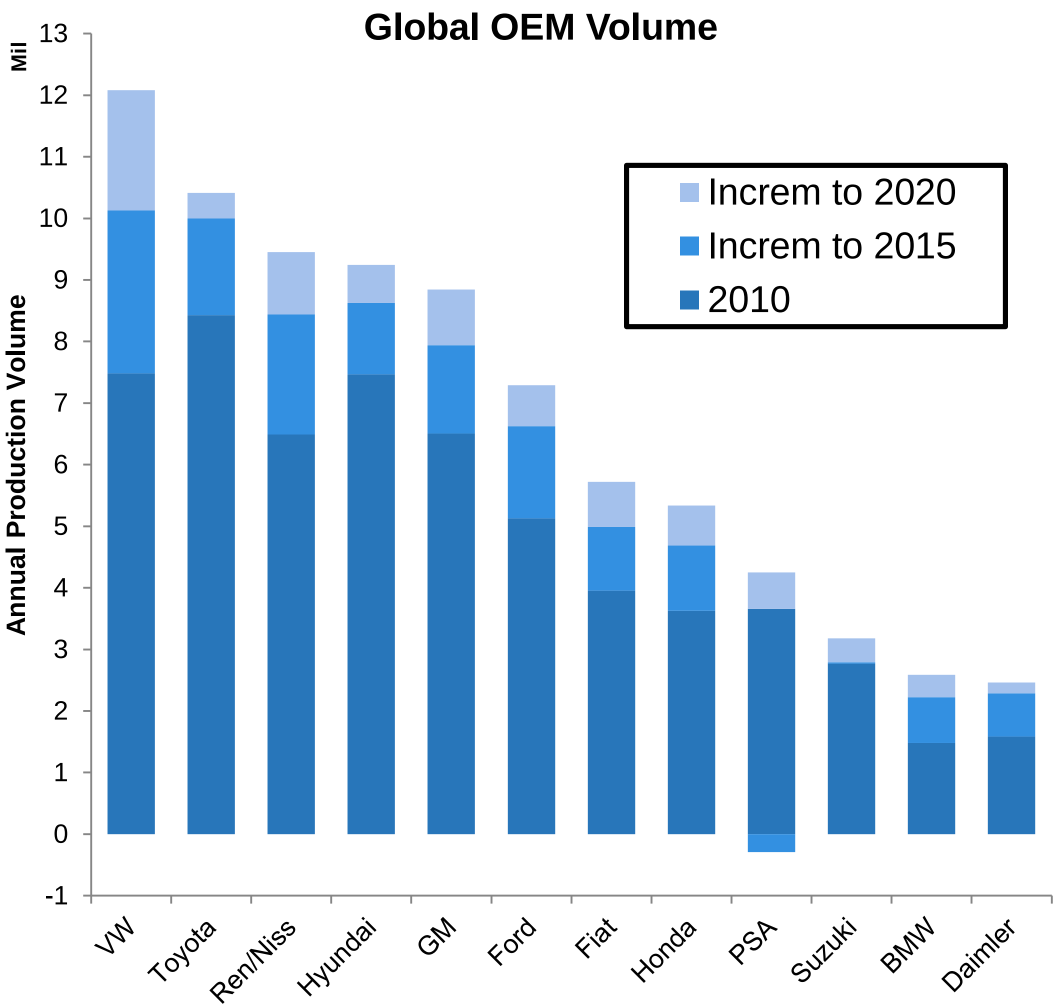
Fixed Cost Coverage is Critical

- OEMs focus on covering fixed facility costs through enhanced flexibility and 3 Shift/Crew structures
- Improvement in China is delayed until later in the decade when older capacity is fallowed and several OEMs consolidate
- Western Europe improvement will be slow – capacity utilization improvement is back-ended
- Japan & South Korea utilization is challenged by weaker domestic market and co-location



Light Vehicle Global Growth

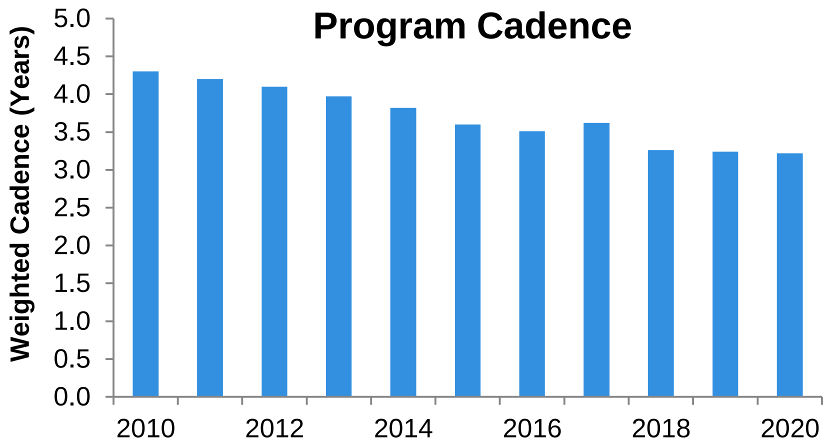
OEMs Still Eyed Increased Scale

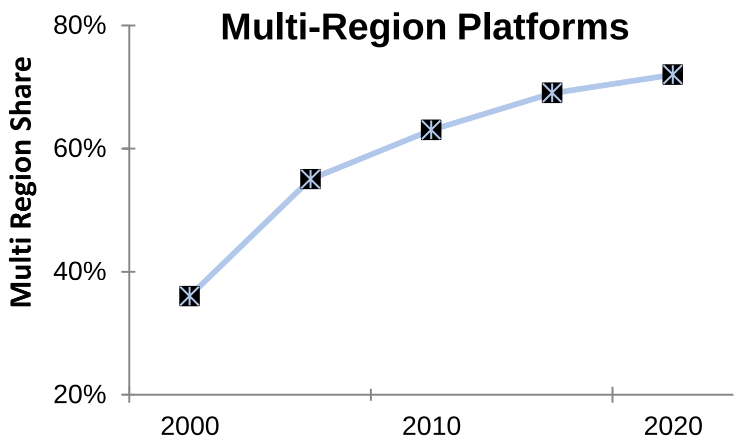


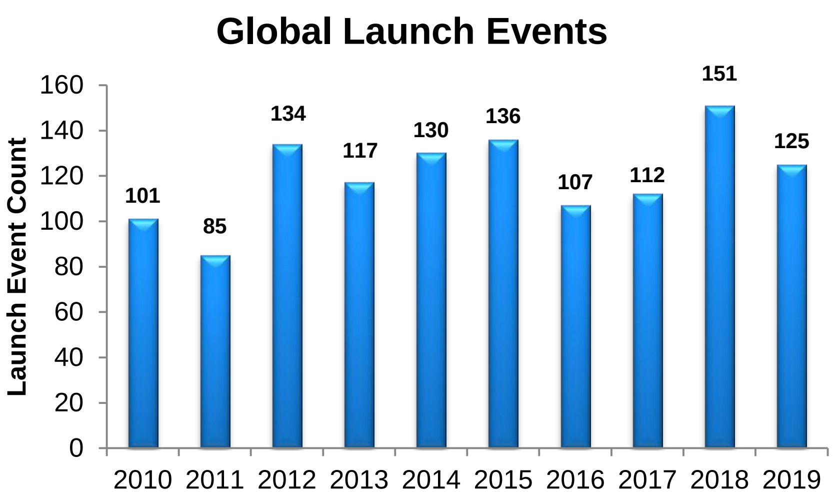
- Three distinct groups emerge:
  - 9+ million units per annum
  - 5 – 7 million units per year
  - 2 – 4 million units per year
- Pace and scope of interconnections is rising as technology and scale converge as key differentiators
- Risk mitigation all drives OEMs to co-develop/sponsor technologies

