



How to Win in the Automotive Composites Market

Lucintel Brief

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Market Intelligence + Growth Consulting + Opportunity Screening + M&A Due Diligence + Benchmarking = **Your Company's Growth.**

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- **Executive Summary**
- **Future Lightweight Technologies**
- **Business Case for Composites**
- **Market Disruptions**
- **Conclusions**

Executive Summary

- **The outlook for light weight materials and composites look strong in automotive industry**
 - Global lightweight materials demand is expected to reach 129 billion lbs in 2025 with a CAGR of ~4.4%
 - Global sales for automotive parts made with composites such as hood, roof, fender, etc. is likely to reach \$30 Bn in 2025 with CAGR of ~2.4%
- **Automotive production has been hit hard and global market is forecast to drop by 20% to 30% in 2020. Major OEMs had halted the production of vehicles in the fight against Covid-19**
- **Automotive industry relies heavily on cross-border shipments of parts for car manufacturing, and government restrictions on international trade has affected the automotive industry supply chain**
- **Carbon fiber composites offer good business case for OEMs and Tier 1 for light weight solutions – depicted by BMW and Plasan case studies**
 - Increasing usage of carbon fiber in various BMW models, such as BMW M3, BMW M4, BMW i8, & BMW i3. Production of i8 has been stopped which is likely to affect the demand for carbon fiber composites in future
- **Major market disruptions are expected in cost reduction, productivity and mass customization to drive competitiveness of composites**

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Carbon Fiber Parts are Gaining Momentum but Mostly in High End Cars



Chassis / Monocoque



Hood



Roof



Fender



Floor Panel



Bumper



Tailgate



C-Pillar

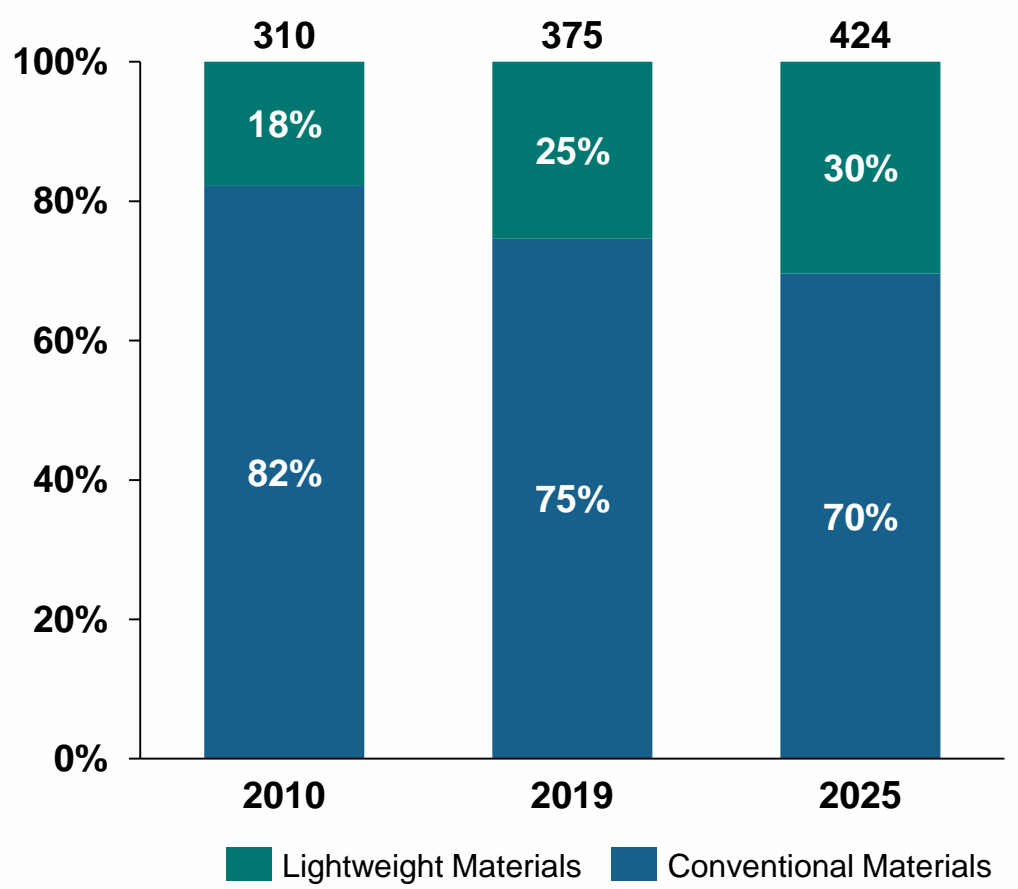
- Some of the OEMs using carbon fiber composites are: BMW, Audi, General Motors, Ford, Toyota, Ferrari, Lamborghini, and Volkswagen
- Carbon fiber composites are mostly used in high end cars, such as Lexus LFA, Mustang, R8 Spyder, Aventador LP700-4, etc.

