IHS Markit

AUTOMOTIVE

Advantages of Being a Proactive Supplier

Industry Changes – Weight Loss & Power Unit Strategy

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Shou Osako
Director, East Asia | Automotive Advisory Services
+813 6262 1726, shou.osako@ihsmarkit.com

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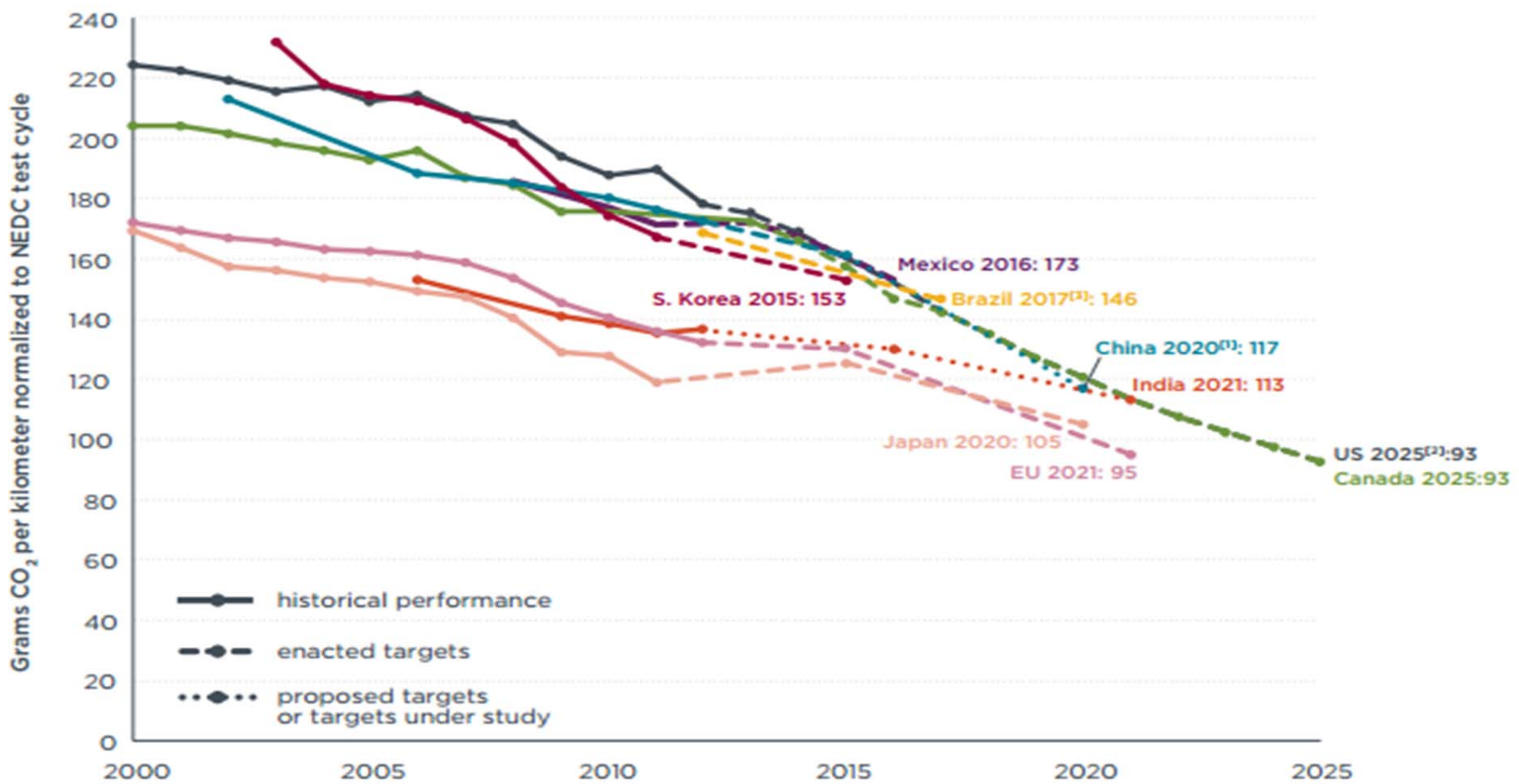
Regulations Strengthen : Compliance Gaps Emerge

Global CO_2 Targets Are Aggressive and Converging



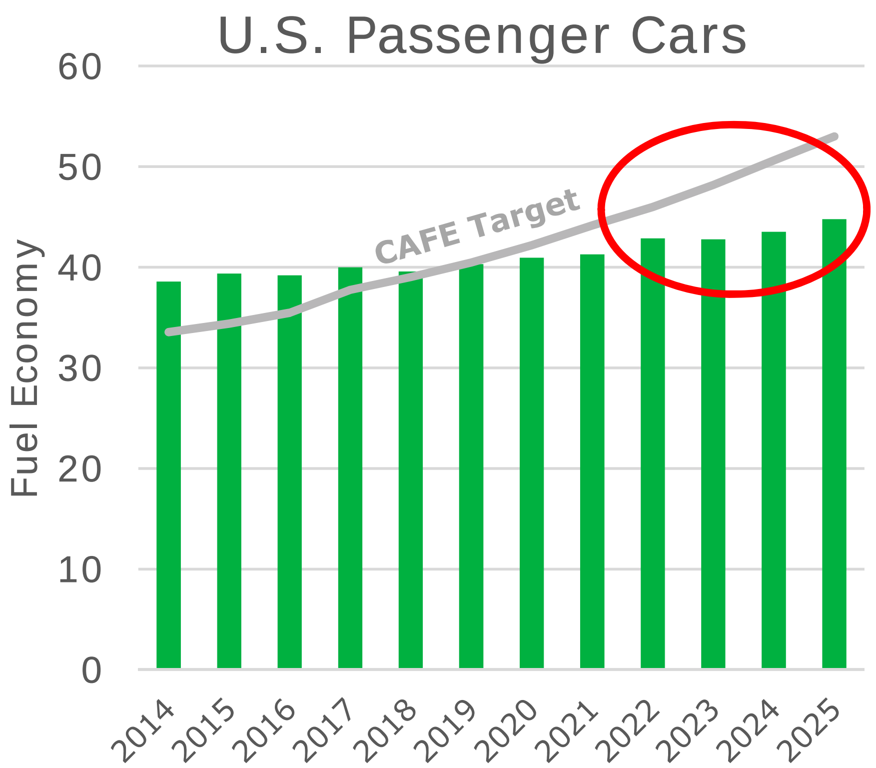
Notes: Reduced CO_2 emission equates to improved fuel efficiency. Global convergence toward 2025.
Source: icct

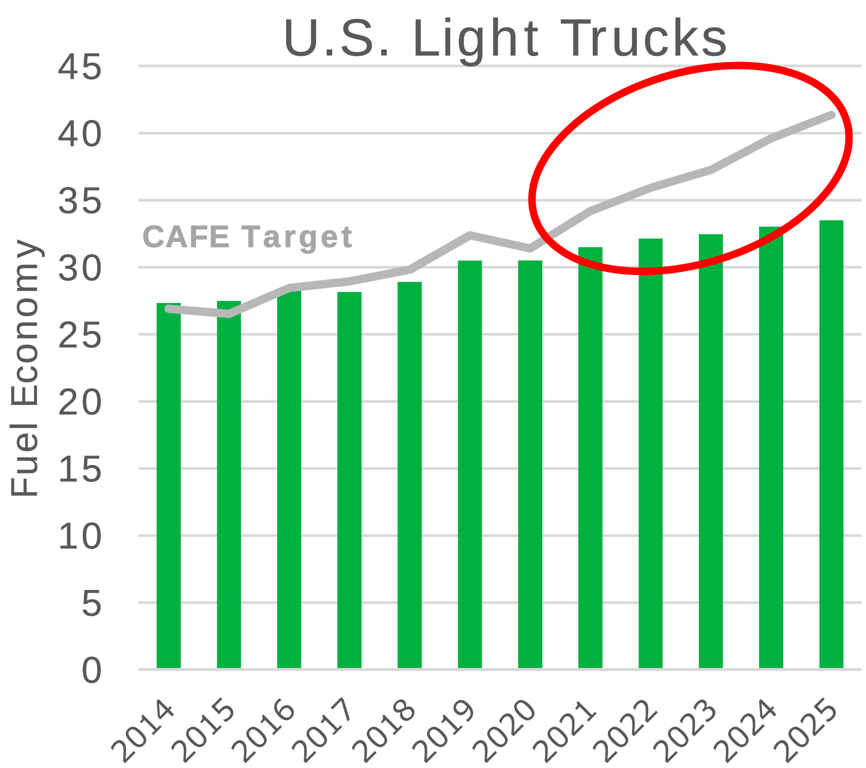
U.S. Midterm Evaluation Scenario

By 2021, IHS Markit and EPA/NHTSA largely agree; the gap to compliance is relatively small

> However, the years after that will be increasingly difficult for OEMs to comply