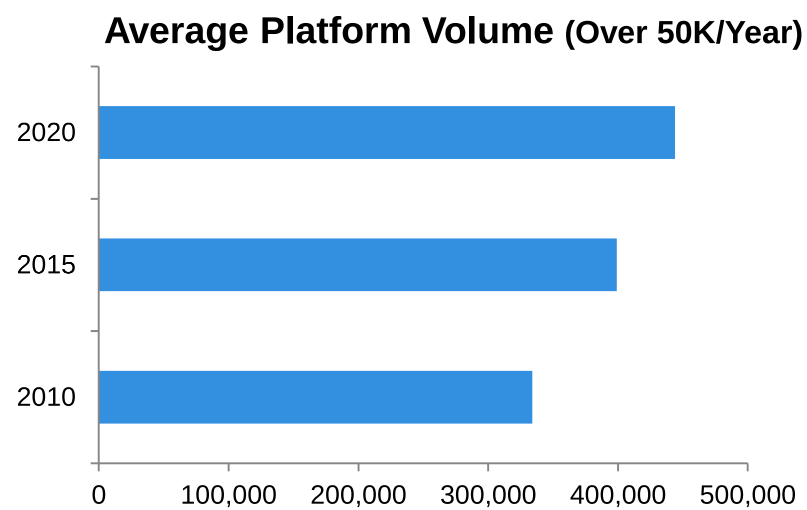
Faster, Greater Scale & Integrated

Industry Pace and Risk Rises …

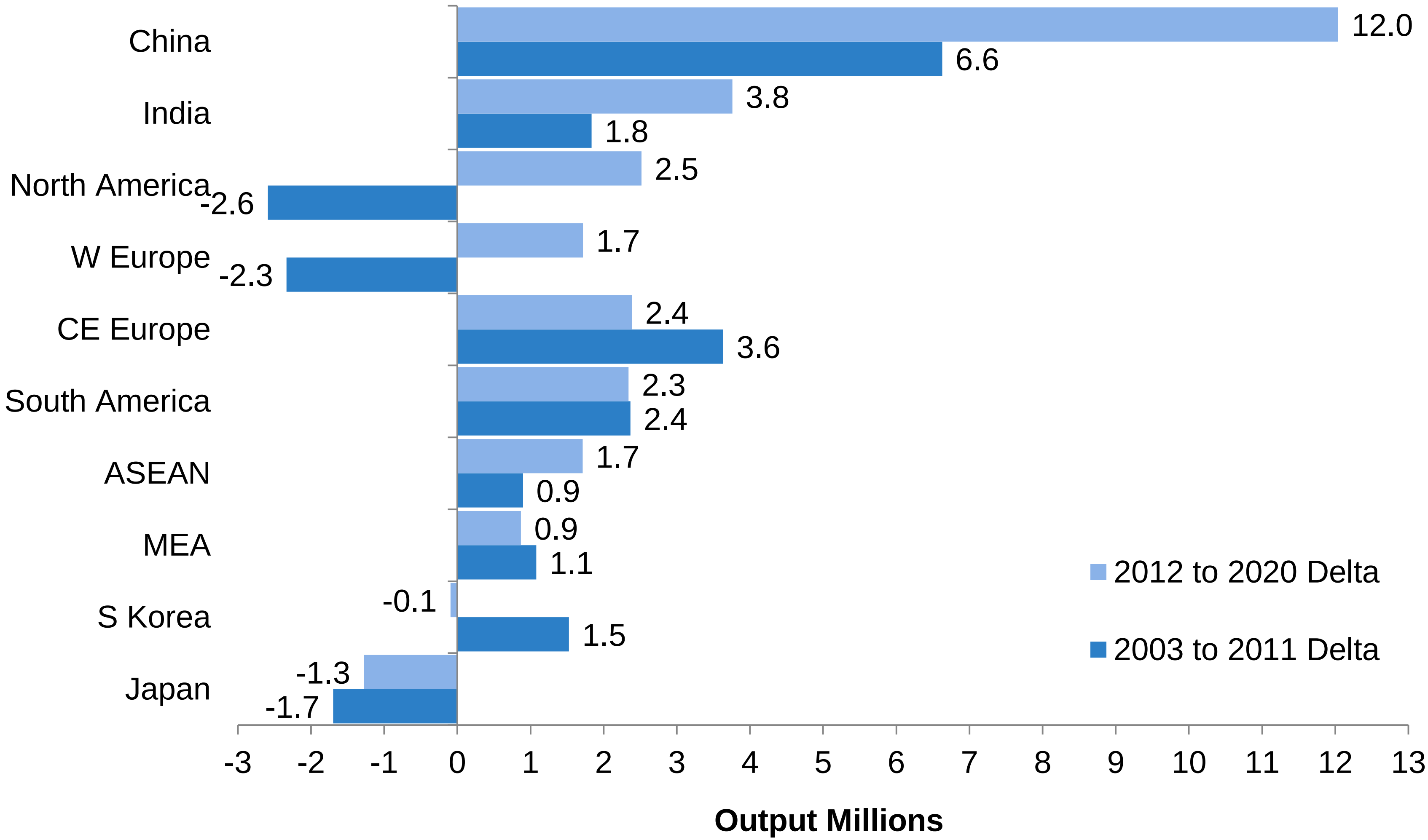






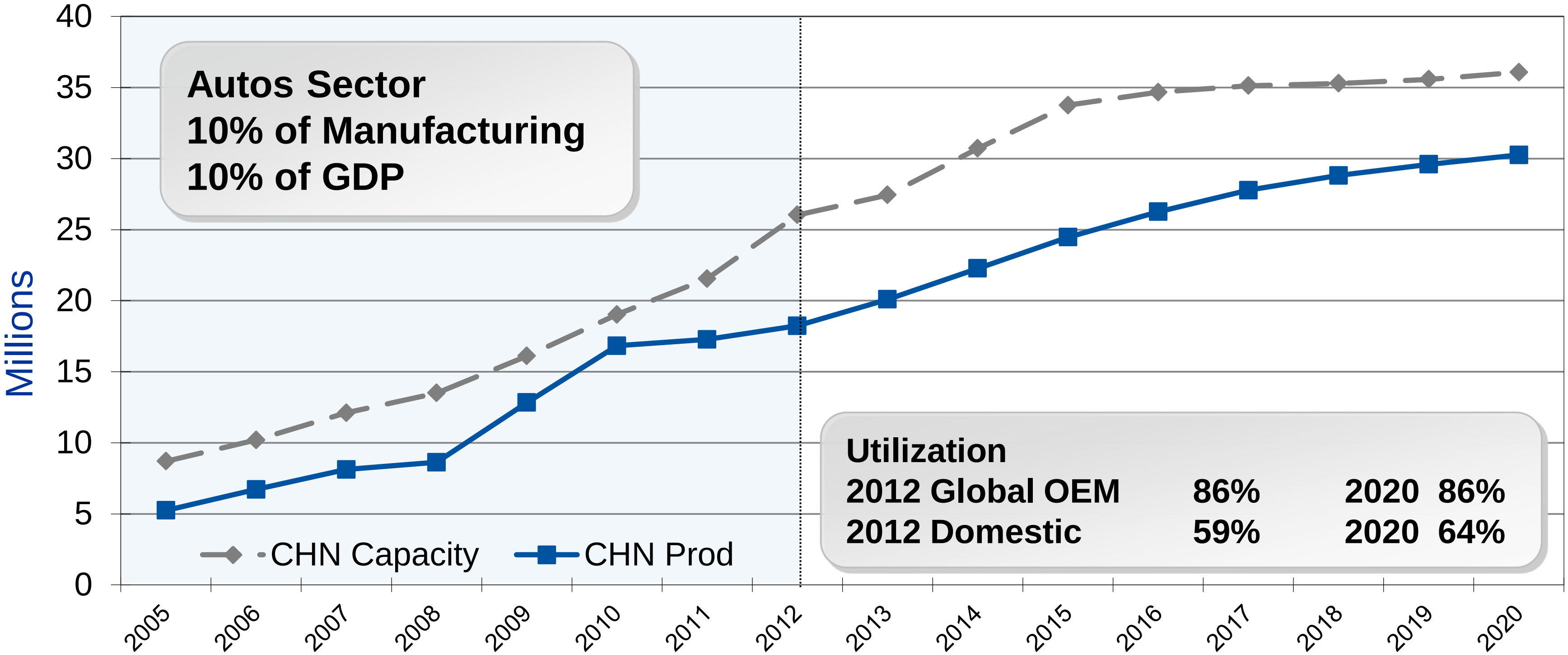


Automotive Landscape
Regional Production Sourcing Change



China Production Assessment

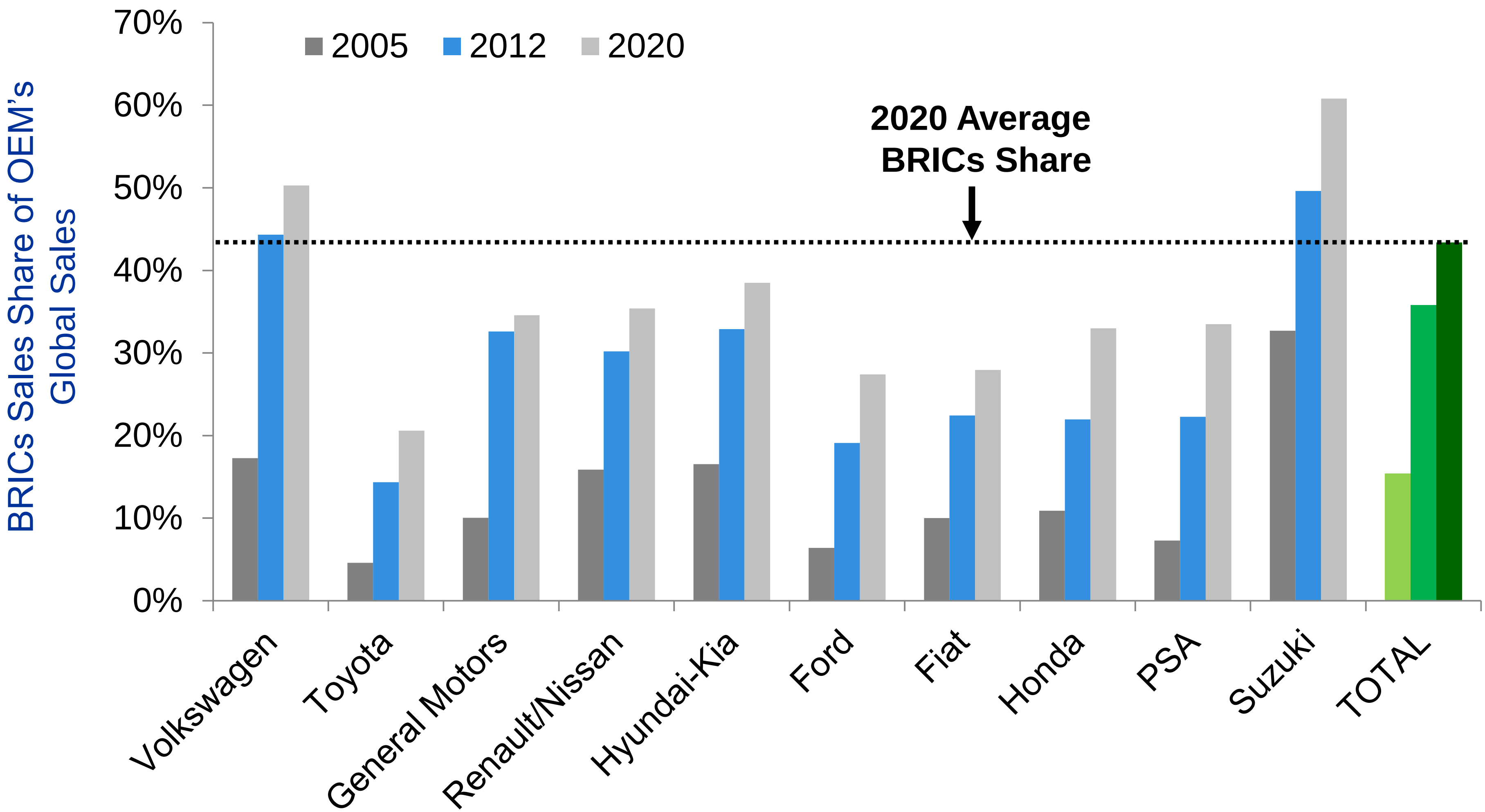
Light Vehicle Production vs. Capacity Investment



- Global OEMs constrained during 2009 and 2010—years of explosive growth. Many manufactures started a round of capacity expansion coming on stream in 2012.
- Moderate growth in 2011 and 2012 has seen OEMs take different directions: Global OEMs continue to invest and to expand their presence in different regions; Chinese OEMs still have spare capacity from earlier in the cycle. $36bn investment planned.

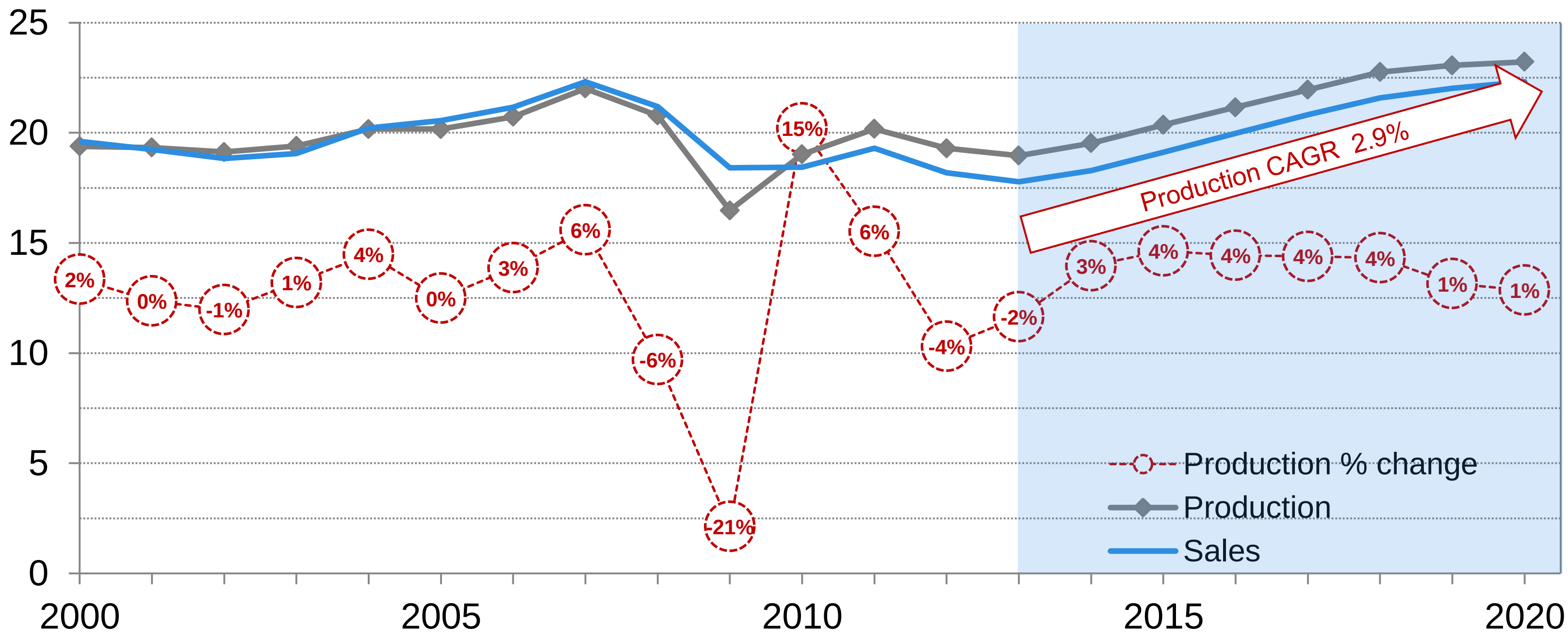
BRICs Share Of OEM Global Sales

Importance Of BRICs To Top 10 OEMs



Notes: Data represents Strategic Group, Top 10 Largest OEMs Shown Sorted by 2012 Sales Volume

Europe Production Outlook:
Slow Improvement



- Since 2012, production outpaces sales as exports surge and localization increases
- New peak emerges long term as Western Europe recovers and Russia realizes potential
- Localization of ‘export’ programs will curb absolute production growth rates