Key Lightweight Technologies Used to Manufacture Automotive Parts

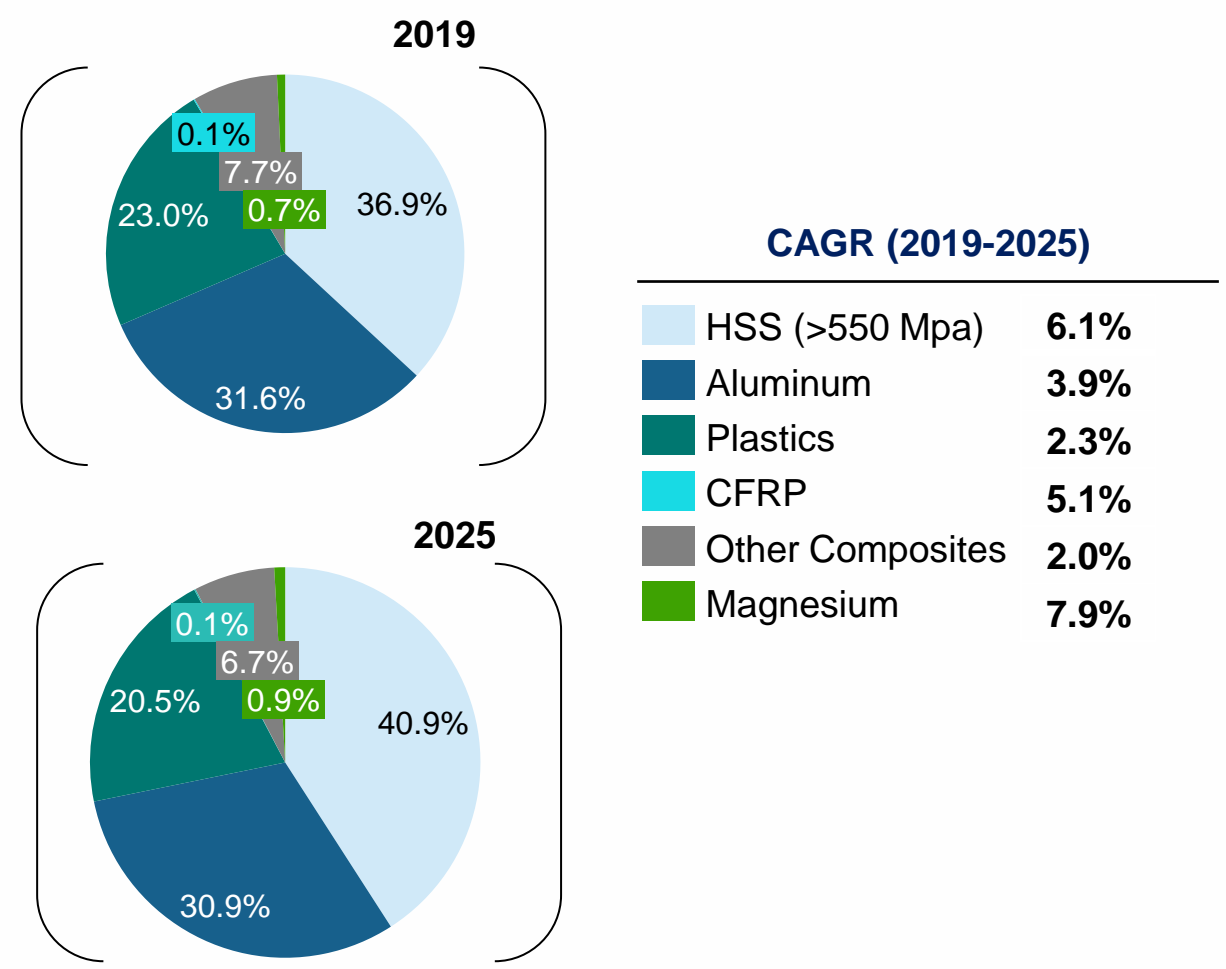
	HSS/AHSS	Aluminum	Glass Composites	Carbon Composites	Natural Composites	Magnesium
Key Processes	<ul style="list-style-type: none"> • Stamping 	<ul style="list-style-type: none"> • Stamping • Casting • Extrusion 	<ul style="list-style-type: none"> • Compression Molding • Injection Molding • RTM 	<ul style="list-style-type: none"> • Prepreg Layup • Resin Infusion (HP-RTM) 	<ul style="list-style-type: none"> • Compression Molding 	<ul style="list-style-type: none"> • Casting • Extrusion
Key Applications (Process)	<ul style="list-style-type: none"> • Usibor (A-pillar, Bumper Beam, B-Pillar, C-Pillar, Door Beam) • Fuel Tank Guard • Body in White • Door Panels • Axle Carrier • Engine Cradle • Dash Panel • Crash Box • Side Rail • Seat Frame 	<ul style="list-style-type: none"> • Heat Shield, Bumpers, Hoods, and Closure Panels: (Stamping Process) • Powertrain (Engine Block, Transmission): (Casting Process) • Chassis & Suspension, Heat Exchangers: (Extrusion Process) 	<ul style="list-style-type: none"> • Intake Manifold: (Injection Molding) • Hood (Compression Molding) • Door Module: (Compression Molding) • Radiator End Tank: (Injection Molding) • Oil Pan: (Injection Molding) 	<ul style="list-style-type: none"> • Monocoque: (Prepreg & RTM Process) • Hood: (Prepreg Layup) • Door Panel: (Prepreg Layup) • Roof: (Prepreg Layup) • Body Panels: (Prepreg Layup & RTM Process) 	<ul style="list-style-type: none"> • Door Panel • Seat Back • Load Floor • Interior Panels • Under Body Shields 	<ul style="list-style-type: none"> • Door Inner, Roof Frame, Lift Gate Inner, Pillar: (Casting Process) • Support Beam, Connectors, Side Rails: (Extrusion Process)

Future Automotive Materials Will be Dominated by Lightweight Materials

Trends & Forecast for Global Materials Demand in Automotive Industry: Lightweight Materials vs. Conventional Materials B lbs.

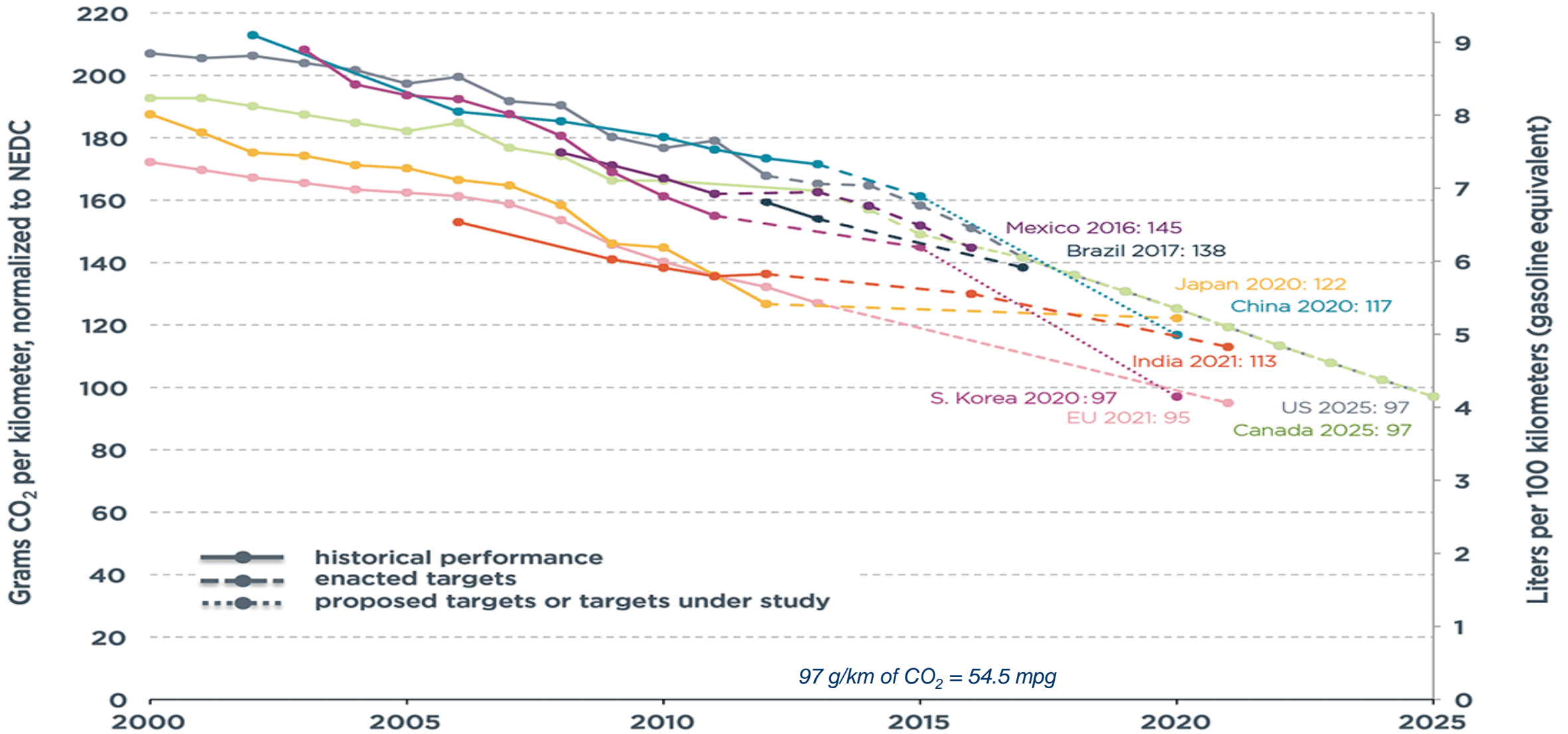


Global Lightweight Materials Market in the Automotive Industry: (2019-2025) in B lbs.