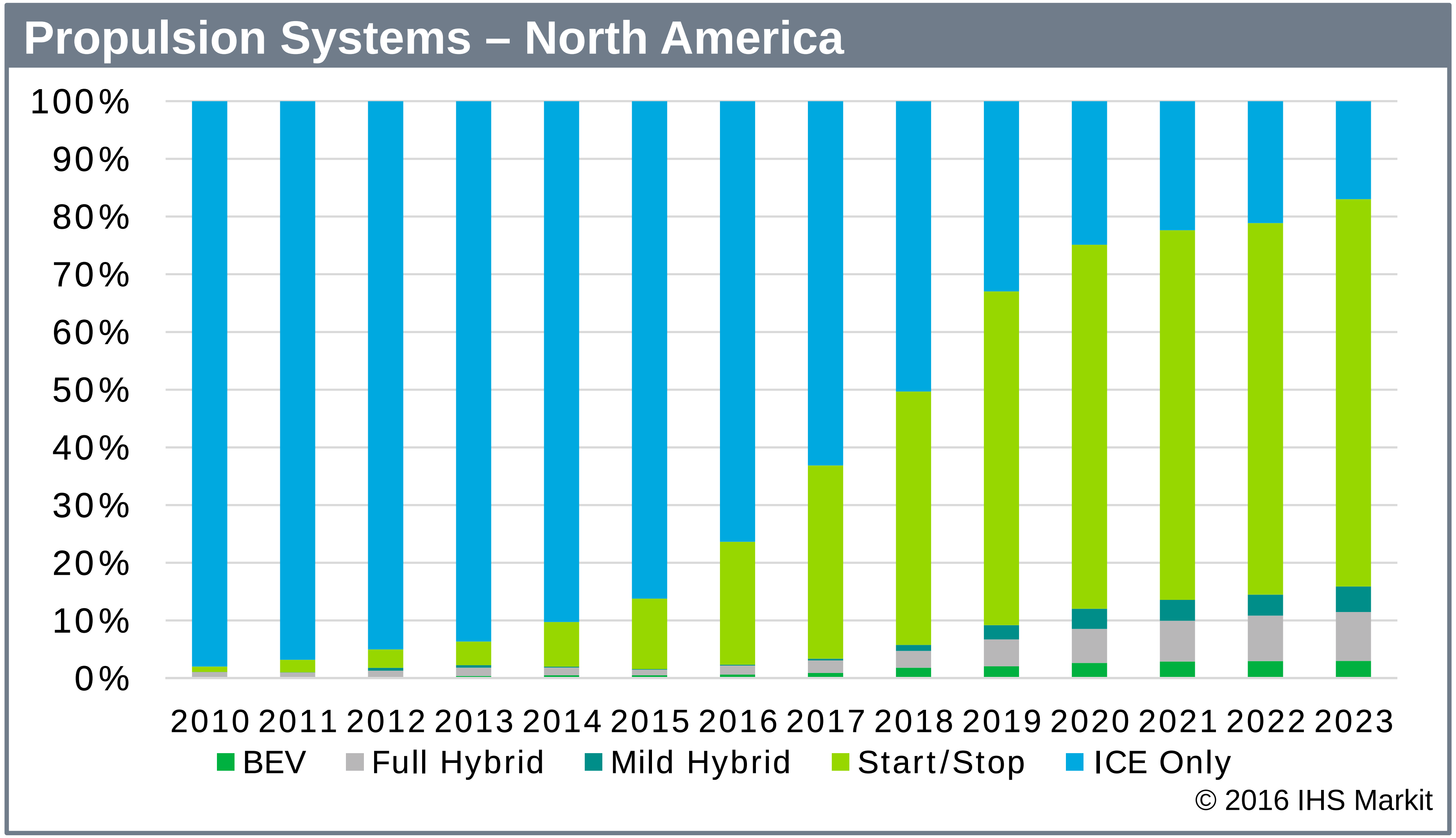
> This will require much more technology than currently assumed by EPA/NHTSA





Electrification Takes Hold

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

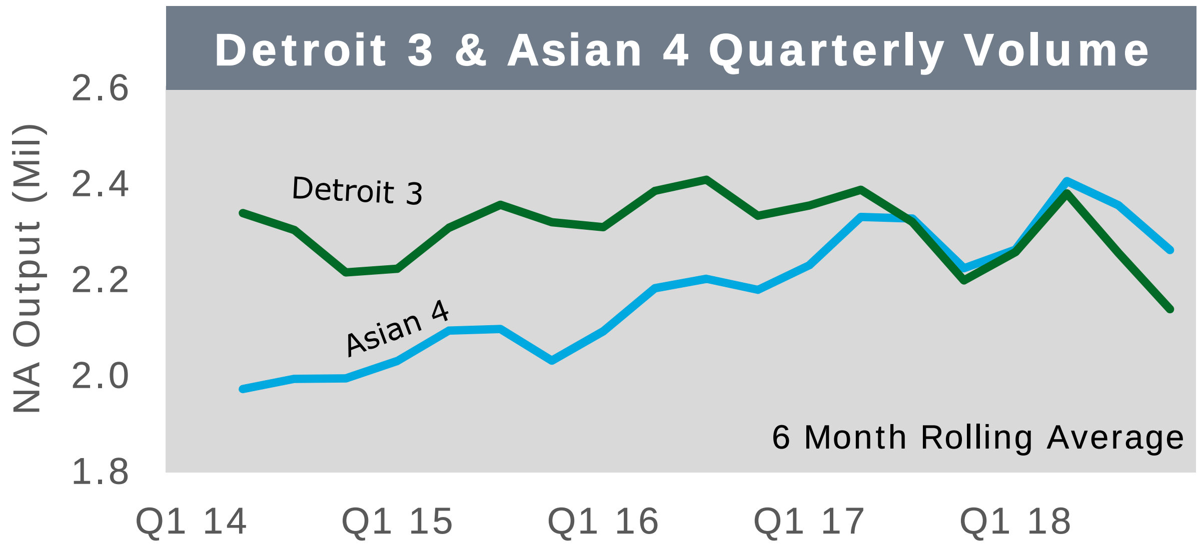


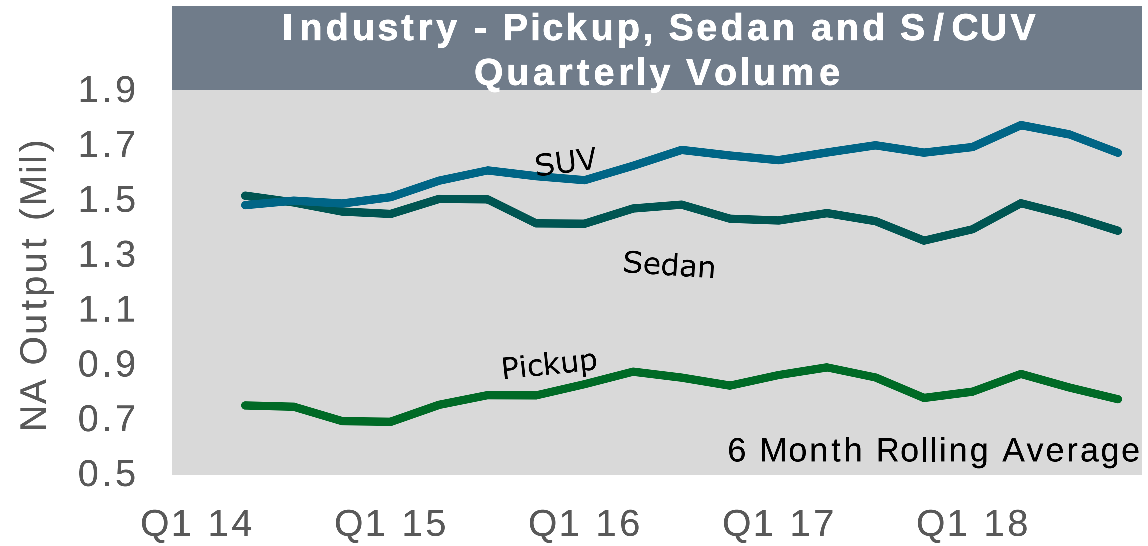
Electrification is Required

- 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

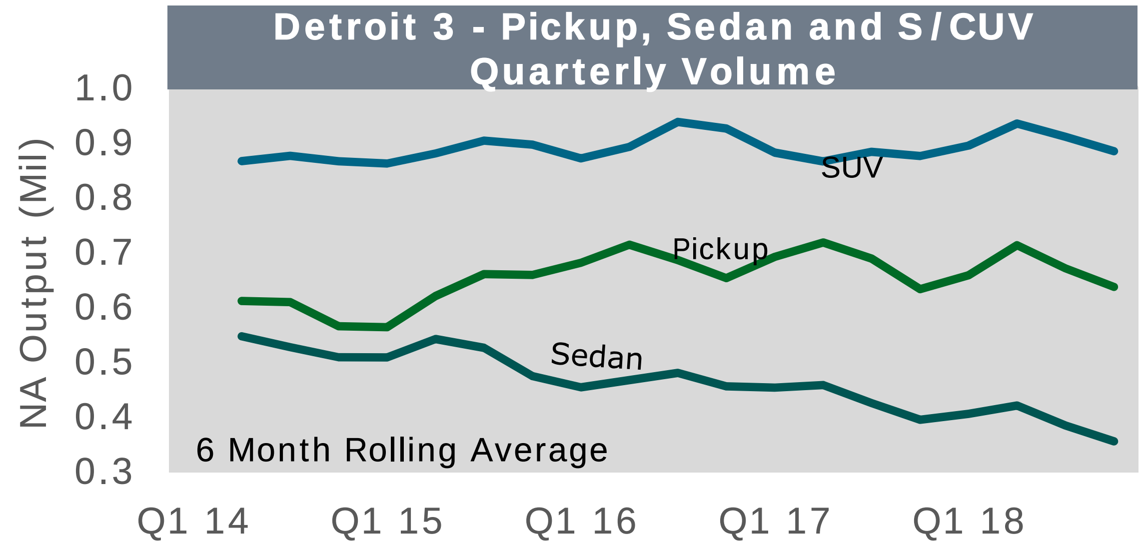
Electrification =Stop/start, MHEV, FHEV & BEV