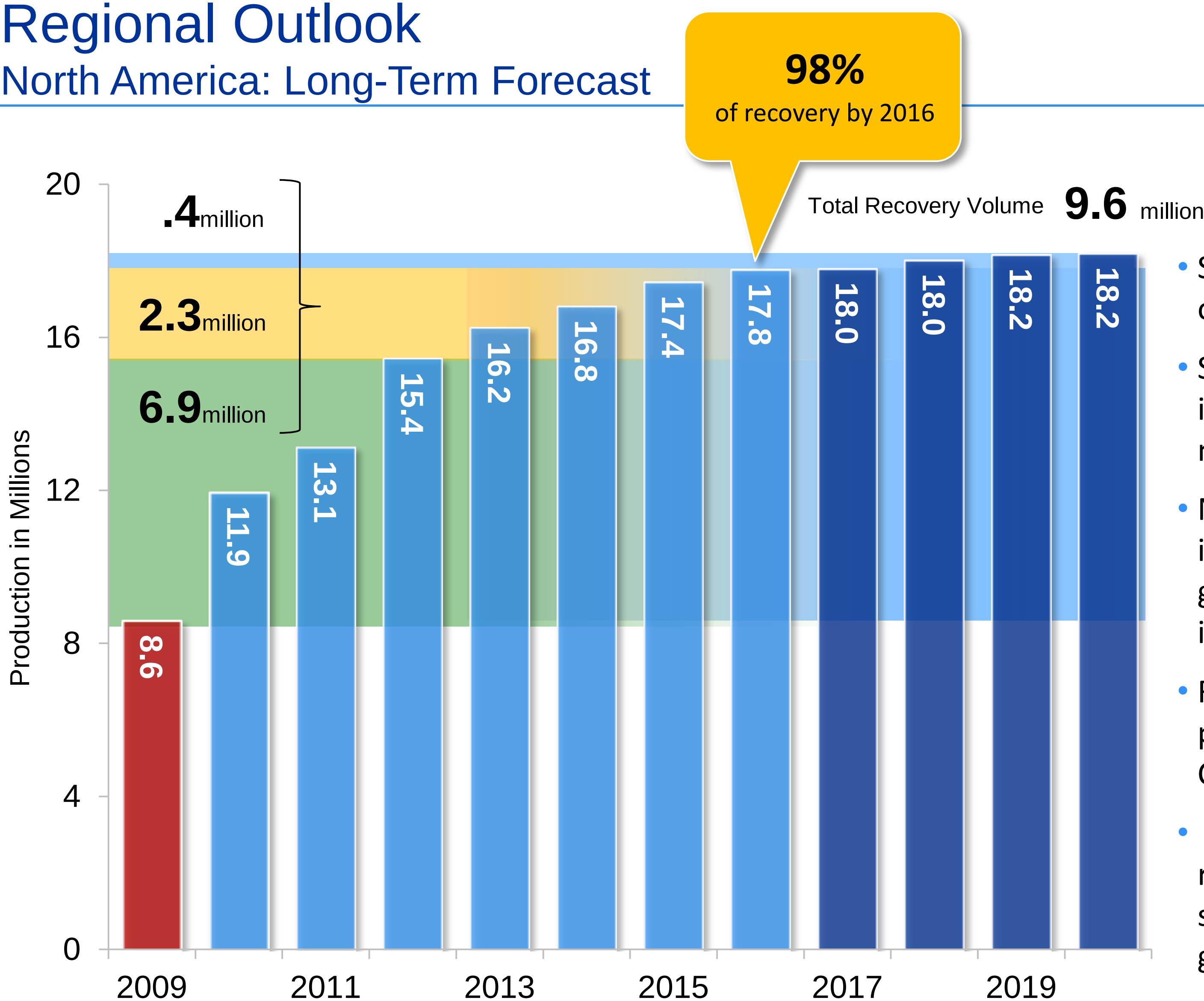
13

Global Light Vehicle Forecast

- Global Outlook
- **NA Outlook**
- Sourcing Dynamics
- Summary

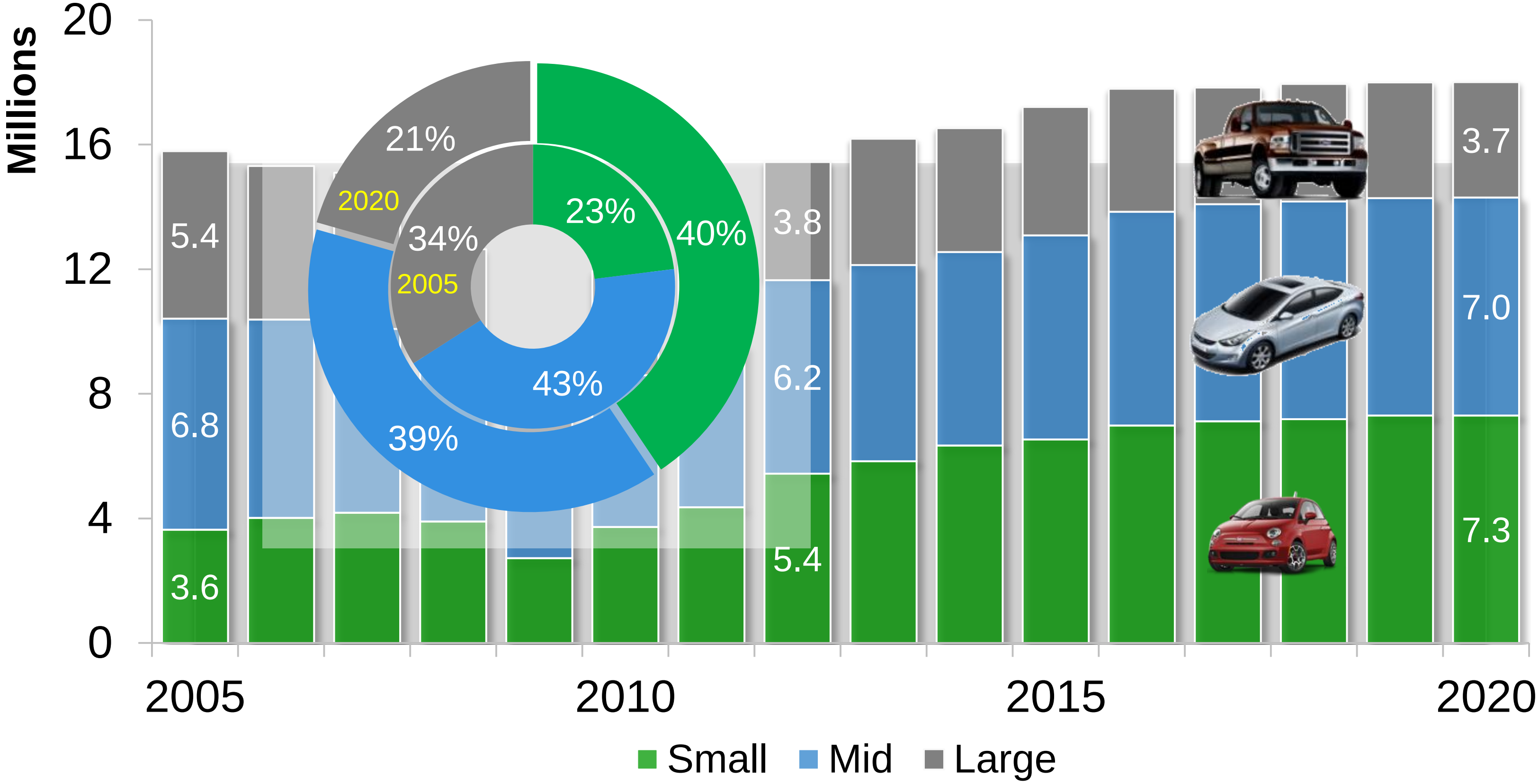
Regional Outlook

North America: Long-Term Forecast



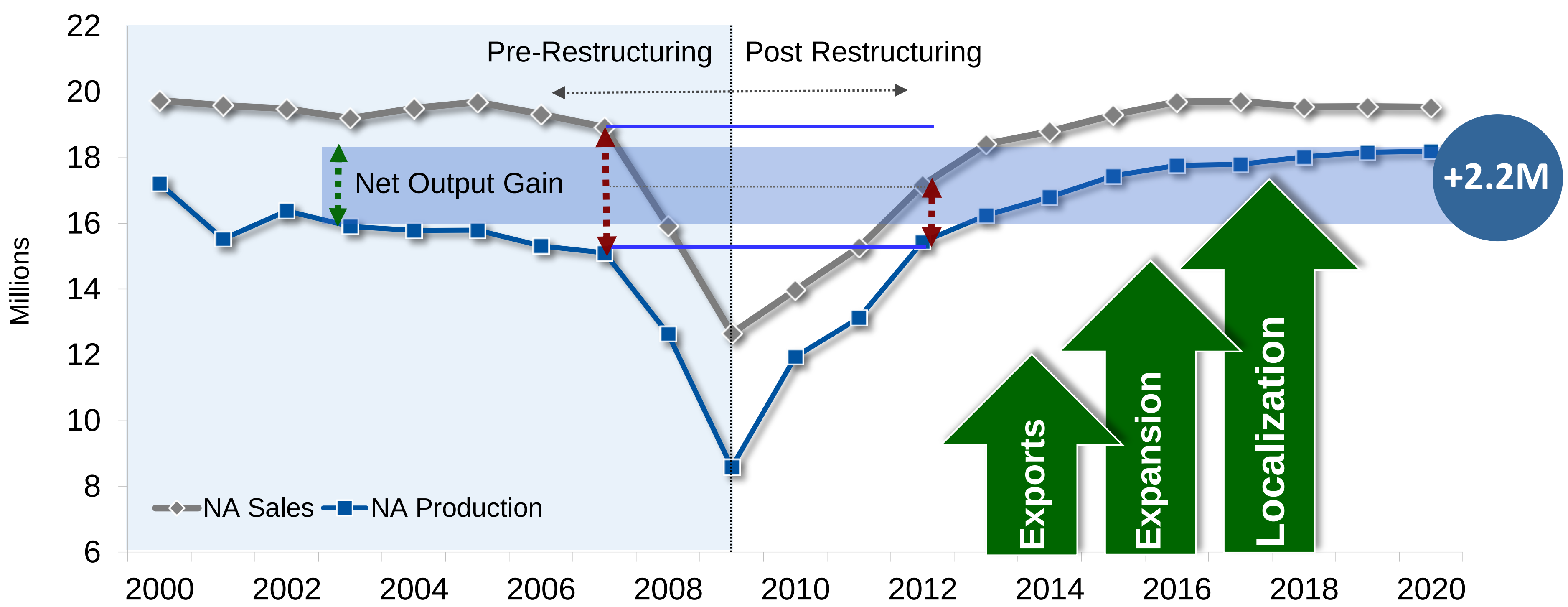
- Shift from ‘recovery’ to opportunity targeting
- Shift in strategy – how to increase profitability in more stable market
- New investments begin in 2014, driving robust gains by 2015, ongoing into 2018
- Further volume prospects for exports & CKD volume
- Luxury strength retained, yet BRIC market sourcing prospects limit growth

NA Segment Shift



Regional Outlook

North America Light Vehicle Sales and Production



- From 2001- 2009, regional sales eclipse output by 27% or 3.7 million units
- Gap is slashed from 2012 – 2020, future sales outpace output by less than 10% or by 1.35 million units by 2018
- Positive sales trajectory tapers after peak in 2017 – US sales well below 2000 highs