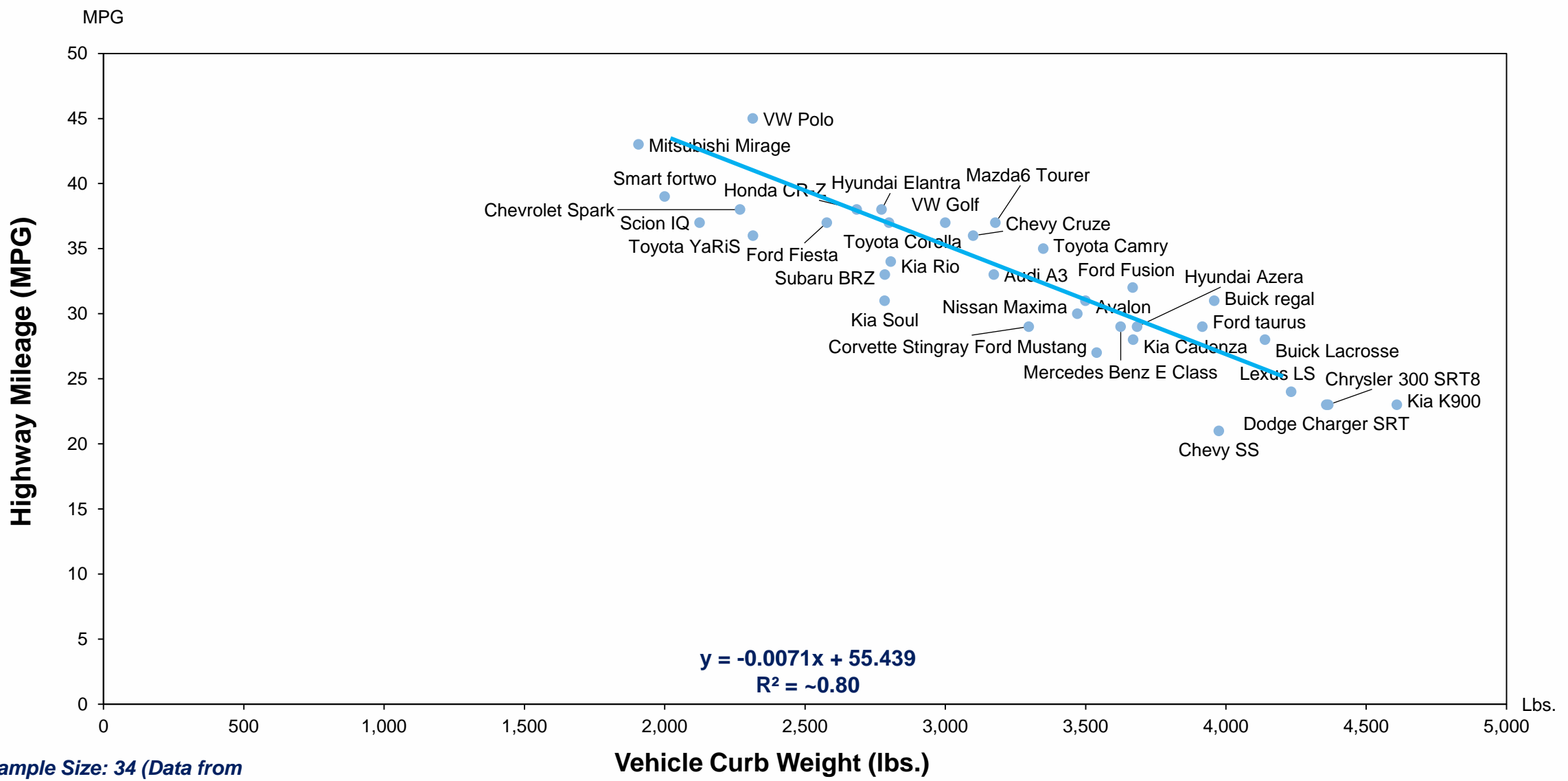
Source: Lucintel

Emission Reduction Targets in the Global Automotive Industry



Source: ICCT

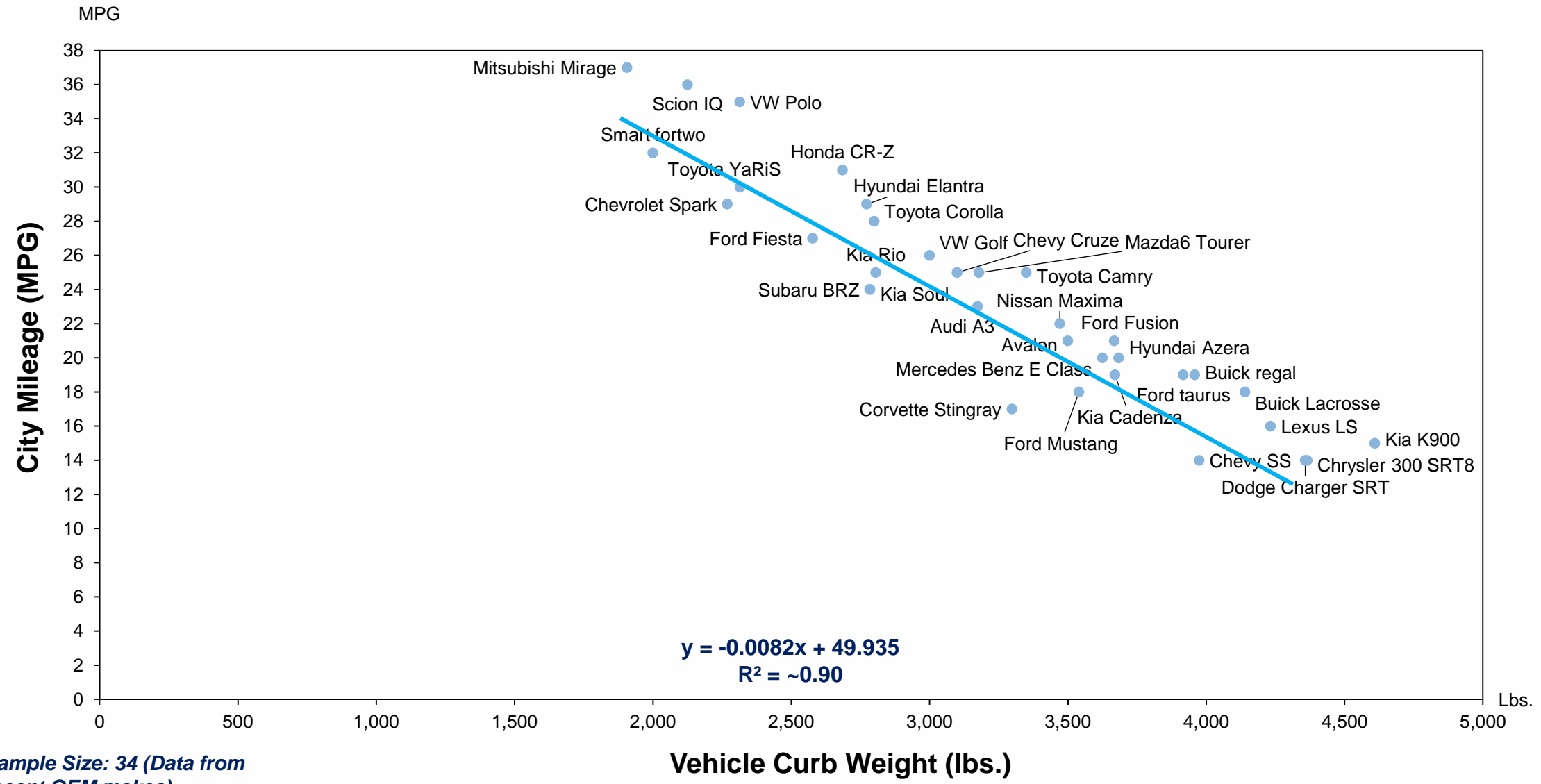
In Highway Driving, 10% Weight Saving Gives about 7% Fuel Saving