Growth Plateaus: Mix Becomes Critical





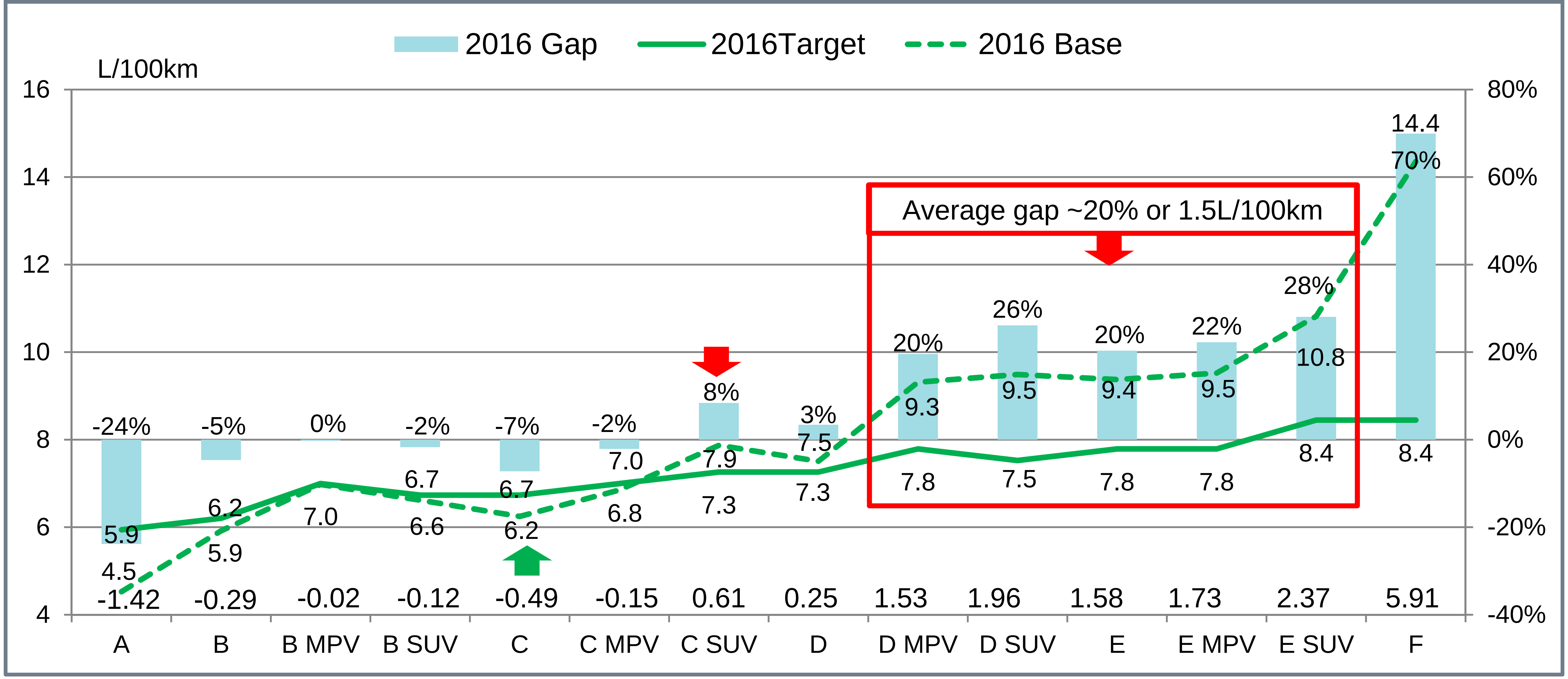
- Asian 4 volume eclipses D3 in 2017
- Sedan decline at D3 not compensated by S/CUV & Pickups
- Industry needs to react to the new marketplace