Production Outlook

Regional Sourcing Migration Continues

2012 – 2020

-3.6% CAGR
-26% or -627K units
1.8M

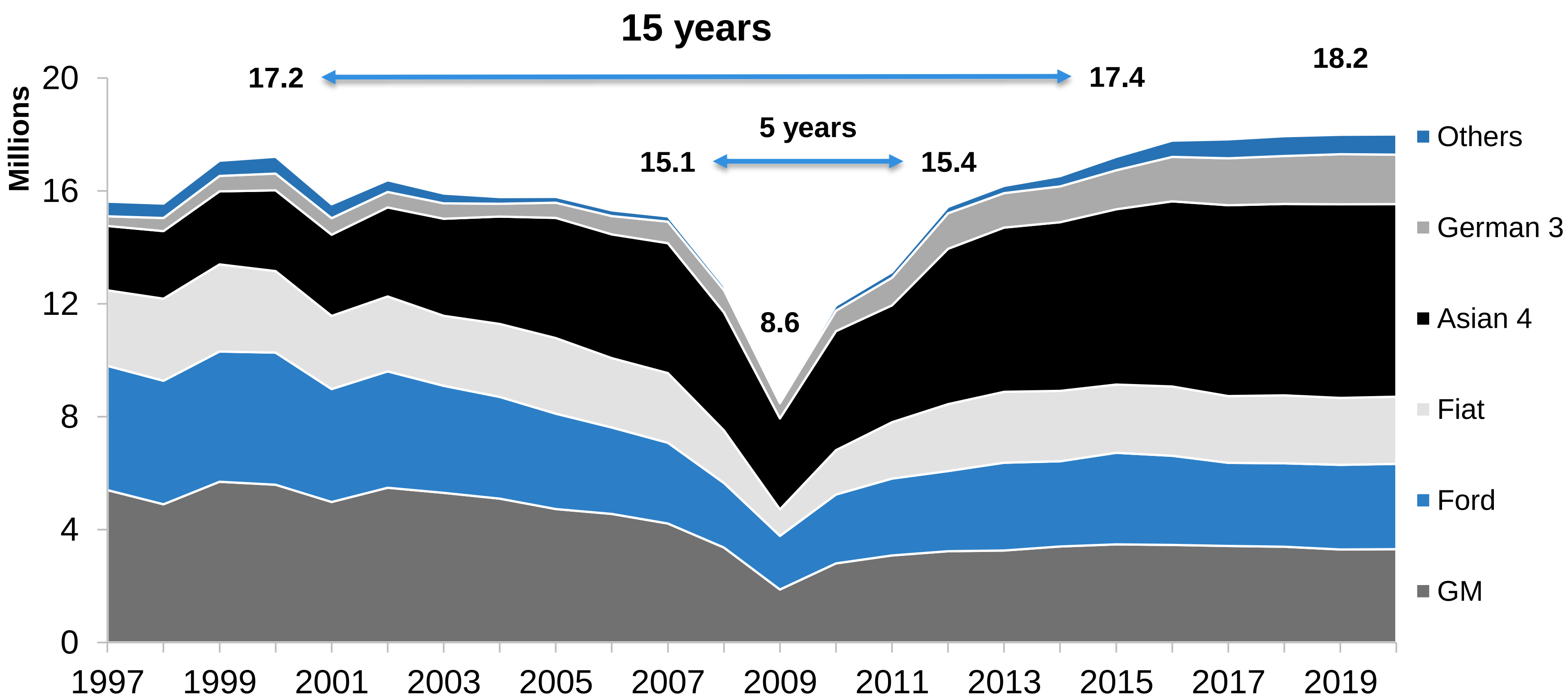
2.1% CAGR
18% or 1.8M units
11.9M

5.6% CAGR
55% or 1.6M units
4.4M

Factors Driving Optimization

- Currency Exposure
- Global Market Access–FTAs
- Global Platforms
- Net Landed Cost

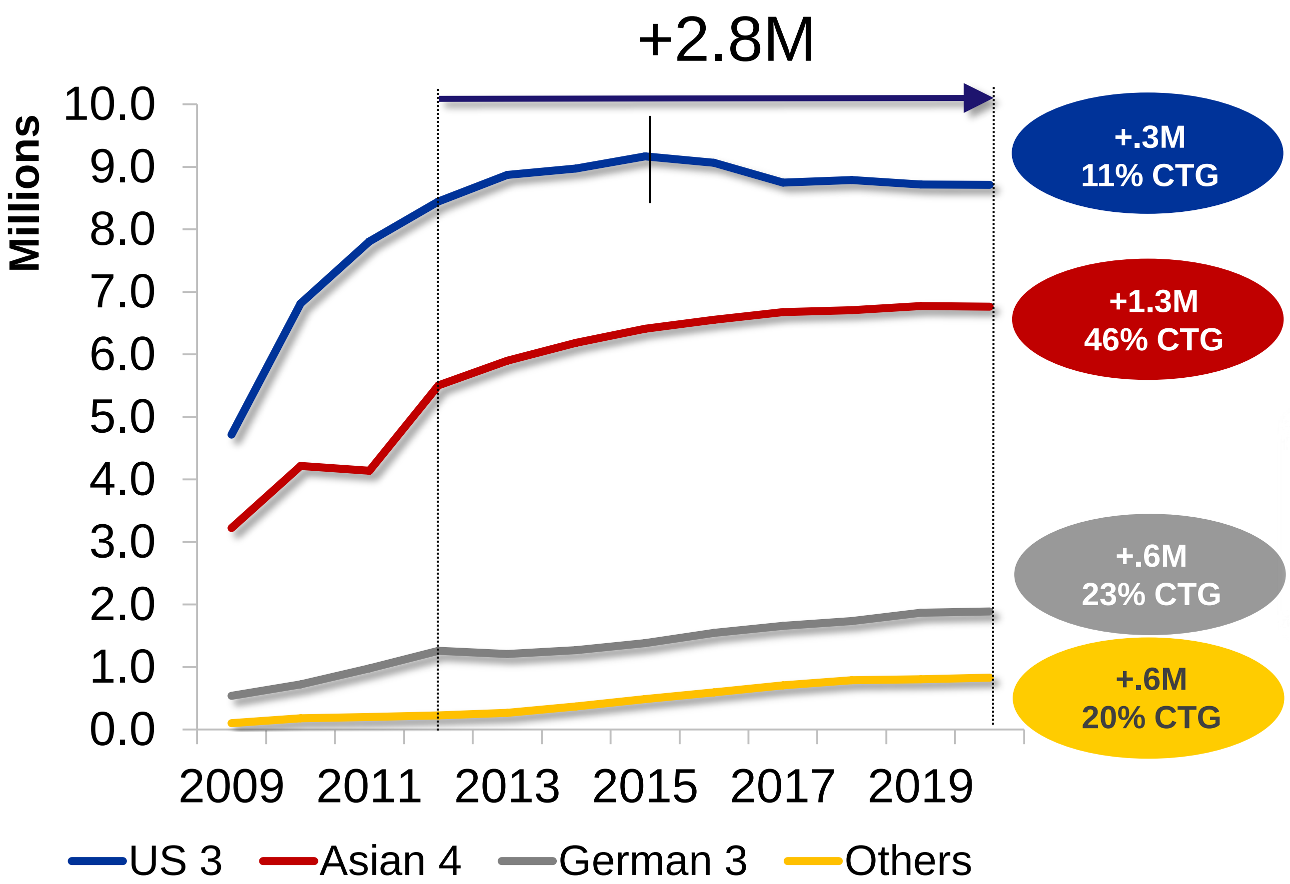
Market Dynamics
Prospects for North American Output



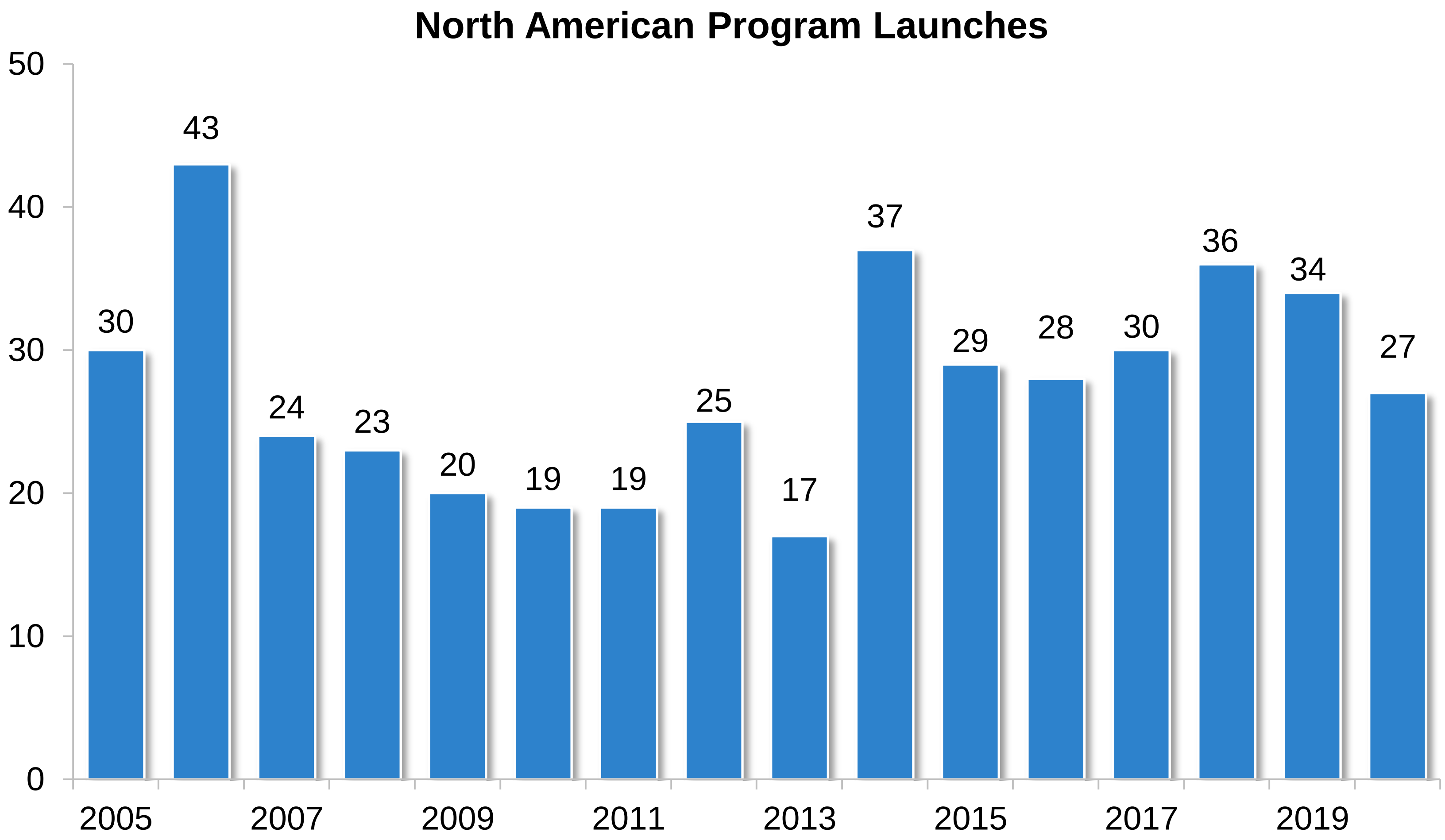
Source: IHS Automotive Light Vehicle Production Forecast

- Production outlook follows demand recovery; import substitution & exports add volume support
- Global product/platform strategies enable competitive sourcing shifts