Sample Size: 34 (Data from recent OEM makes)

Source: Lucintel

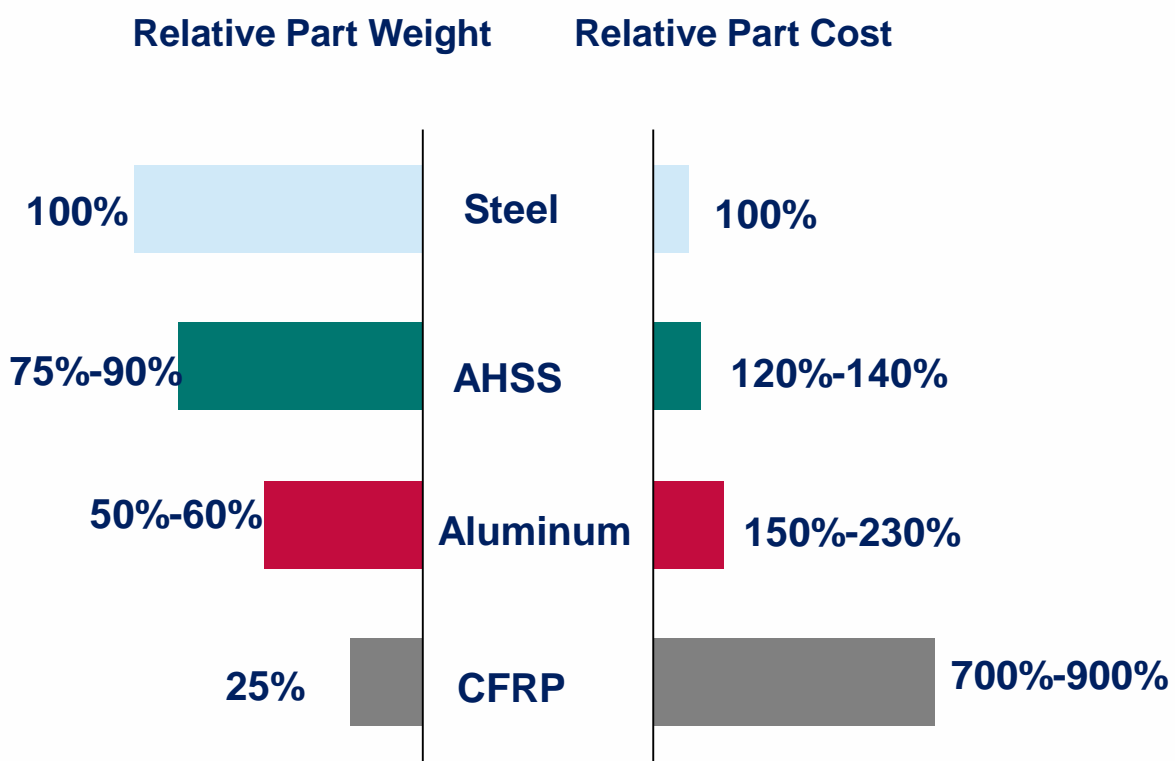
On City Driving, 10% Weight Saving Gives about 11% Fuel Saving



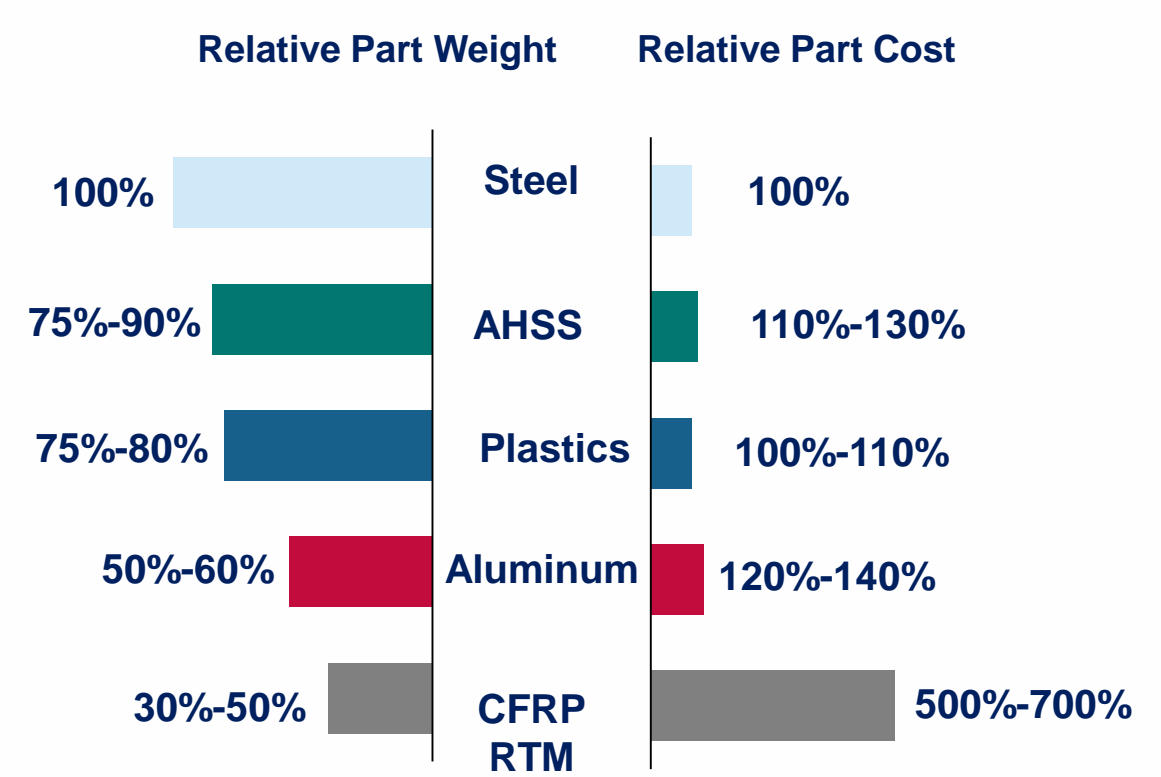
Sample Size: 34 (Data from recent OEM makes)