Asian 4: Honda, Hyundai, Nissan, Toyota

2016 China Fuel Efficiency Forecast

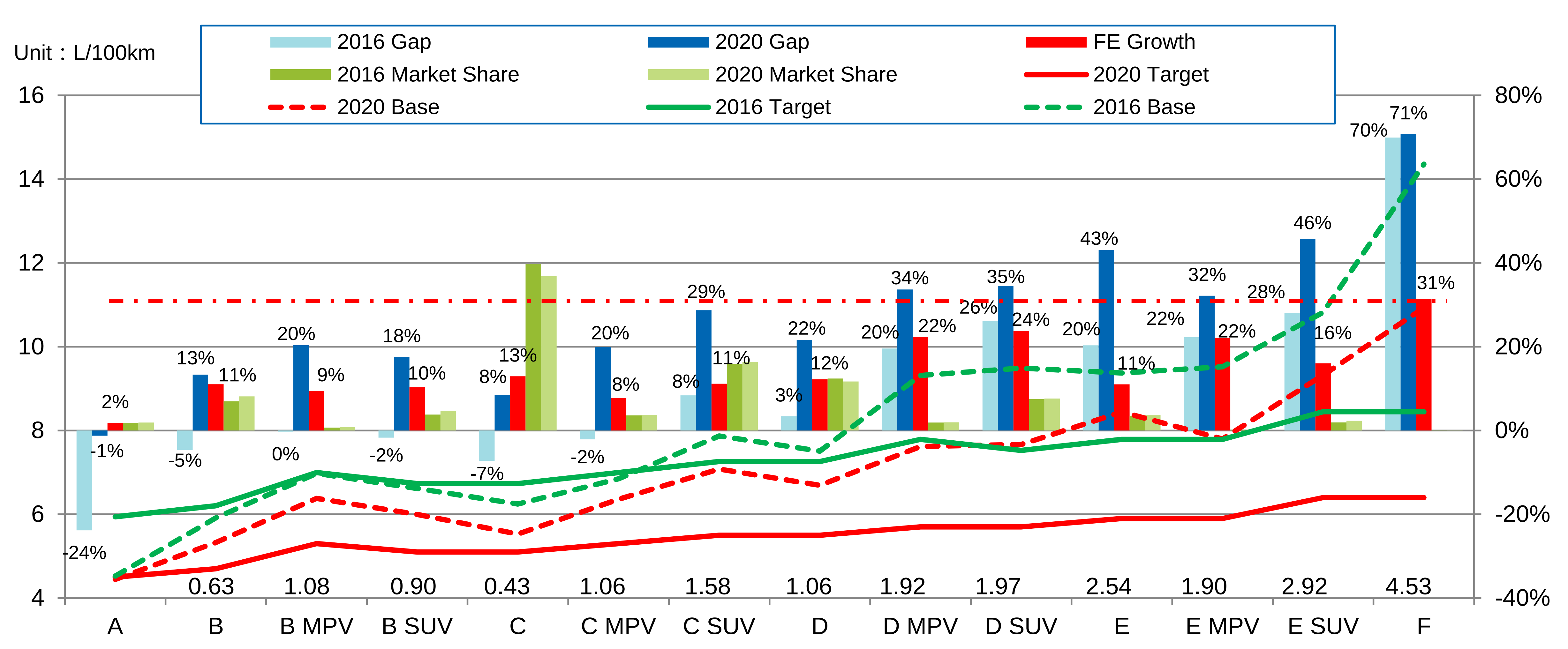
Problems for big vehicles since 2016



*The baseline fuel consumption forecast is simulated by VPaC

2016 China Fuel Efficiency Forecast

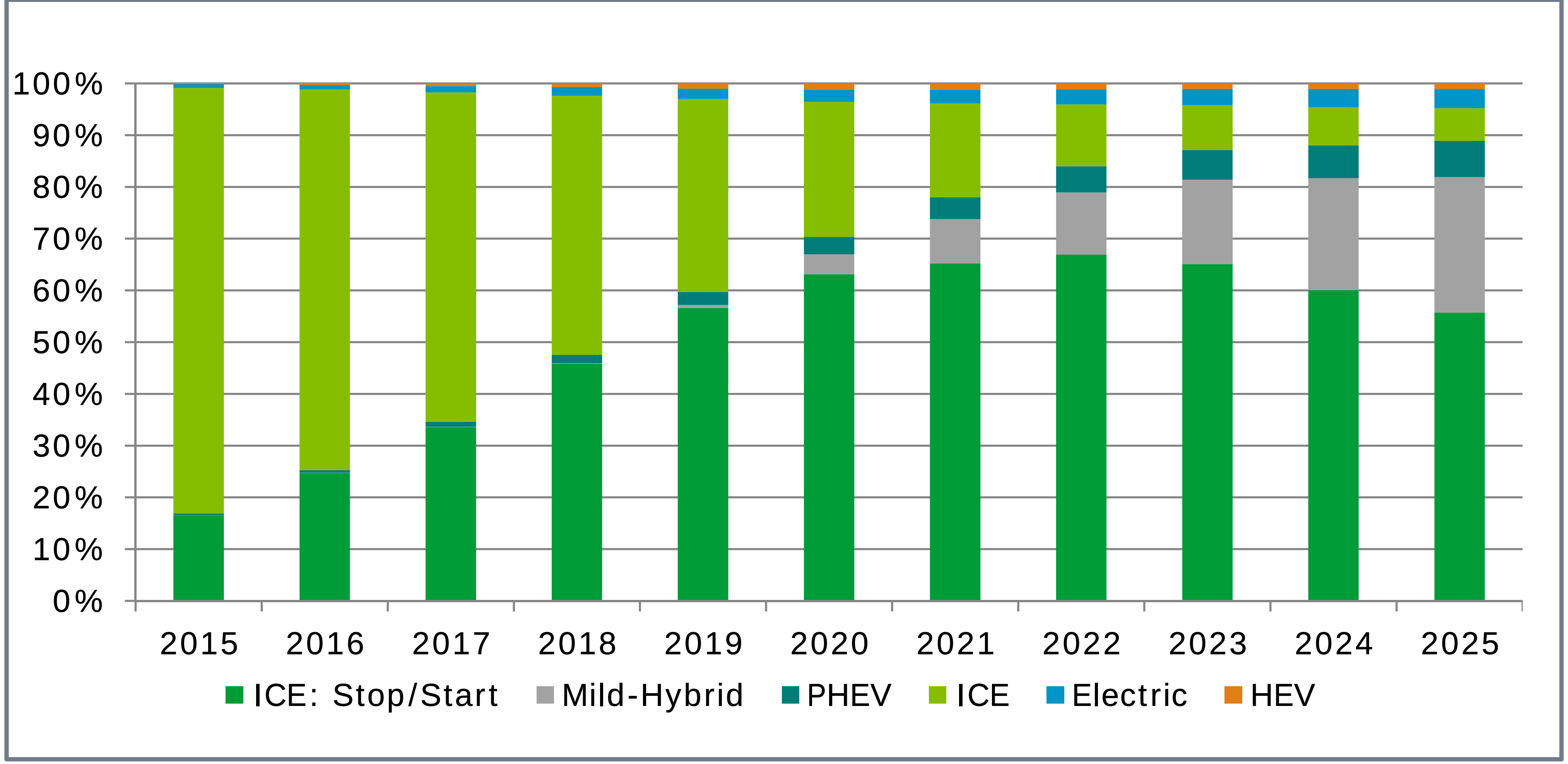
CAFC Forecast 2016 vs. 2020



*The baseline fuel consumption forecast is simulated by VPaC

Electrification is the major trend of Chinese PV market

Total PV Market Development by Propulsion--China



Electrification is Required

- Pure ICE engine still took 80% of total PV market in 2015
- stop/start will massively equipped in the next 5 years and then replaced by Hybrid-Mild beyond 2022
- Low oil environment complicates
- electrification mandate complicates

Three Disruptive Realities

How Do Industry Participants Adapt ….

Electrification

- 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*

Supplier Business Planning Needs to Change

- Increased Competition
- Faster Cycles
- Global Interconnections
  - More than 70% of platforms are built in 2+ regions.
- Value Chain and Profit Pools Shift
  - Suppliers hold a higher value of vehicles value: ~65% and growing
  - Increased ‘Buy’ focused on electronics and powertrain vs. traditional systems
- Innovation Origination
  - Suppliers drive more of the innovation and capital risk
- Product and Process Complexity
  - Despite platform count reductions, homologation, legislation, reduced cadence and trim level expansion drives increased complexity

Foresight Reigns: Suppliers Need to be More Proactive

- Anticipate market and technology trends
- Understand their organization's priorities
- Do they have the right customer mix?
- Is there a globalization strategy?
- Are the right human resources and physical footprint in place?
- Should they entertain joint venture or affiliations to reach new markets?

Suppliers Need expand their business planning past traditional vehicle and powertrain forecasts in an increasingly complex marketplace.

Solutions

- **Body-In-White Material Forecasts**
- VPAC Bench & Scenarios
- Supplier Strategic Planning & Opportunity Targeting
- Competitor Analysis

The BIW Material Forecast Process

Establish BIW Share by System, Usage & Material

Current Vehicle Structure

- IHS LV Production Forecast
- 3rd Party Research
- Industry Contacts/ Interviews
- Primary & Secondary Research
- Multi-Material exposure

Forecasted Structures

- IHS LV Production Forecast
- IHS Sales-Based Powertrain gap analysis
- Capital, supplier affiliations, competition, capability & cost

Integral Business Planning

- Output in Excel and PowerPoint
- Ability to drive material, process & location trends
- Linked to the IHS production forecast
- Unique approach suited to suppliers of all tiers

Material Change Priority by System / Location in BIW

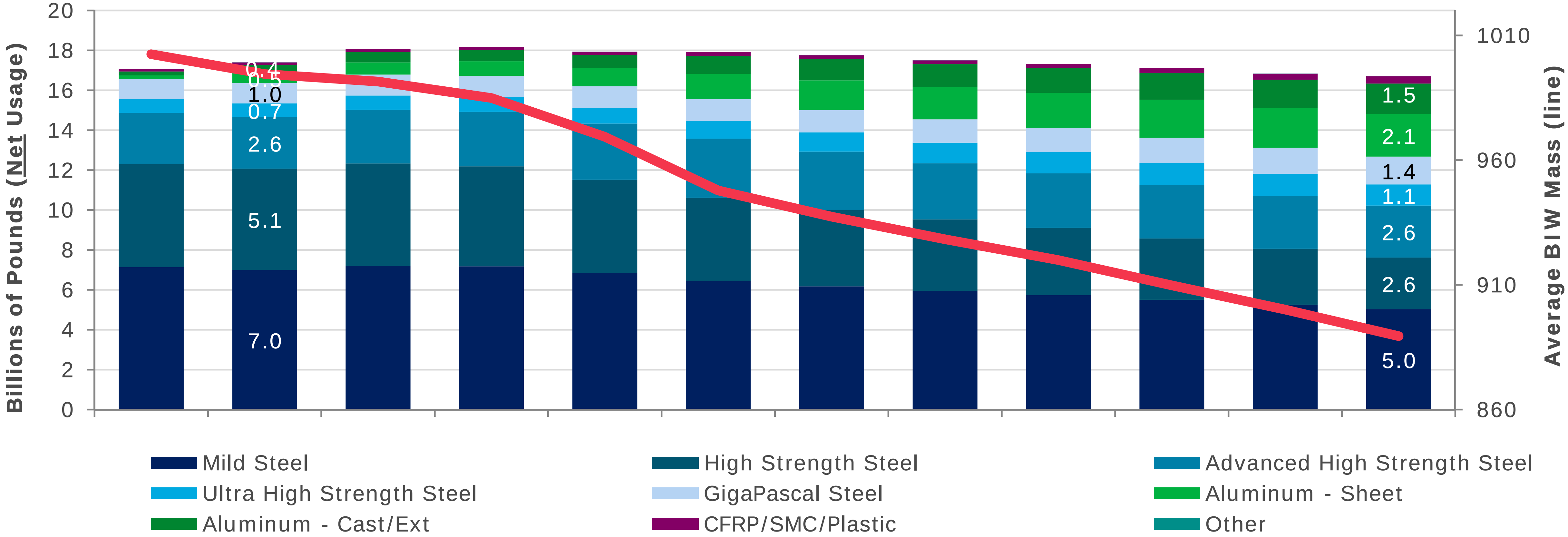
- Dependent upon OEM, Segment, Cost/Availability & Compliance Gap
  - Material Shift Order of Operations Assumptions (By Segment)
    - Hood
    - Decklid
    - Closures
    - Fenders
    - Front shock towers
    - Roof
    - A & B-Post
    - Rest of BIW bodies

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

Material Forecast Analysis

Total NA LV Industry By Pounds

Total BIW declines despite growth in CUVs and rising NA output



Source: April 2016 Material Forecast

Solutions

- Body-In-White Material Forecasts
- **VPAC Bench & Scenarios**
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VPaC Planning Process

- **IHS Markit will set up a workshop to understand your goals:**
  - Europe dropping diesels from A and B segment vehicles?
  - Global 2-3 cylinder dominance?
  - Cost/benefit for compliance, EV or PHEV?