Market Dynamics
Detroit 3 in the Minority

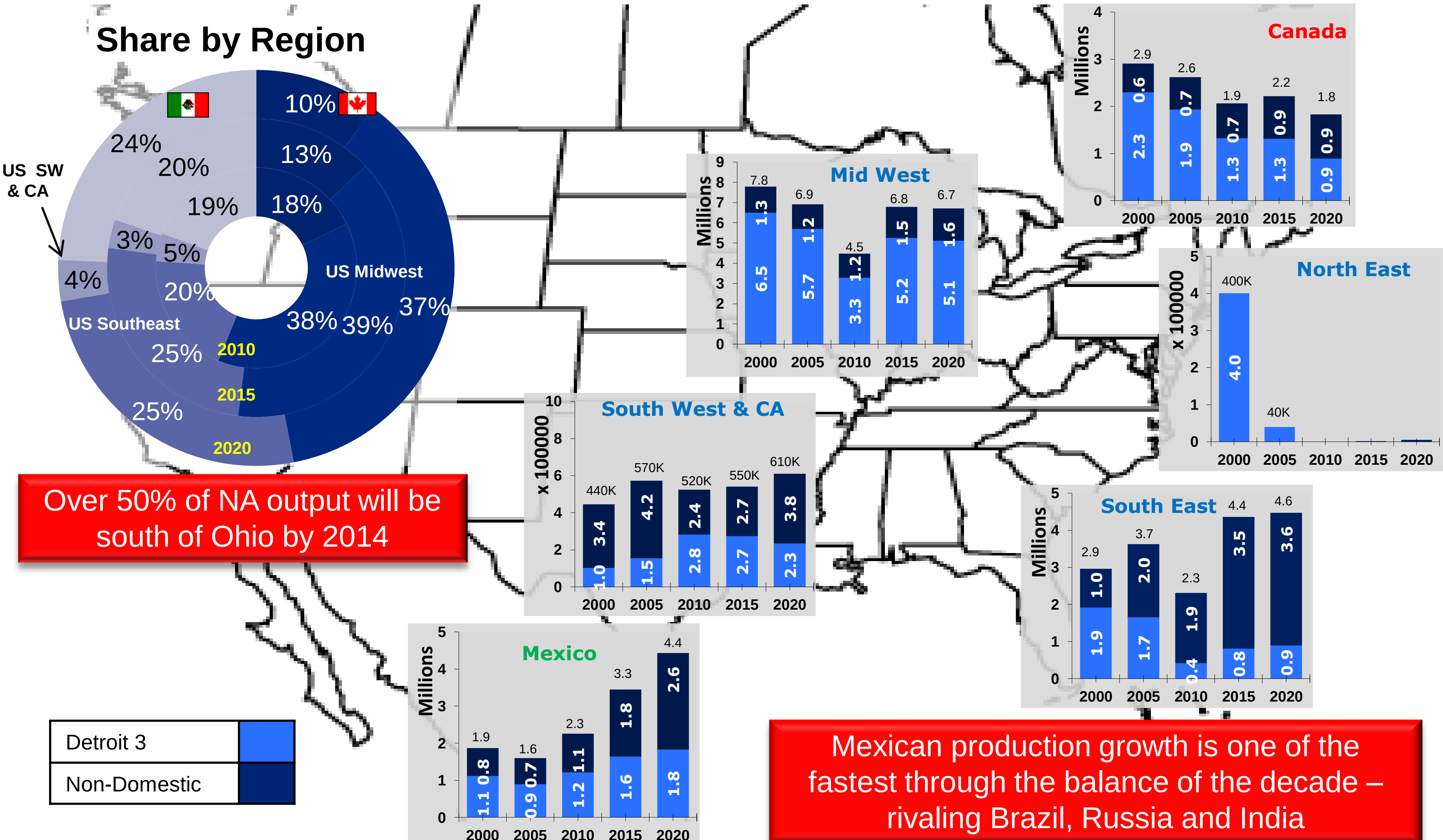


Market Dynamics
Launch Activity Surges, Investment & Competition Too



Source: IHS Automotive Light Vehicle Production Forecast

NAFTA Output By Region
Shifting Towards the US South & Mexico

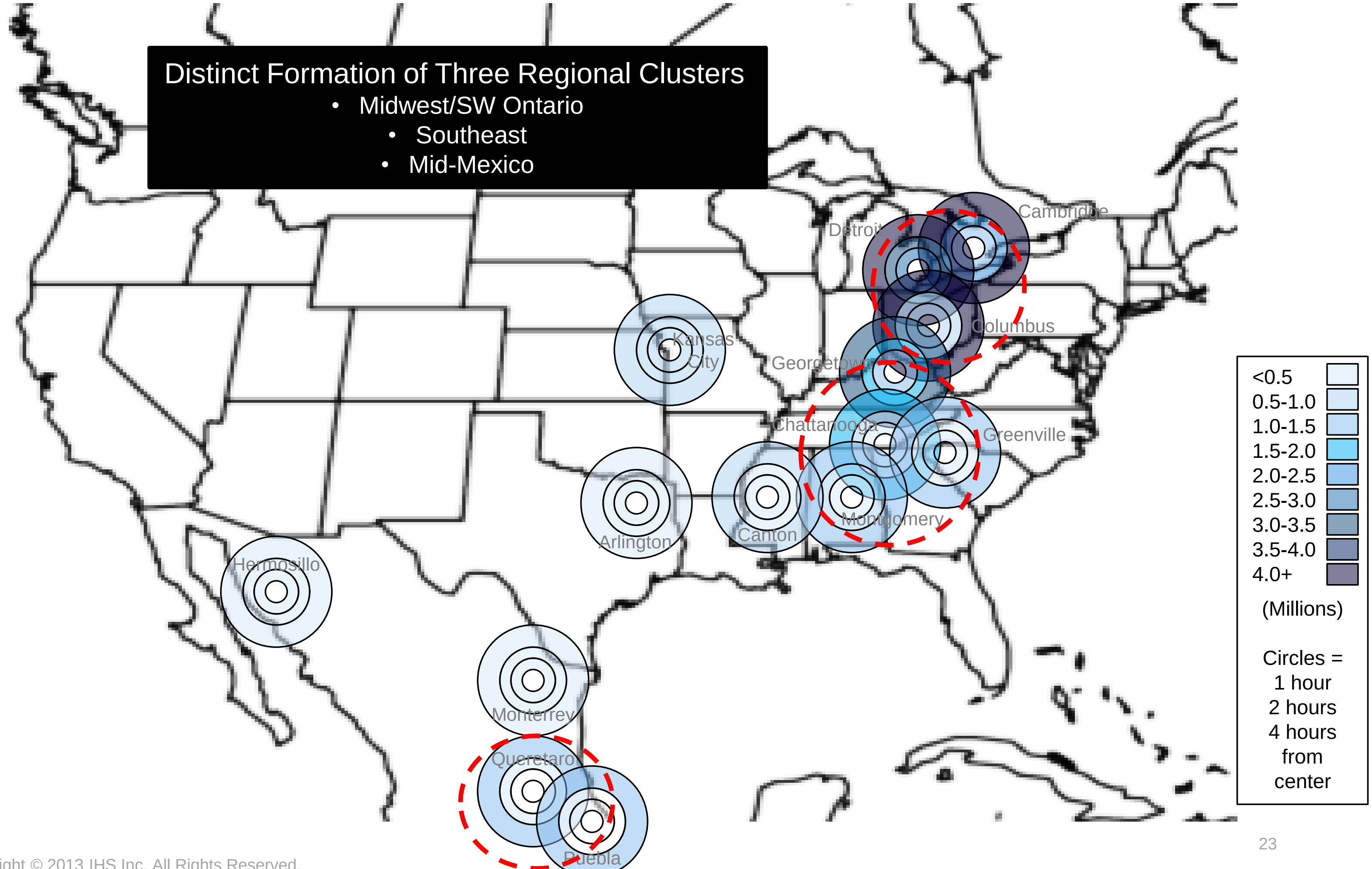


Over 50% of NA output will be south of Ohio by 2014

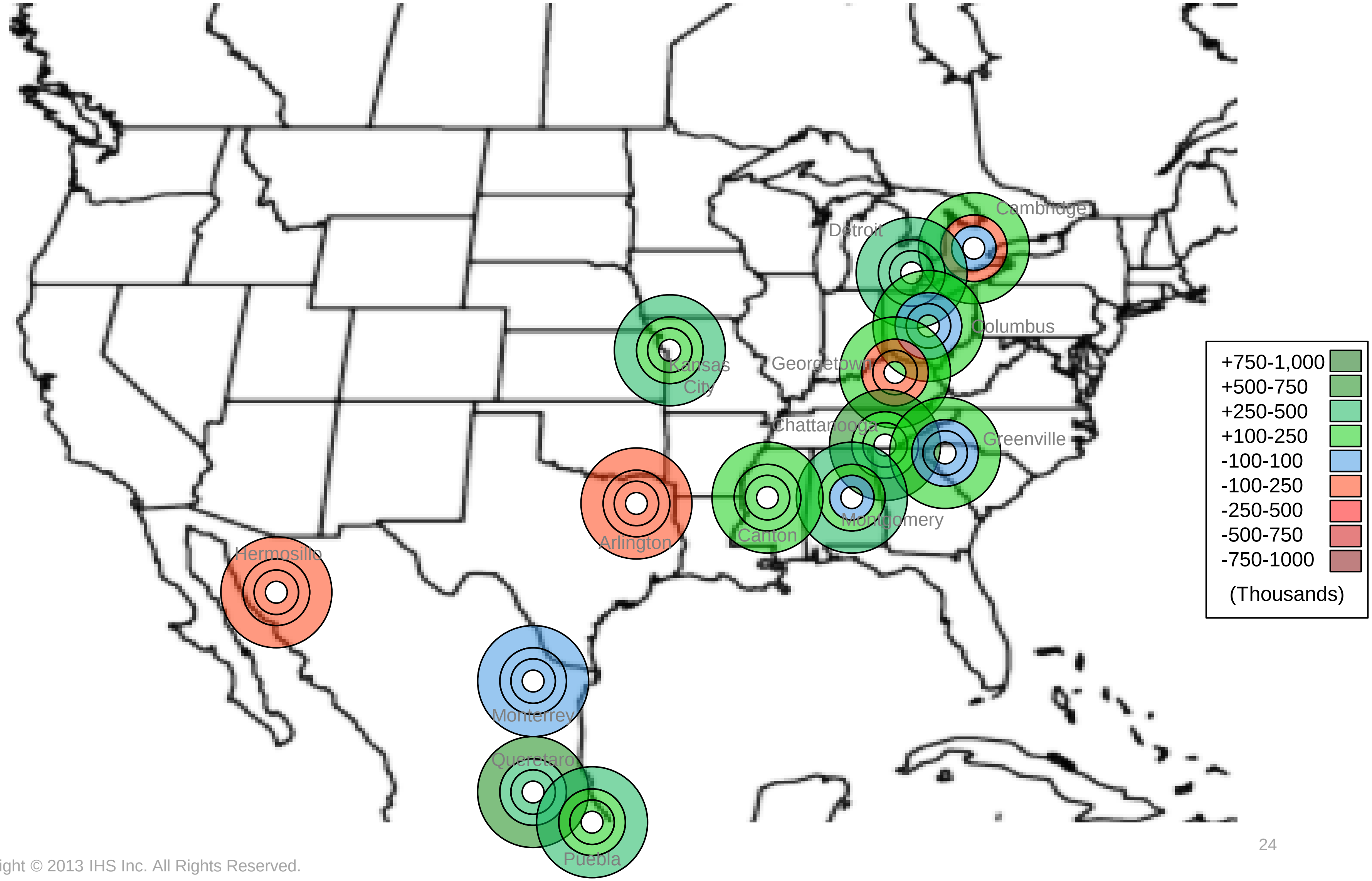
Detroit 3	
Non-Domestic	

Mexican production growth is one of the fastest through the balance of the decade – rivaling Brazil, Russia and India