Advanced Materials Offer Considerable Weight Savings at High Costs

Structural Application



Non Structural Application (Fender)



Drivers

CAFÉ Requirement

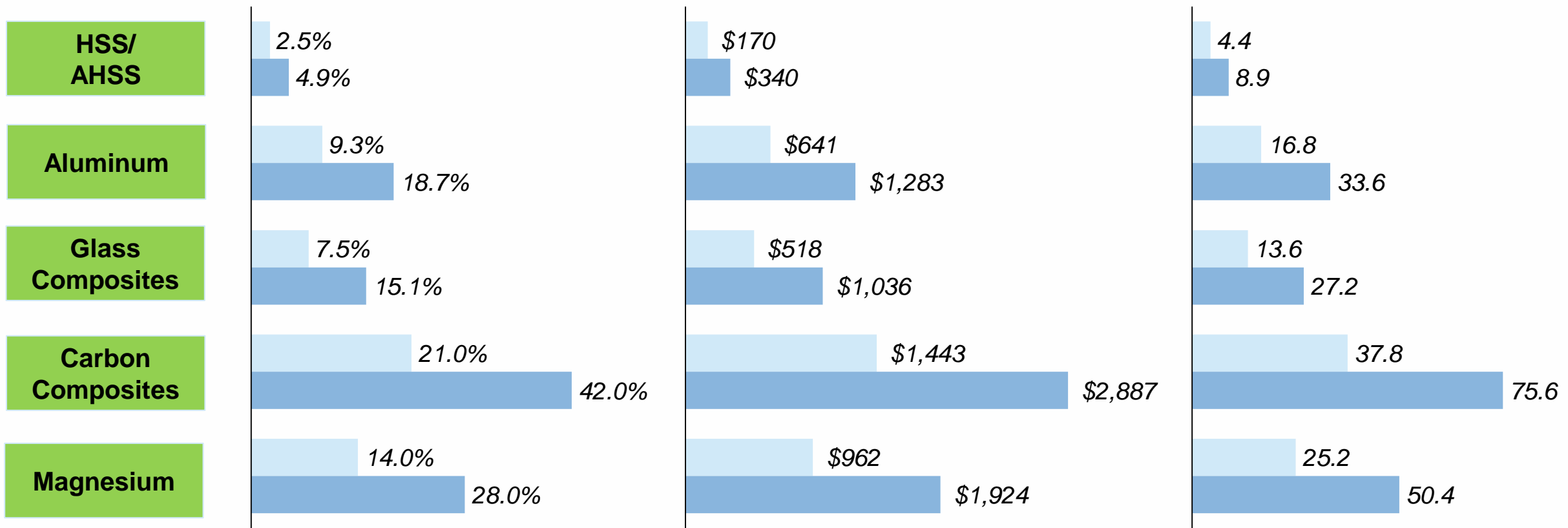
CO₂ Emission

Opportunities for Lightweight Materials in terms of Fuel Saving and CO₂ emission Saving Potential

Weight Reduction
(of Total Vehicle Weight)

Fuel Saving (\$)
(Life Time Saving Per Vehicle)

CO₂ Emission Saving
(Gram/km Per Vehicle)



■ @20% Use of Lightweight Materials
 ■ @40% Use of Lightweight Materials

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Current Major Structural, Semi-Structural, and Cosmetic Applications of CFRP – Require More Innovations to Reduce Cost

Structural



Passenger Cell



B-Pillar



C-Pillar

Semi-Structural



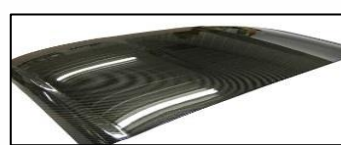
Rear Diffuser



Bonnet/Hood



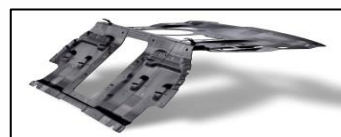
Side Blade



Roof Panel



Rear Wing



Rear Wall



Seat



Side Panel



Fender



Wheel

Cosmetic



Mirror Cover



Sill Panel



Rear Spoiler



Fender Cover



Steering Wheel



Side Flap



Gear Shift Knob
















How to Grow and Develop Competitive Edge for Composites

- **About 129 billion lbs light weight materials will be used in 2025 by auto OEMs**
- **Purchasing decisions continue to be influenced heavily by price of the component**
- **To develop competitive edge in automotive market, industry needs to focus on below:**
 - **Price Reduction:** Look for cost reduction in composite parts from various ways such as raw material cost, labor cost, energy cost, etc.
 - **Need for Innovative Manufacturing Technologies:** Development of transformative manufacturing technologies with reduced cycle time for manufacturing complex parts.
 - **Develop Robust Supply Chain:** Invest in developing global supply chain for raw materials, design, tooling and manufacturing for composites.
 - **Develop Better Simulation and Prediction Techniques:** Marketplace needs to come up with better simulation software for manufacturing of composite parts
 - **Need for Investment in Repair and Recycling Technologies:** Solve OEM challenges in repair and recycling by developing cost effective technologies and infrastructure

Supply Chain In the Automotive Industry. Major CFRP Component Manufacturers are Working in Collaboration with Major OEMs



Cooperation of OEMs and Part Fabricators on Technology are the Key for New Product Developments in the Automotive Industry

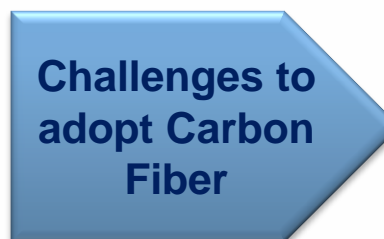
Tier 1 Players	Comments	OEMs
	<p>JV for mass production of CFRP Parts</p>	<p>DAIMLER</p>
	<p>JV Dissolved but Agreement to CFRP Parts and CF material</p>	
	<p>Contract to manufacture structural components like monocoque</p>	
	<p>Came together with novel process development and manufacturing of complex cosmetic parts like mirror housing</p>	
	<p>Has been developing composite automotive components like body panels, front wing, door skin, and body sides since 2013</p>	
	<p>Development of complete automatic process to produce stiff rear wall panel</p>	
	<p>Produced Roof for Audi RS5 using PCM technology developed by MRC</p>	
	<p>Came together to develop novel procedure for high volume CFRP component production for 2020 city cars</p>	