Workshop
- Define Needs
- Capabilities
- Potential Solutions

Quote
- Based on workshop specifications

Kickoff Meeting
- In-person or via Web Conference

VPaC Custom Development
- Incorporation of Sales Based Powertrain

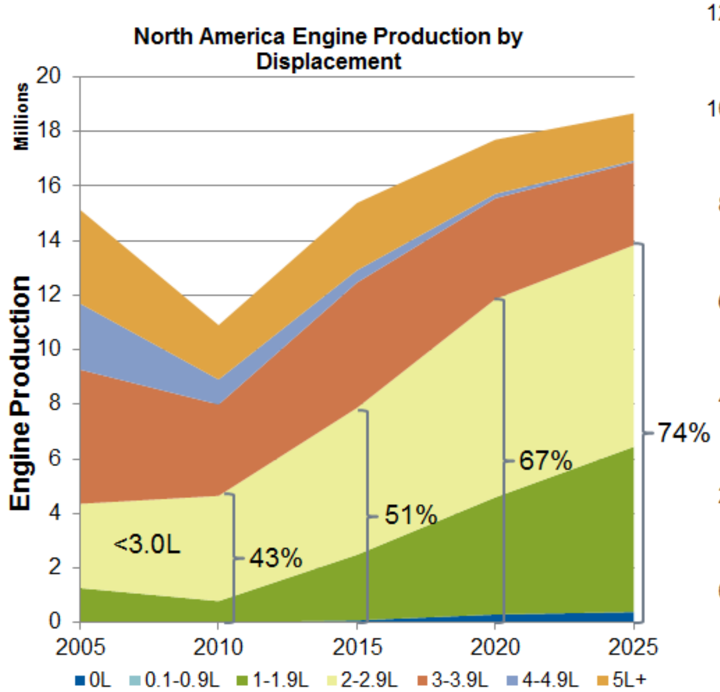
Presentation of Findings

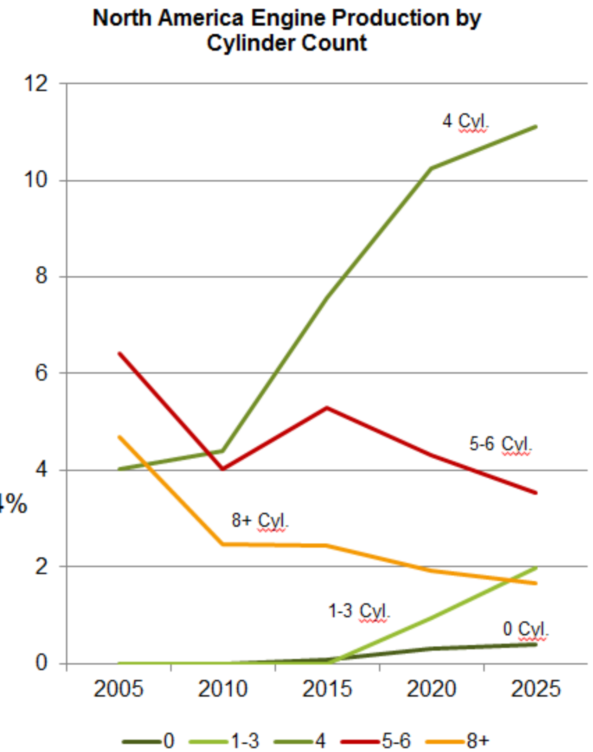
- **Outputs will leverage VPaC data to answer critical questions about the market or opportunity.**
  > Delivered in PowerPoint with a robust discussion of findings between IHS Markit and you

Example: U.S. Powertrain Technology Trend

North America Engine Output

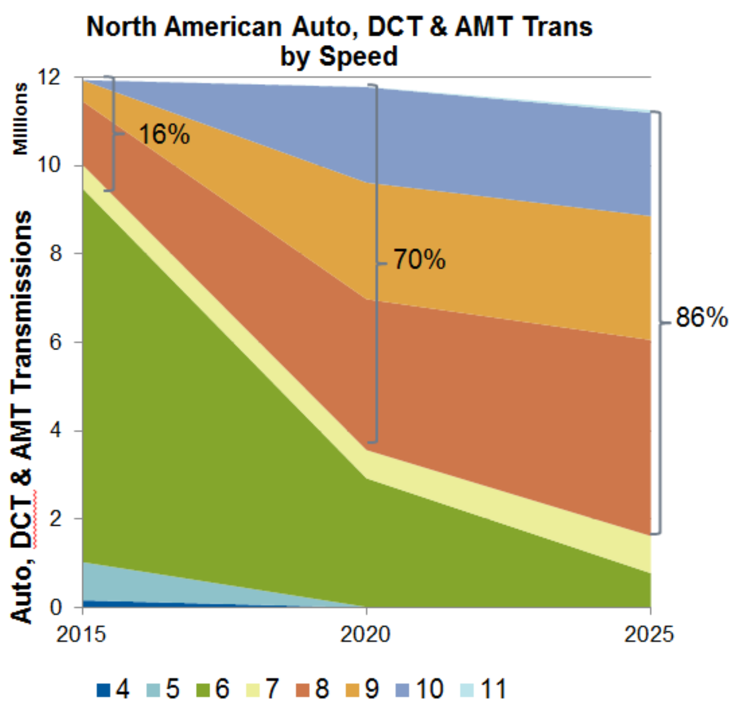
Sub 3.0L totals to 74% of the Market





US Market Transmission Trends

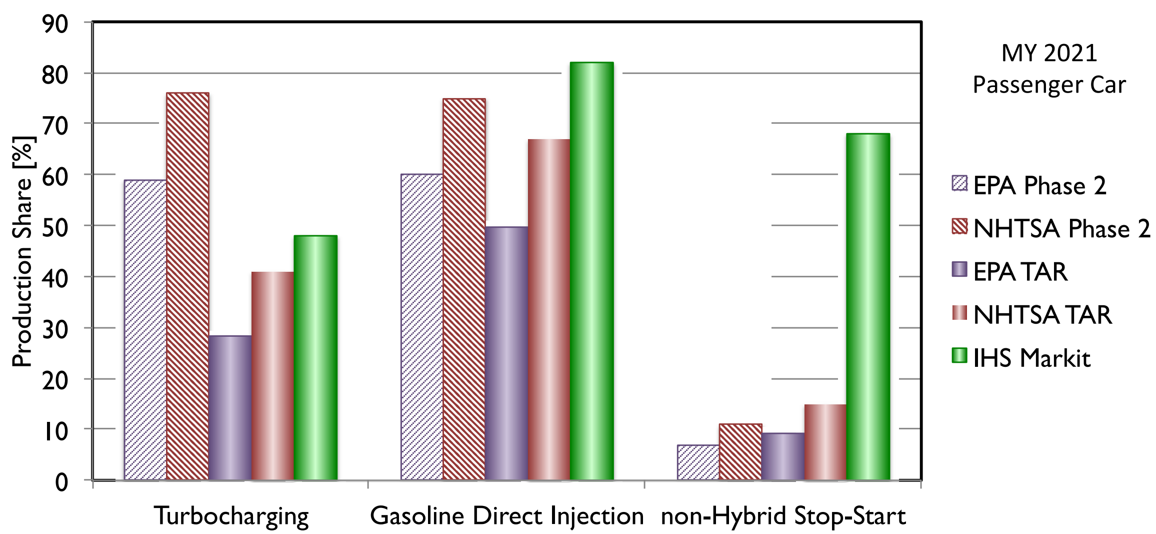
Shift to greater speeds + dominance by auto and CVT

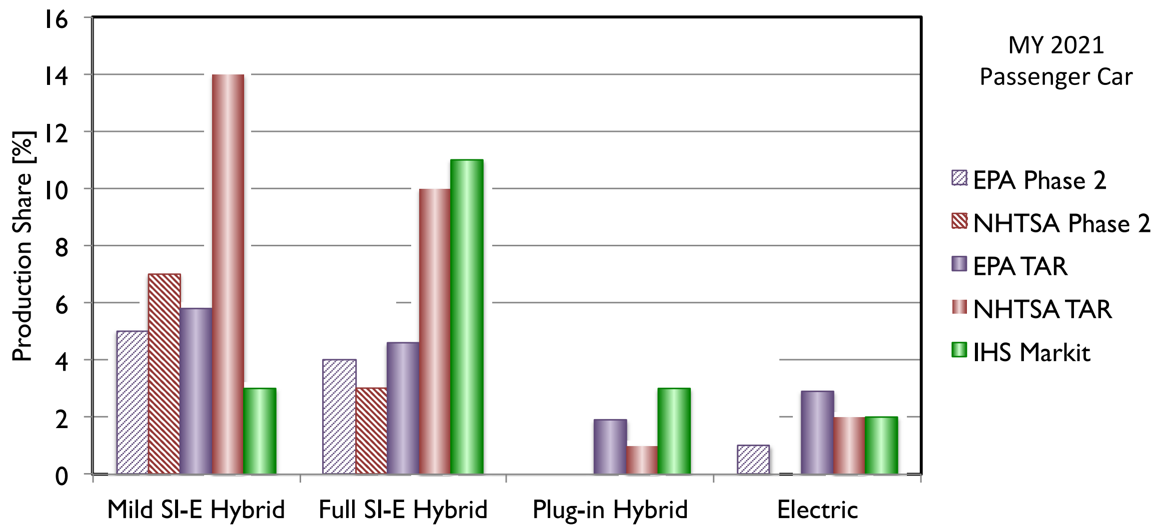


Out of the Base forecast, IHS predicts;

- Which technologies will gain, remain, shrink
- When you will see robust growth
- Electrification Trend
- Trends not only Engine/Transmission but other related components
- Fuel efficiency for each vehicle and Power unit level