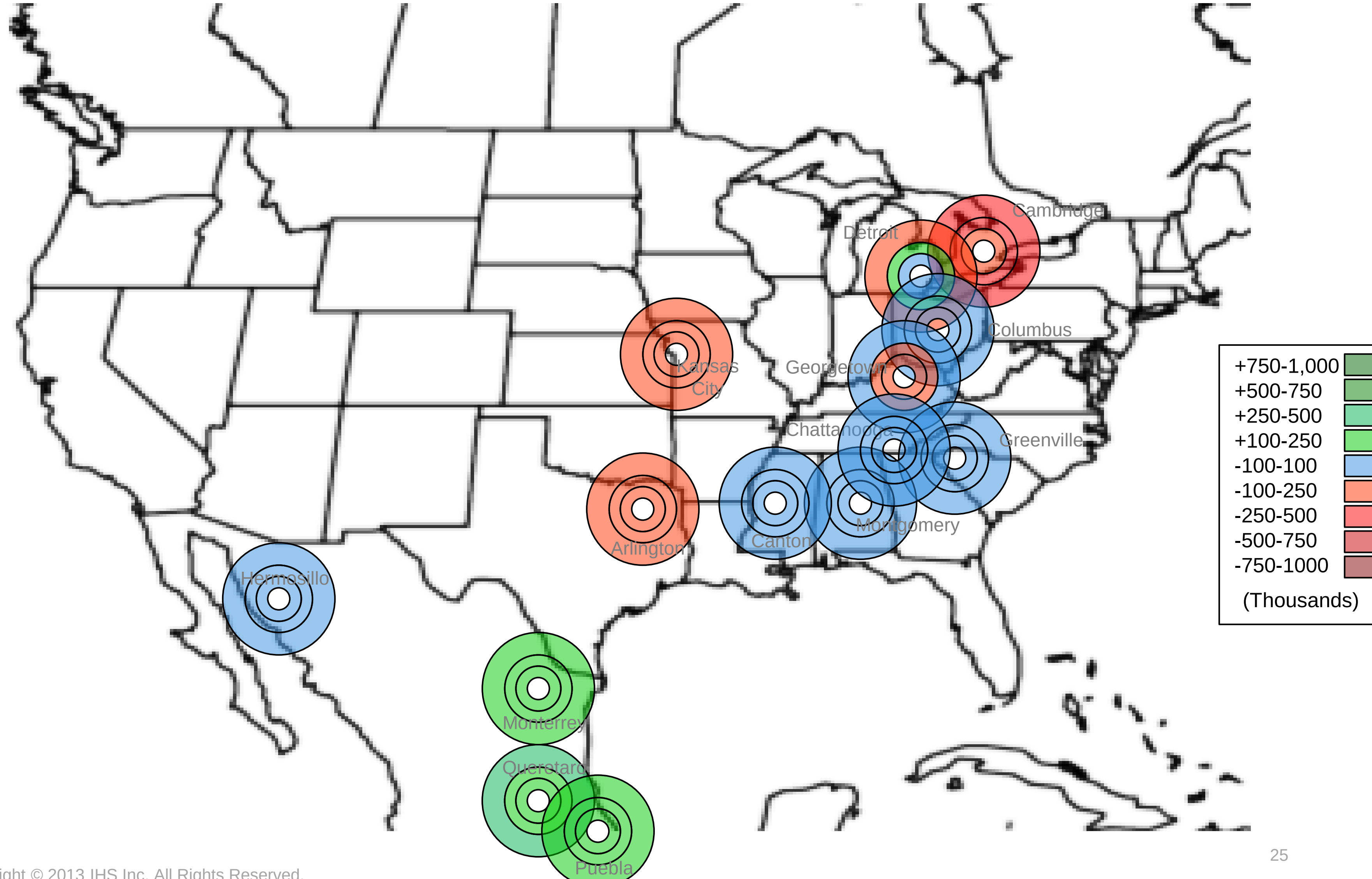
LV Production Locational Analysis
2013 CY



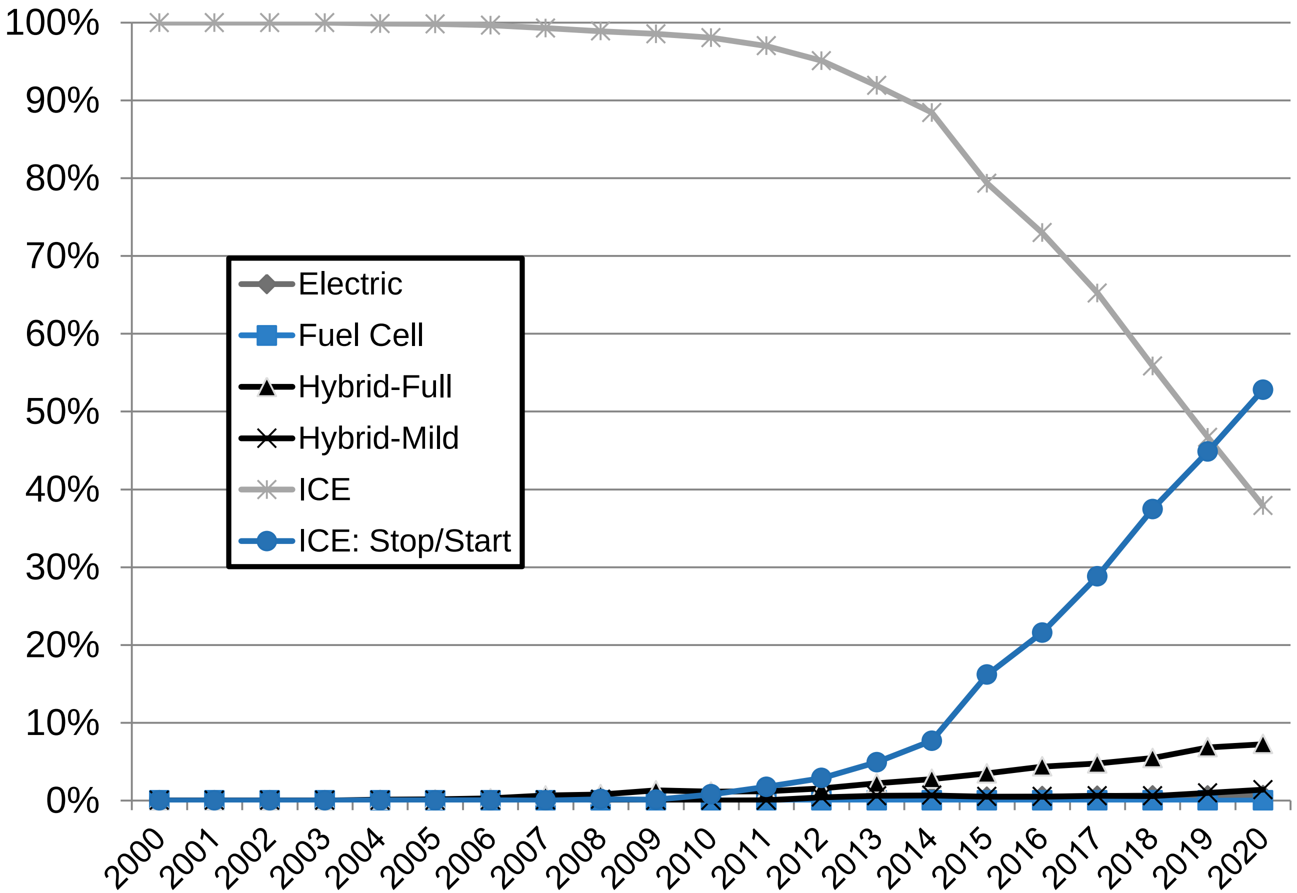
LV Production Locational Analysis
2013-2016 Change



LV Production Locational Analysis
2016-2020 Change



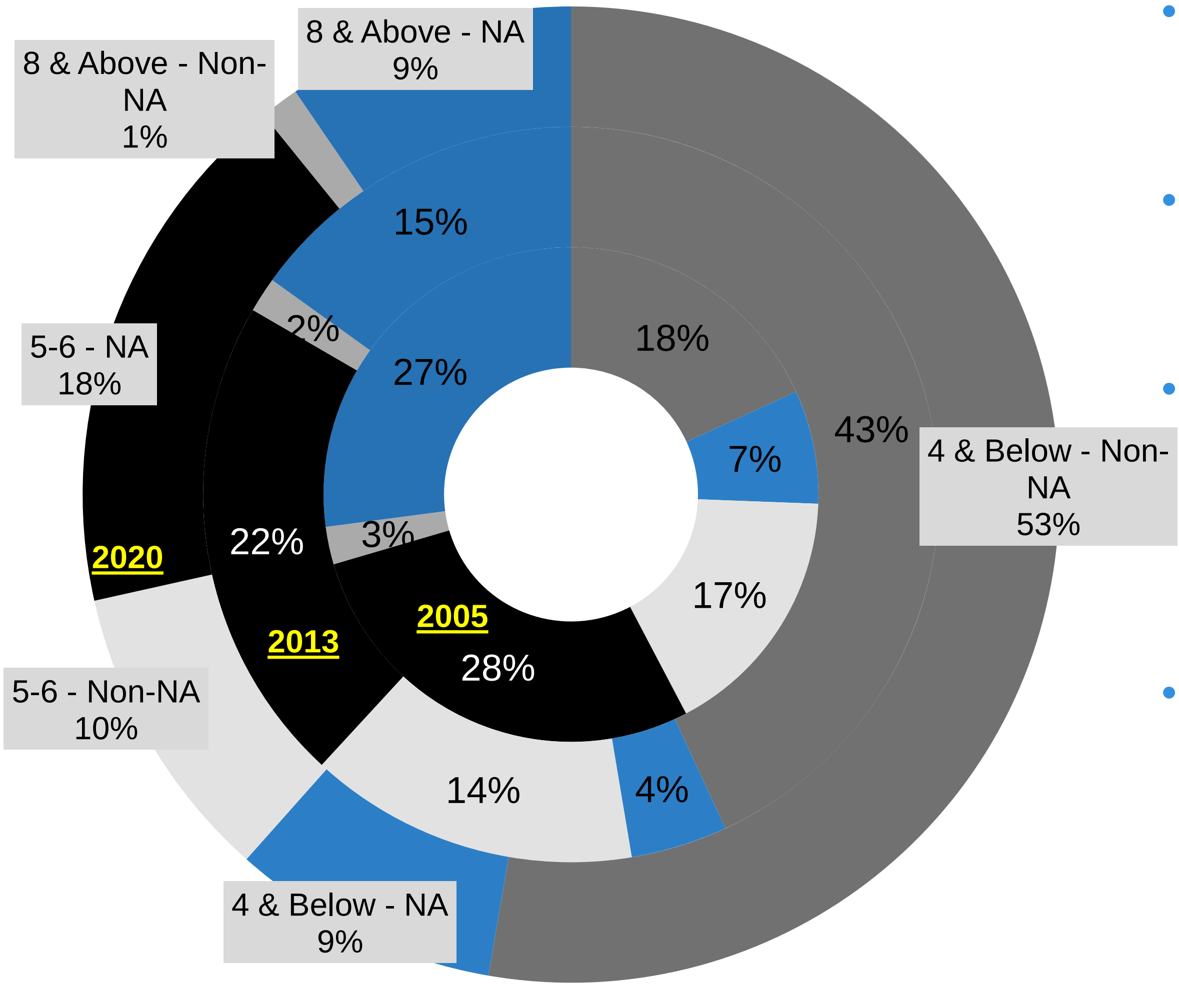
NA Engine Installation by Technology
All OEMs



- Stop start will reach ~ 50% installation by 2018 in NA
- Every major platform design for production start from 2015 onwards will have Stop/Start packaged
- OEMs will increasingly be conscious of slosh noise for future platforms