Business Case 1: Why BMW Chose Carbon Composites

Factors Driving the Use of Carbon Composites by BMW



Strategies Adopted by BMW to Ensure Effective Usage of CF Materials



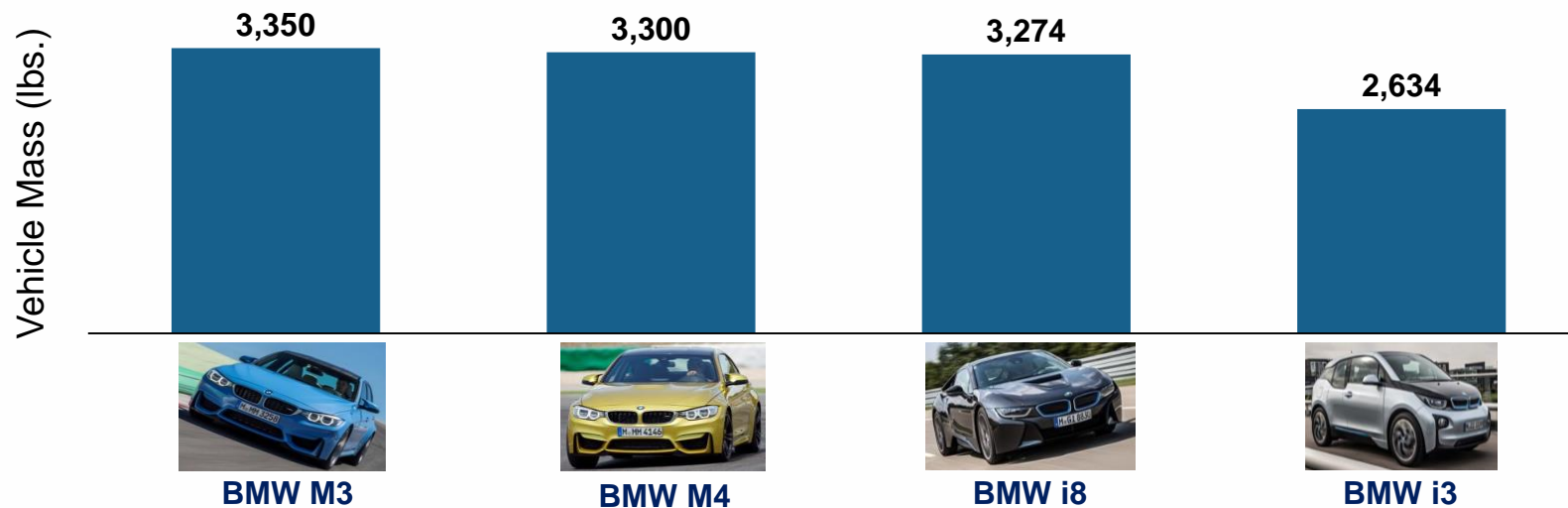
- High Cost of carbon fiber restricts its usage in high volume vehicles
- Continuous availability
- High cycle time



- BMW & SGL jointly invested to establish carbon fiber manufacturing plant at Moses Lake
- The facility supplies CF and preforms for BMW i vehicles & 7 series
- This strategy helps BMW to have control over CF prices

Increasing Usage of Carbon Fiber will Significantly Cut Vehicle Mass

Weight Saving in BMW Cars with Increasing Usage of Carbon Fiber



CF Applications in BMW Car Models



Driveshaft-M4



Roof-BMW M3



Trunklid-BMW M4



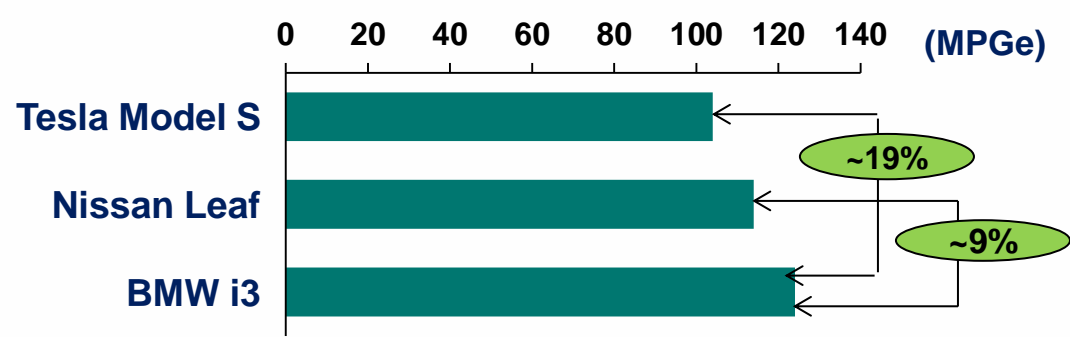
Life Module-BMW i3 & i8

Note: 5% weight reduction in new BMW M3 and M4 model over its predecessors with the use of CF

Source: Lucintel

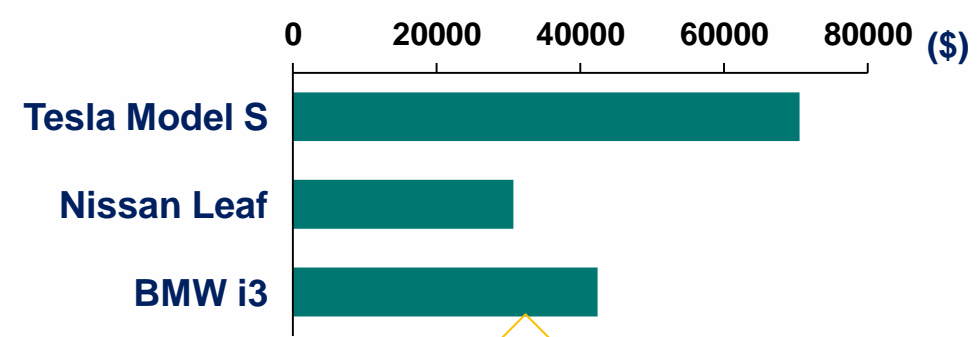
High Usage of Carbon Fiber in EVs Offers Significant Weight Saving and Improved Mileage

Mileage Comparison



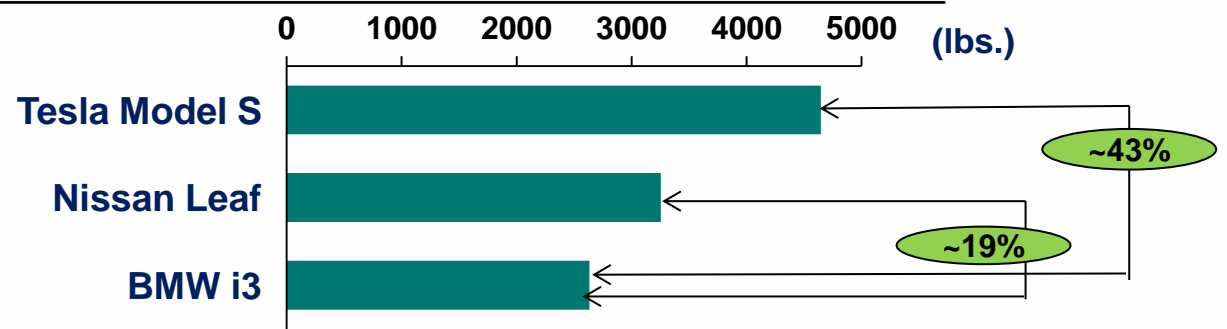
High CF content in BMW i3 has improved its mileage