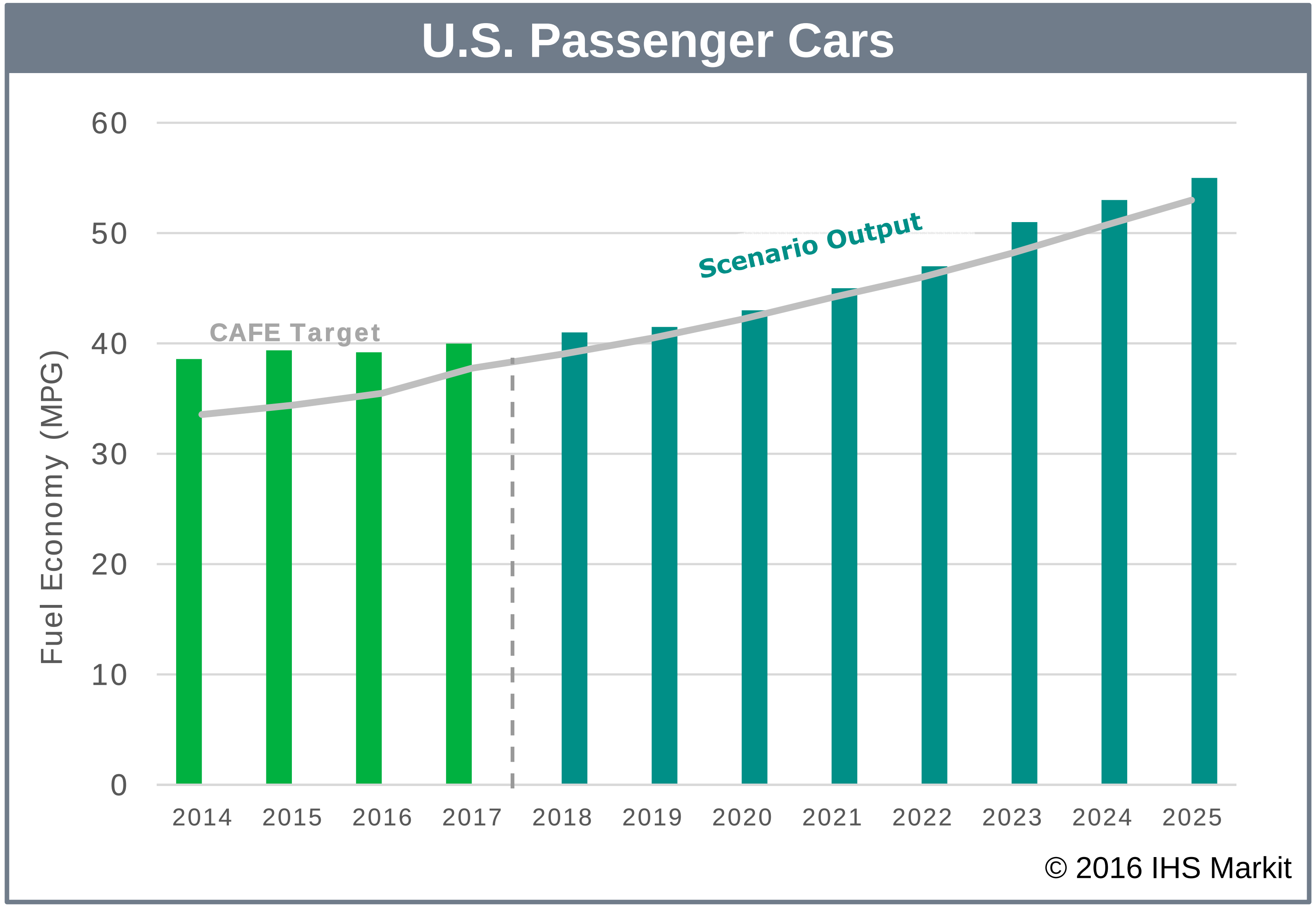
Example: U.S. Midterm Evaluation Scenario





- There are significant gaps in technology assumptions between IHS Markit and EPA/NHTSA
  - > GDI
  - > Stop/start
  - > Full HEVs
  - > Plug-ins
- However, EPA and NHTSA indicate that this is enough technology for OEMs to comply with 2021 FE and GHG targets.

Example: U.S. Midterm Evaluation Scenario



- What would happen if we added additional technology to the fleet in order for the vehicles to comply in the 2022-2025 range?
- IHS Markit works together with our partners to set up scenarios/views of a possible future:
  - > Highest level of technology
  - > Specific technology path
  - > Lowest cost for compliance

Solutions

- Body-In-White Material Forecasts
- VPAC Bench & Scenarios
- **Supplier Strategic Planning & Opportunity Targeting**
- Competitor Analysis

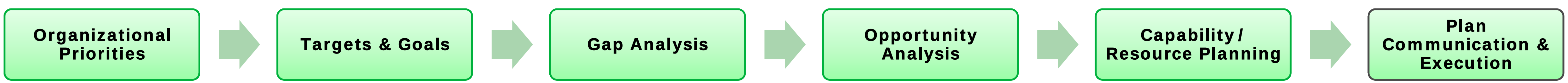
Supplier Business Planning is Continuous

<u>IHS Markit</u>

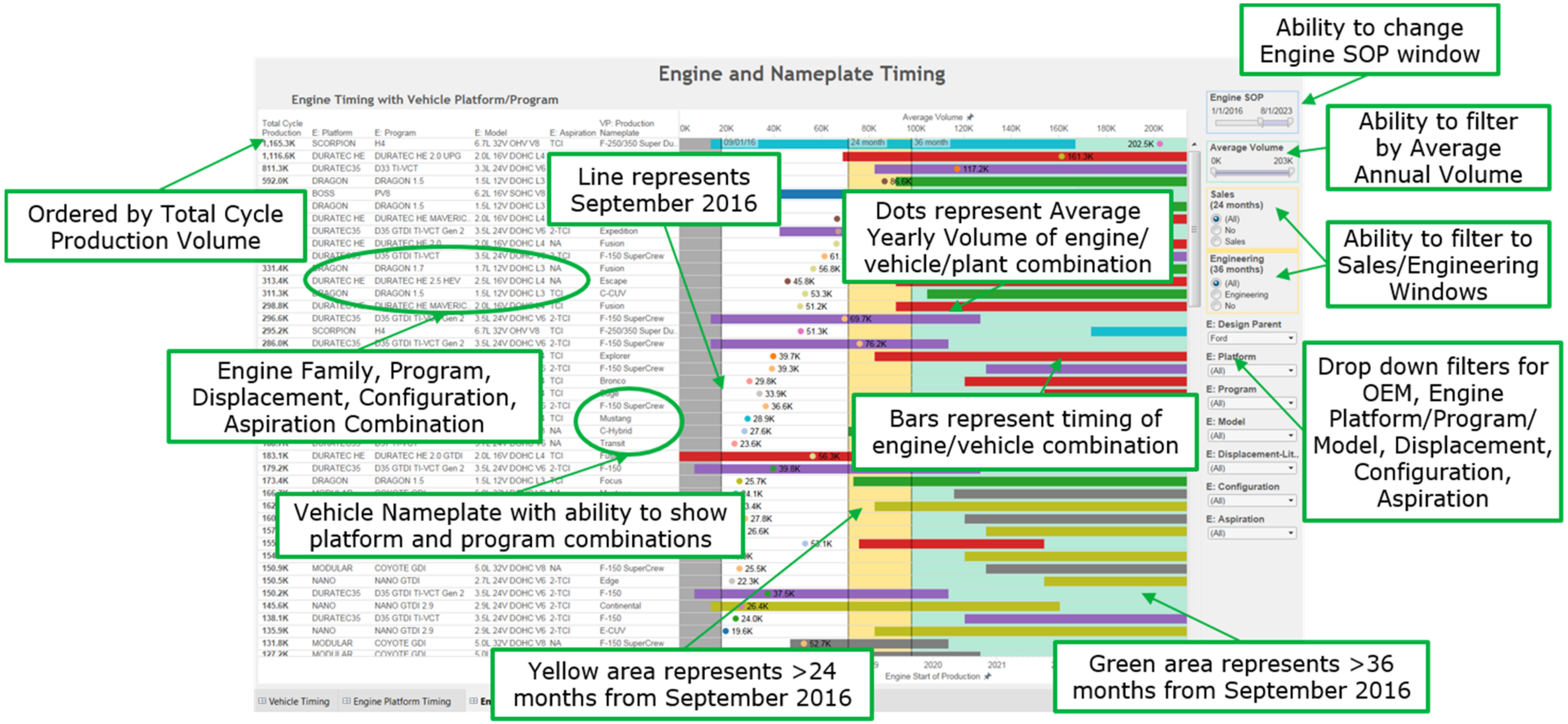
- Competitor & Market Assessment
- Legislative/Regulatory Impact
- Vehicle/Powertrain & Component Forecasts
- Opportunity Analysis

Supplier Business planning involves all facets of the suppliers organization:

Finance, Sales, Marketing, Design, Engineering, Supply Chain, Manufacturing, Logistics, Suppliers, Customers and Stakeholders.