North American Powertrain Trends

Engine Installation by Cylinder Count and Design Region

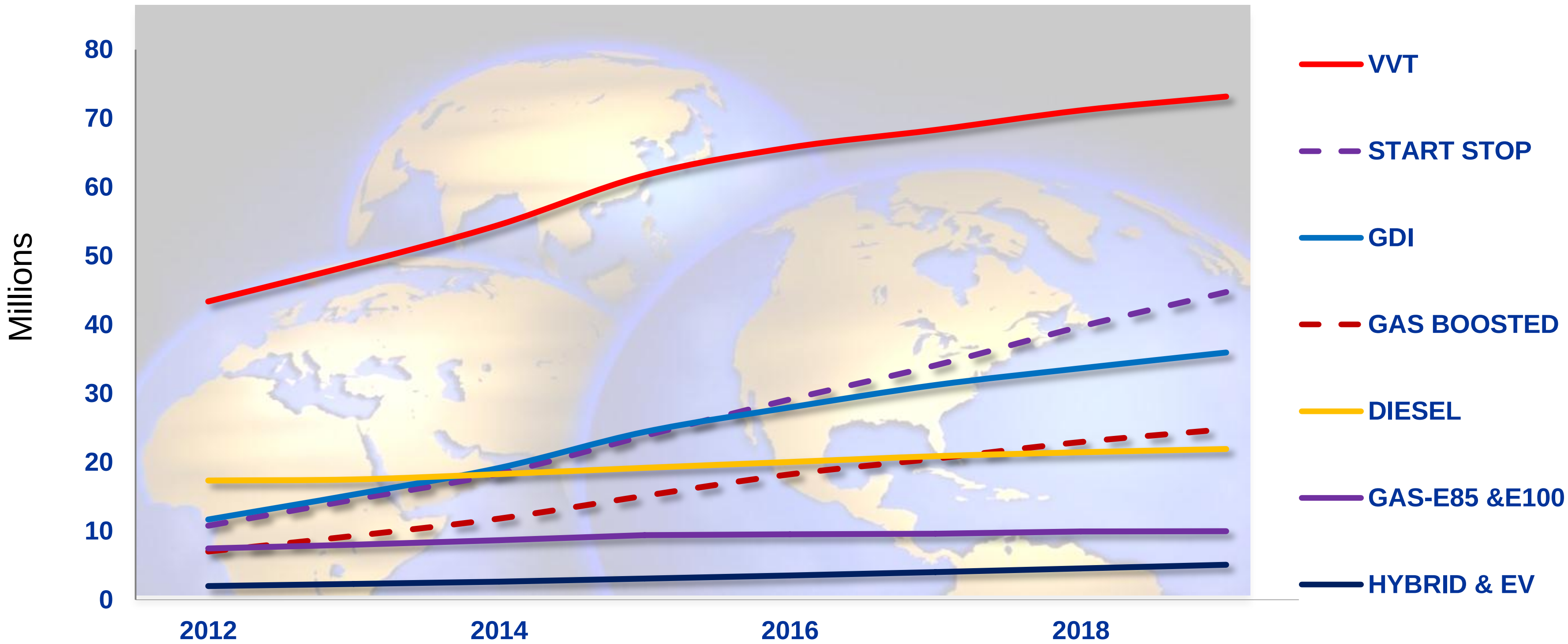


- Non-NA design rises to 60%+ by 2020 – almost double from 2005 at 38%
- Four cylinders and below account for 60%+ of the total – also double
- V8 powerplants still designed in NA though accounting for ~10% of total – mainly in full-frame offerings
- V6 gains from V8 substitution though downsizing and charging technologies enable for a decline from 45% in 2005 to less than 30% in 2020

Global Light Vehicle Forecast

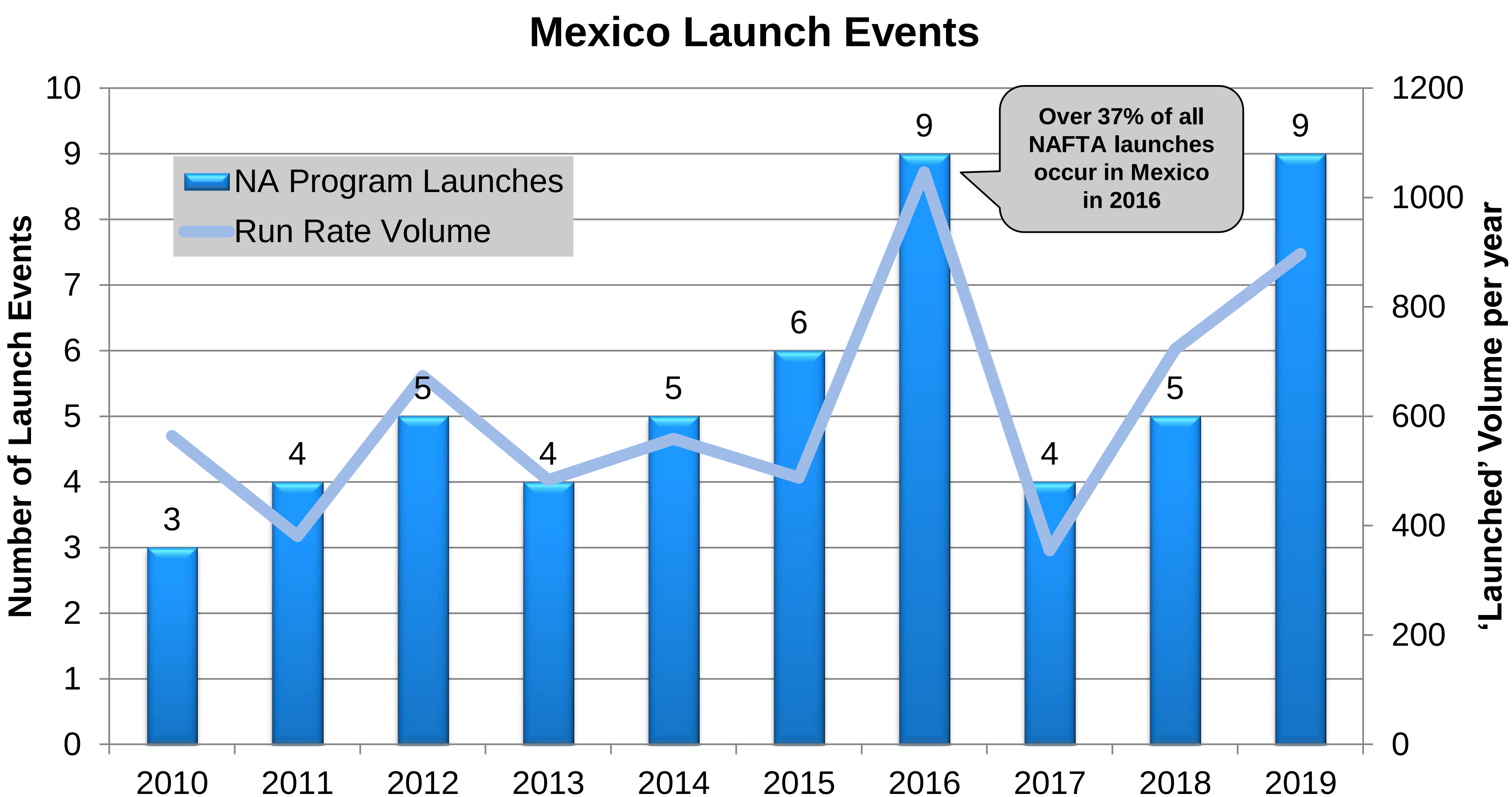
- Global Outlook
- NA Outlook
- **Sourcing Dynamics**
- Summary

Global Overview of How Key Engine Technologies Will Evolve



- VVT almost standard on new engines; many migrating to more advanced designs
- Start Stop technology steadily increases, driven strongly by Europe
- GDI and gas boosting both ramp up quickly, Electrification still niche player globally

Market Dynamics
Mexico's Launch Activity

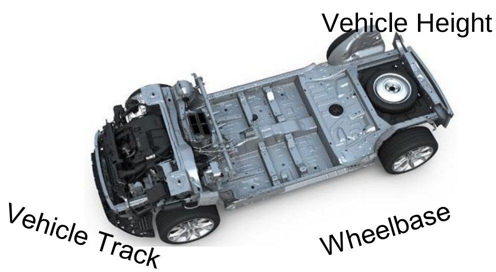


Launch Event = Vehicle launch @ a facility with sustainable volume >50K/Year

New Platform Concepts:

VOLKSWAGEN
AKTIENGESELLSCHAFT

PSA PEUGEOT CITROËN



RENAULT NISSAN

MQB A/B

"One of the prominent characteristics of the Modular Transverse Matrix is the uniform mounting position of ALL engines. Assembly kit allows for synergies between all vehicle classes"

•2020 scale: 5.6 million units

•2020 program count: 130+

EMP2

"Advanced modularity allows for new combinations: Four different track widths; Five wheelbases; Two cockpit and cowl solutions; Two rear suspension architectures"

•2020 scale: 1.7 million units

•2020 program count: 50+

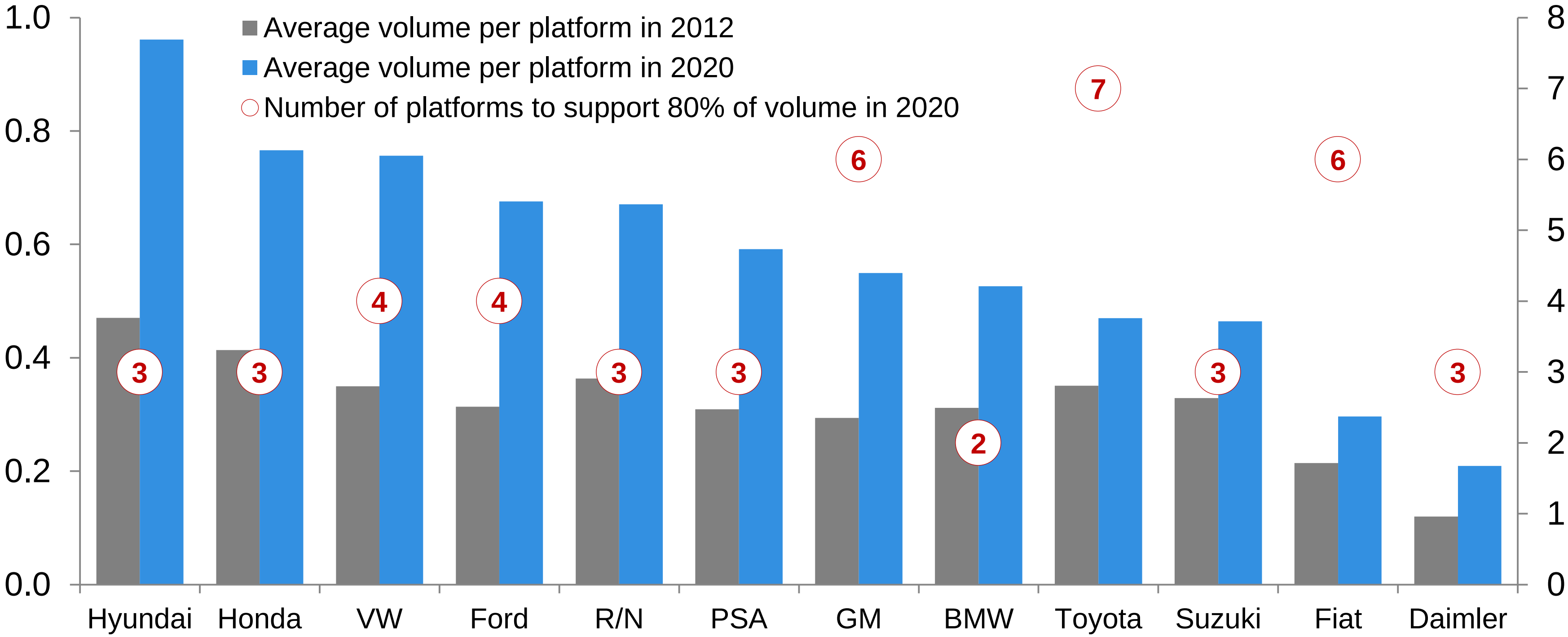
CMF1

"Common Module Family is based on the assembly of compatible Big Modules: engine bay, cockpit, front underbody, rear underbody and electrical/electronic architecture"