Price Comparison



BMW i3 price lies in between the two models & offers high weight saving and mileage which makes it more competitive

Weight Comparison

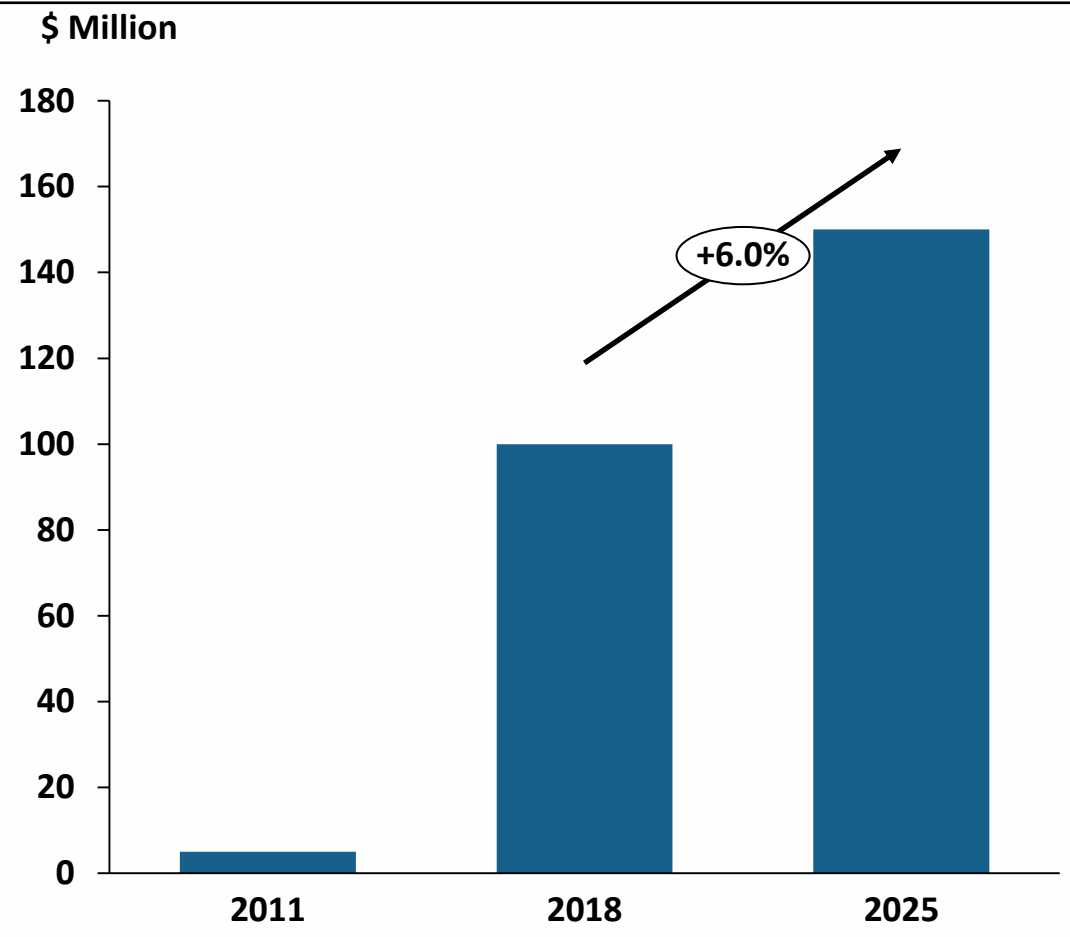


Note: MPGe (Miles per gallon gasoline equivalent)

Source: Lucintel

Business Case 2: Plasan Revenue Increased 20 Times in Five Years from Carbon Composites

Plasan: Revenue Analysis (2011-2025)



Company Introduction

- **Plasan Carbon Composites** is a carbon fiber component manufacturer, mainly for the automotive industry.
- Company transformed itself from low volume producer of composites components to high volume carbon composites part supplier in 10 years.
- Company targeting to achieve \$150 million in 2025 from \$5 million in 2011
- Company is continuously developing carbon composites parts for OEMs offering weight saving solutions

Source: Lucintel

Voice of the Market: Need for Light Weight Options with Good Business Case



Our top management is asking us to reduce weight by almost 50% in various platforms. We are looking into various material options. Significant weight saving potential is available in closure panels such as door panels, deck lids, and hood. We encourage component and material suppliers to come up with better solutions for our vehicle.

Product Manager, Chrysler



Go Further

Cost is a challenge with bio-composites as most users are not willing to pay a premium. Scale-up is needed for bio-composite materials for better economics.

Materials Research, Ford Motors

There is an increasing demand for low density materials in automotive and commercial vehicle market. We are continuously working to develop products with lower density using different combinations of raw materials. We are closely working with Tier 1 players and also OEMs to identify the future of new materials in structural and semi structural automotive applications.

Director, Menzolit



Voice of the Market: Material and Component Suppliers Need to Develop Better Lightweight Solutions



Government in North America has passed mandatory regulations, i.e. CAFÉ standards to improve the fuel economy. In order to improve the fuel economy, we need to work on the weight reduction in our trucks. We are looking into composites and other material options for making of our truck components.

Director, Peterbilt



We have been using composite on our components for a long time and are satisfied with its performance, though we are open to opt a newer materials offering better mechanical and aesthetic properties with light weight. We tend to depend on component suppliers and material manufacturer for new applications for our vehicles.

Engineer, Mercedes Benz Trucks



We use many SMC components such as bumper, roof cap, cabin structure, door extensions and fenders for our Trucks. For our Bus, we use hand lay-up and RTM process to manufacture composites parts. We are looking for new materials and technologies to make various components.

Engineer, MAN SE

Voice of the Market: COVID has Impacted the Production and Sales in the Automotive Industry



“We are evaluating all material options such as AHSS, Aluminum, Magnesium, Glass Composites and Carbon Composites for making automotive parts. Any material option should have a good business case without sacrificing safety, part count, and other requirements. We have closed all our facilities till 30th march, but now we will extend it for some more time. We are expecting a decline of 30% in our production & sales for the year 2020, if the situation gets worse. We are reviewing and evaluating the situation on a weekly basis”

Manager, GM



“Operations have been affected for JLR (Jaguar Land Rover). We have suspended our operation in UK till 20th of April, due to the outbreak of coronavirus. We expect significant decline in the revenue for the year 2020.”