Engine Opportunity Targeting

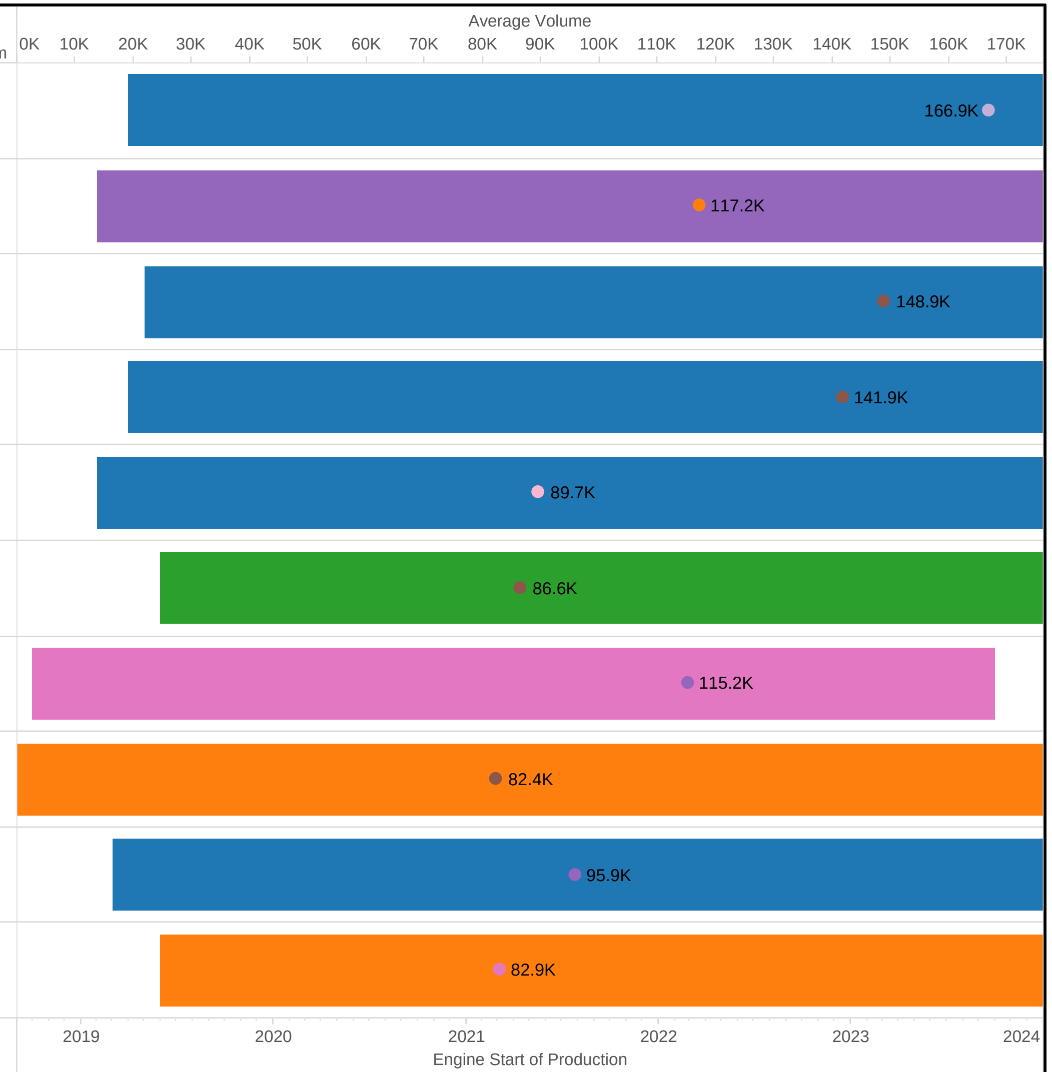


Supplier-specific opportunity targeting analysis given unique criteria:

- Sourcing Window
- Sourcing Structure
- Volume, technology, region and incumbent criteria

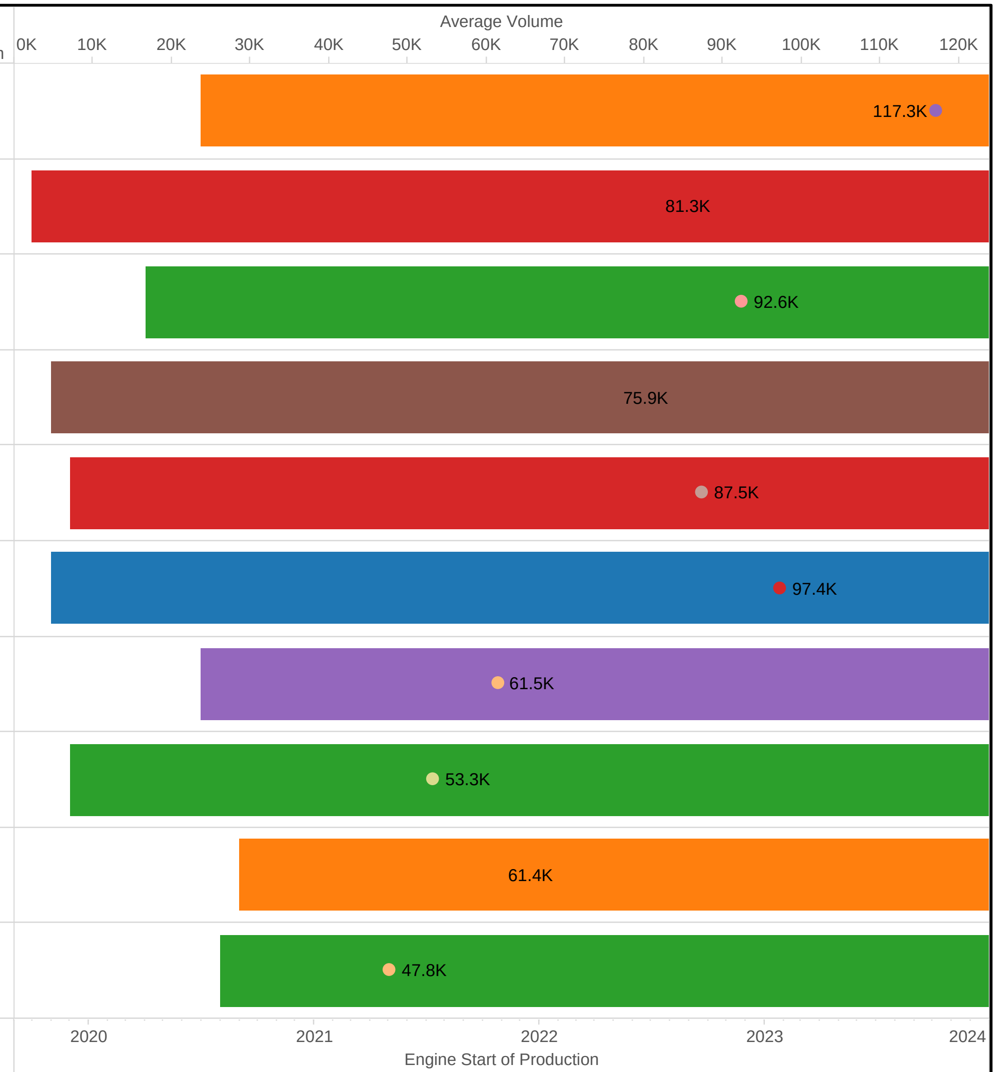
Top 10 Opportunities – 24 Months

E: Platform	E: Program	E: Model	VP: Production Nameplate	VP: Platform	VP: Program
S2G (HR)	HR16DE (XH16)	1.6L 16V DOHC L4	Sentra	CMF-C/D	L21B
DURATEC35	D33 TI-VCT	3.3L 24V DOHC V6	Explorer	CD6	U625
New ZR	2.0ZR	2.0L 16V DOHC L4	Corolla	GA-C	150B
New ZR	2.0ZR	2.0L 16V DOHC L4	Corolla	GA-C	150B
CSS-NGE/NDE	(L3T) G45T-3	1.35L 12V DOHC L3	Trax	VSS-F B/C	9BUC
DRAGON	DRAGON 1.5	1.5L 12V DOHC L3	Escape	C2	CX482
CUMMINS ISB	ETJ	6.7L 24V OHV L6	2500/3500	DS/DJ	DK
GEN II/III/IV/V	L83 - GEN V - 5.3L AFM	5.3L 16V OHV V8	Silverado	VSS-T	T1XC
PENTASTAR	3.6L UPGRADE	3.6L 24V DOHC V6	Grand Cherokee	WK/WK(2)	WL
VQ	VQ35VD	3.5L 24V DOHC V6	Pathfinder	D	P42R