•2020 scale: 1.7 million units

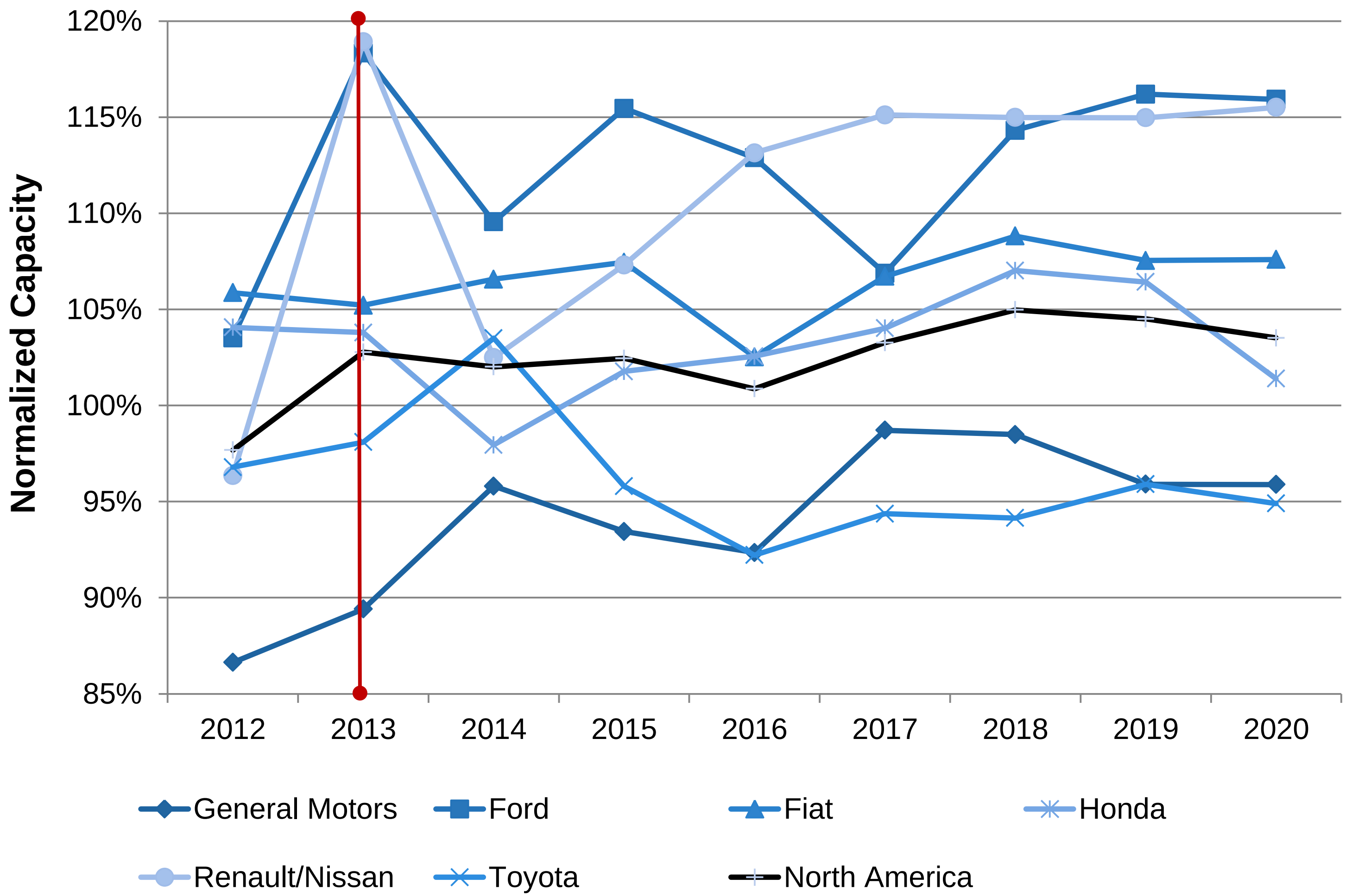
•2020 program count: 50+

Platform Metrics



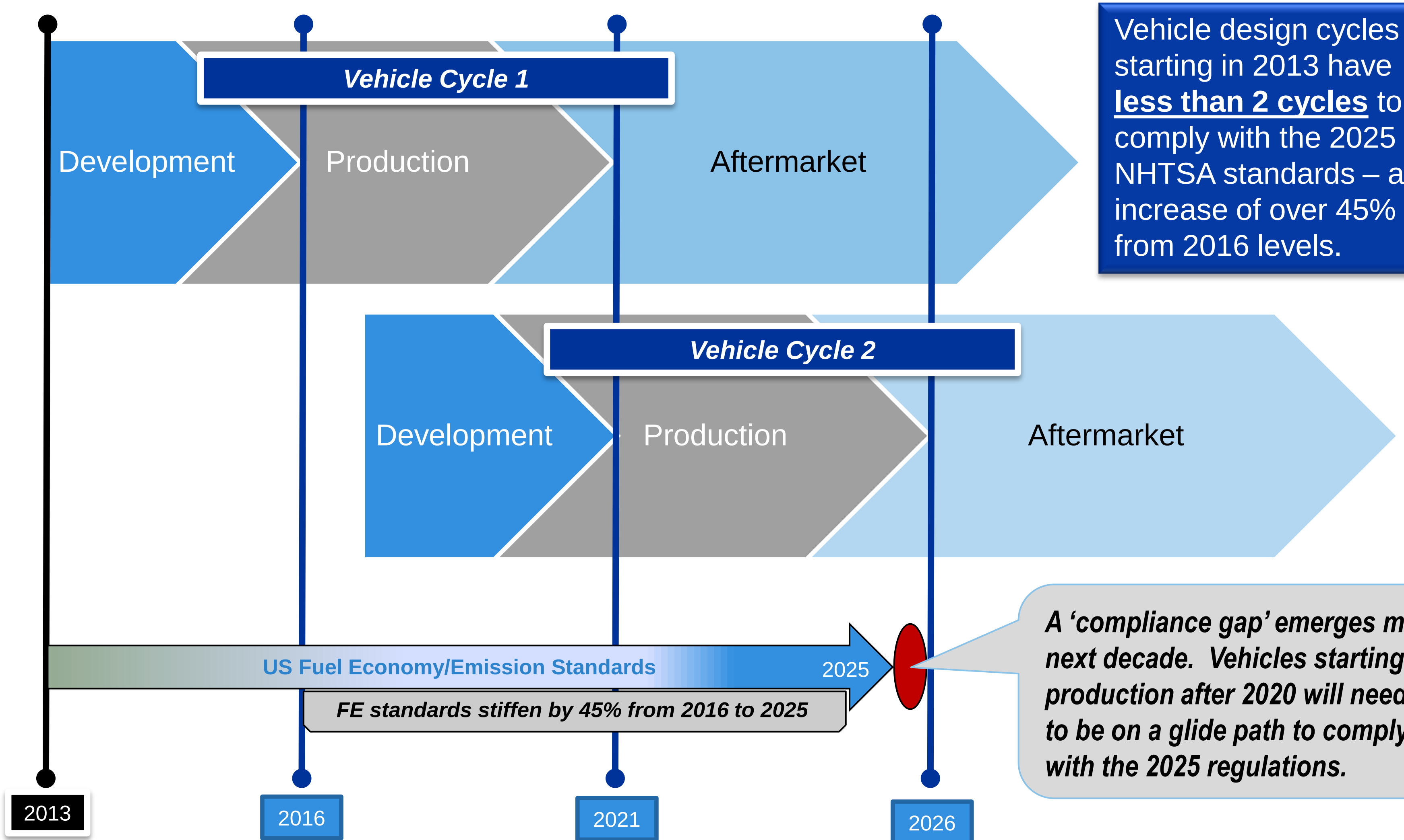
- Average platform volume to double, volume manufacturers have greatest opportunities
- Premium OEMs lack absolute scale but generate high efficiency
- Toyota, Fiat-Chrysler and GM lag in terms of consolidation

NA Normalized Capacity Utilization
2012-2020



- Ford has tough choices to make – redeploy Ohio Truck or build new
- Shift of previously imported vehicles at Renault/Nissan bolsters utilization
- General Motors has extra capacity to utilize for market share gains or export
- Supplier capacity in critical areas in an era of technology change

The Fuel Economy Dilemma
Massive Structural Change by 2025

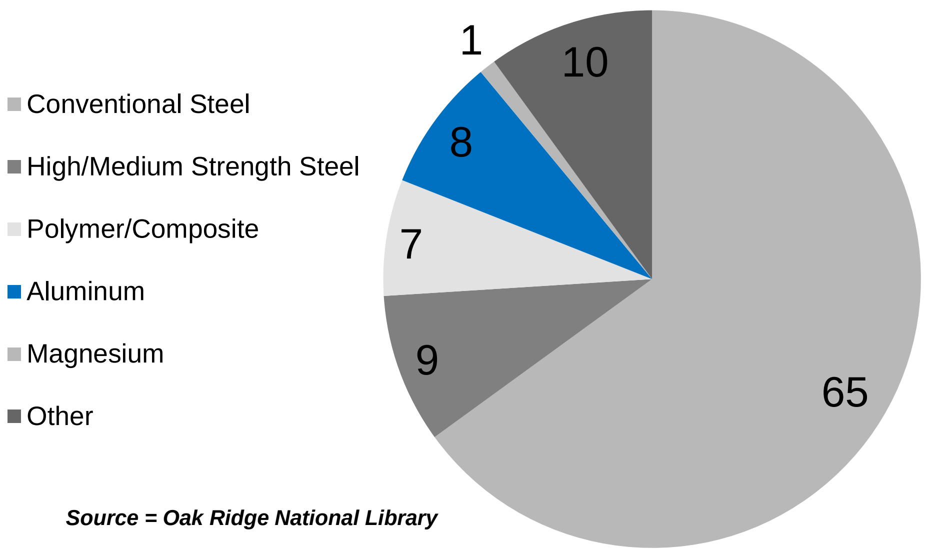


Vehicle design cycles starting in 2013 have **<u>less than 2 cycles</u>** to comply with the 2025 NHTSA standards – an increase of over 45% from 2016 levels.

A 'compliance gap' emerges mid next decade. Vehicles starting production after 2020 will need to be on a glide path to comply with the 2025 regulations.

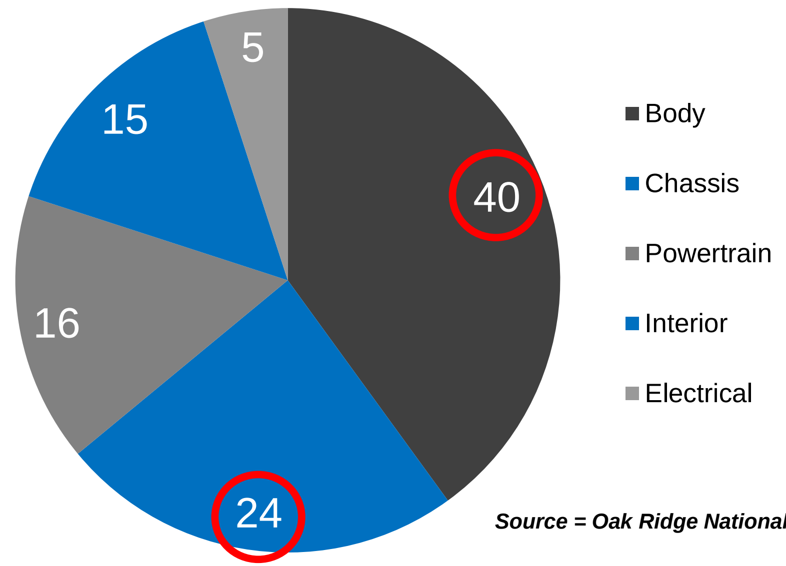
Vehicle Composition and Weight Distribution

Vehicle Composition by Material



Source = Oak Ridge National Library

Vehicle System Weight Distribution



Source = Oak Ridge National Library

•Pressure for weight reduction is slated to focus on body and structure first as aluminum, advanced high strength steels and lighter forgings begin to penetrate the body and structure

•Second focal point will be chassis/suspension with a material shift towards New steel forming processes, aluminum and new drive designs.

Vehicle Optimization is Critical
A Multi-Material/Multi-Powertrain Environment

- Each OEM has its own requirements, infrastructure, supplier affiliations and technology suite
- Material usage and powertrain technology will depend upon:
  - Duty cycle
  - Cycle time
  - Cost considerations
  - Upstream capacity
  - Portfolio considerations
  - Safety
  - Material interaction/ joining
  - Customer preferences
  - Capital infrastructure

Multi-Material

Source: Volvo

Multi-Powertrain

Source: General Motors

Global Light Vehicle Forecast

- Global Outlook
- NA Outlook
- Sourcing Dynamics
- **Summary**

Summary

•NA LV production is increasingly stretched as exports, import substitution and more effective fixed cost utilization takes center stage

•Global platforms have changed the face of the industry – sourcing, cadence, multi-region coverage, regional protection and capacity utilization

•Integration of alternative materials stretches the industry – vehicle optimization is the new mantra

•All vehicle systems will be under tremendous scrutiny for mass reduction and efficiency – an exciting decade is in the offing …..

IHS Automotive
DRIVEN BY POLK

Thank You

Michael Robinet
Managing Director, IHS Automotive

December 6, 2013