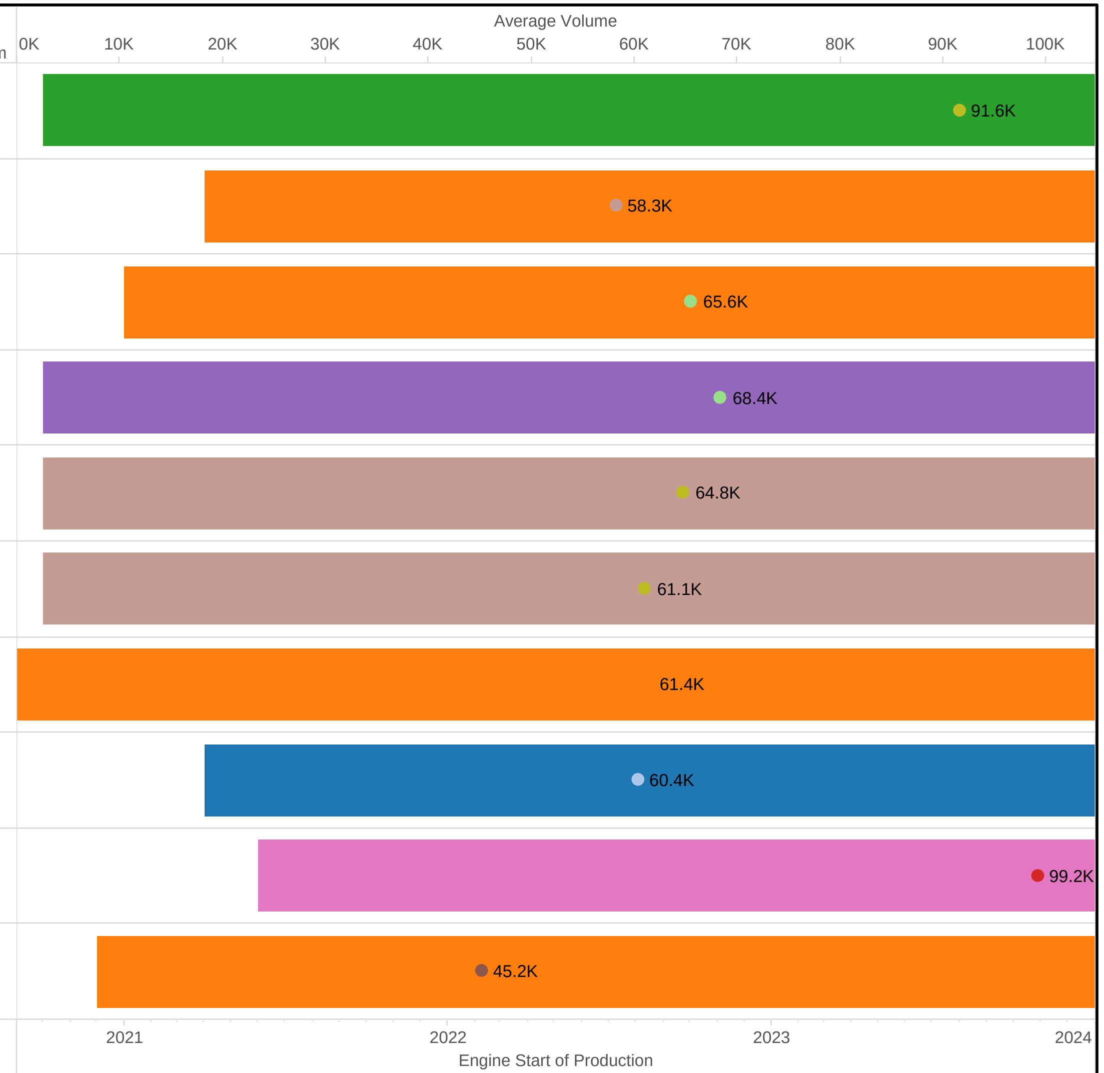
Top 10 Opportunities – 36 Months

E: Platform	E: Program	E: Model	VP: Production Nameplate	VP: Platform	VP: Program
G4-NU	NU-2.0L	2.0L 16V DOHC L4	Sonata	N	LF(2)
GR	7GR	3.5L 24V DOHC V6	Sienna	GA-K	580L(2)
WORLD ENGINE L4	ED6 - TIGER SHARK M-AIR	2.4L 16V SOHC L4	Cherokee	C-EVO/CUSW	KL(2)
ELECTRIC	Electric	0L 0V None None	Model 3 CUV	GEN III	Model E
GR	7GR	3.5L 24V DOHC V6	Highlander	GA-K	440A(2)
FB	FB20_DI	2.0L 16V DOHC H4	Outback	SGP	BF4(2)
DURATEC35	D35 GTDI TI-VCT	3.5L 24V DOHC V6	F-150 SuperCrew	T3	P702
DRAGON	DRAGON 1.5	1.5L 12V DOHC L3	C-CUV	C2	CX430
G4-NU	NU-2.0L	2.0L 16V DOHC L4	Optima	N	JF(2)
New-L (AP2)	L15B MFI(AP2)	1.5L 16V DOHC L4	Fit	GSP(2)	2WF(2)



Top 10 Opportunities – 48 Months

E: Platform	E: Program	E: Model	VP: Production Nameplate	VP: Platform	VP: Program
New-L (AP2)	L15B GDI(AP2)	1.5L 16V DOHC L4	Civic	CCA	2SV(2)
J	New-J30 turbo (AP5)	3.0L 24V DOHC V6	Pilot	2SL/2SF	2SF(2)
G4-NU	NU-1.8L	1.8L 16V DOHC L4	Elantra	KP3	AD(2)
AR	8AR-FTS	2.0L 16V DOHC L4	RX	GA-K	760A(2)
New-K (AP4)	New-K20 GDI	2.0L 16V DOHC L4	Civic	CCA	2SV(2)
New-K (AP4)	New-K20 GDI	2.0L 16V DOHC L4	Civic	CCA	2SV(2)
G4-NU	NU-2.0L	2.0L 16V DOHC L4	Optima	N	JF(2)
New ZR	2.0ZR-HEV	2.0L 16V DOHC L4	Prius	GA-C	690X
SGE	LFV	1.5L 16V DOHC L4	Malibu	VSS-F D/E	9DSC
G4-NU	NU-1.8L	1.8L 16V DOHC L4	Sorento	N	UM(2)



Solutions

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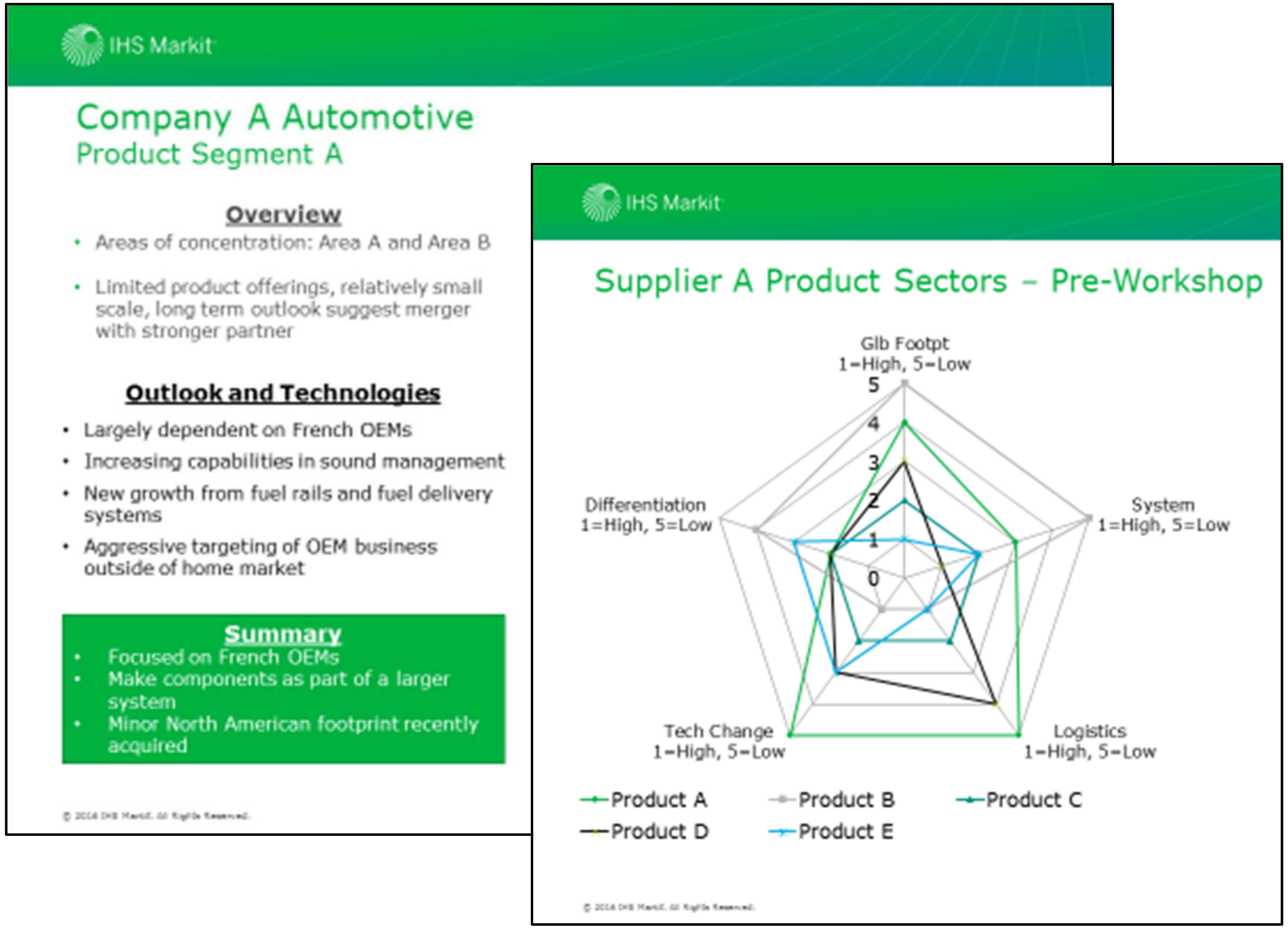
- **Competitor Analysis**

Competitor / Technology Assessment



Critically important to understand;

- Competitors' Profile : Finance, footprint etc.
- Their product offerings and tech roadmap
- Differentiation strategy
- Local procurement and logistics
- M&A, Investment
- Market share and Customer share

In which area change will occur? ➔ what's your plan?

Summary

- Lack of volume growth in key markets shifts the focus to optimizing mix and focusing on high margin opportunities
- Unprecedented number of challenges facing the industry:
  - Global regulatory initiatives
  - Shifting of resources and energy towards non-traditional systems
  - Supplier consolidation and investment expectations of multi-regional strategies
- Three Disruptors: Electrification, Autonomous Vehicles & Shared Mobility
- Strategies to navigate the impending ‘Cost Cliff’
  - Actionable Innovation, Vertical Integration and Risk Mitigation

IHS Markit Customer Care:

CustomerCare@ihsmarkit.com
Americas: +1 800 IHS CARE (+1 800 447 2273)
Europe, Middle East, and Africa: +44 (0) 1344 328 300
Asia and the Pacific Rim: +604 291 3600

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