JLR, UK



“Overall automotive business is growing at a slow pace and facing a decline of 40% to 50% currently. We are facing today are reaching out to the people for new projects and supply of raw material is also limited. Industry will face challenge of high prices of raw material due to transportation factor. As per the current market situation we are expecting that the prices will go up by 20% in near future”

Plasan Carbon Composites, USA

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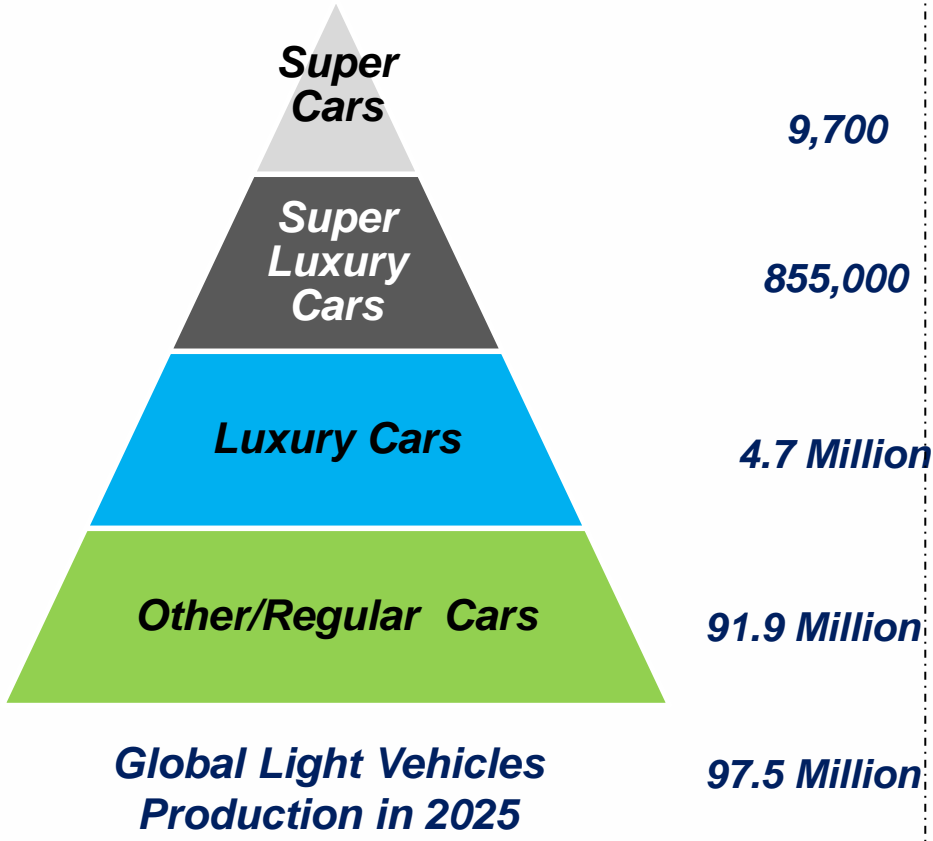
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Major Disruptions are Expected to Strengthen the Competitiveness of Composites

Major Developments	Enablers	Impacted Industries
<p>Cost Reduction in Carbon fiber</p>	<p>Alternative precursors, such as lignin, olefin, textile PAN, etc. Someone will launch low cost carbon fiber (\$3 - \$6 per lb) in future</p>	<ul style="list-style-type: none"> • Automotive • Industrial • Construction
<p>Improvement in Productivity</p>	<p>Low cure resins and faster and dependable technologies. Part manufacturing process with cycle time of 1 to 2 minutes for mass production</p>	<ul style="list-style-type: none"> • Automotive • Industrial • Aerospace
<p>Mass Customization</p>	<p>3D printing for different composites applications especially in automotive and healthcare</p>	<ul style="list-style-type: none"> • Aerospace • Automotive • Healthcare

Reduction in Carbon Fiber Costs could double Revenues from the Automotive Industry

Global Light Vehicles Production Forecast by Car Type in 2025



Expected Demand of CF @ Current Price in 2025			Expected Demand of CF @ \$5/lb in 2025		
CF Usage in % of cars	Demand in M lbs	\$M	CF Usage in % of cars	Demand in M lbs	\$M
100%	2.4	24.3	100%	2.4	12.1
95%	65.0	649.8	100%	128.3	641.3
55%	65.1	651.3	80%	277.4	1,137.2
3%	4.1	41.1	15%	138.2	691.0
<hr/>			<hr/>		
136.1 1,366.5			496.3 2,481.6		
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Source: Lucintel

Recent Innovations in Automotive Parts

3D Thermoplastic Mirror Cover



Supplier: Mubea Carbo Tech

OEM: Porsche

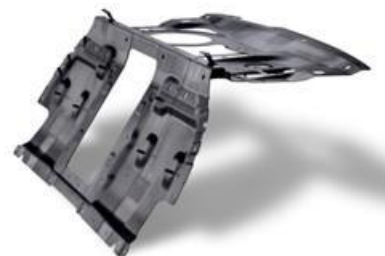
Innovation Year: 2018

Innovative Product/Technology: Fiberject technology

Value Proposition

- 85% cycle time reduction
- Up to 50% cost reduction
- More than 20,000 parts per year

CFRP Rear Wall Panel



Supplier: Voith

OEM: Audi

Innovation Year: 2018

Innovative Product/Technology: Fully Digital Automated Process

Value Proposition

- Curing time less than 2 mins
- Molding cycle time 5 mins
- Enables to manufacture 65,000 parts/year

Pickup Box



Material Supplier: Teijin

OEM: General Motors

Innovation Year: 2019

Innovative Product/Technology: Thermoplastic Pickup Box

Value Proposition

- 40% reduction in weight
- 10 times greater impact resistance
- Corrosion resistant, recyclable

CFRP Tuning Parts



OEM: Hyundai

Innovation Year: 2020

Innovative Product/Technology: Various carbon fiber parts in motorsports car front lip, rear diffuser, rear spoiler, carbon side mirror cover

Value Proposition

- 6 times more rigid than steel
- 3 times more post-elastic stiffness
- 4 times more lightness

Source: Lucintel

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Conclusions – How Companies Should Prepare

- About 129 billion lbs light weight materials will be used in 2025 by auto OEMs.
- Although current costs for Carbon fiber composites are high, they represent good business opportunities in terms of offering light-weight solutions.
- Demand for carbon composites in the automotive industry is expected to continue to grow based on innovations in materials, technologies and applications in combination with continued cost reductions
- To develop competitive edge in automotive composites, marketplace needs to invest in cost reduction, technology development, simulation, repair, recycling and robust supply chain development.
- Companies in the composites industry need to have clear strategies and objectives for how they want to compete (what materials, applications, segments, technology, etc.)
- Lucintel can help you define and implement a strategy designed to grow your business, more specifically to:
 - **Identify and evaluate attractive opportunities:** Develop dynamic understanding of the relevant market segments you target where you should compete, broken down by segment, application, technology and region. What gaps exist to realize full potential? Also, to develop a short list of specific investment opportunities
 - **Finance your Growth:** Help you secure the financing needed to implement your chosen strategy

Appendix: About Lucintel and Case Study for Growth

Lucintel - At a Glance

- Premier management consulting and market research firm. Founded in 1998.
- Deep global insights into major industries. Team of over 120 analysts / consultants across globe
- Management comprised of PhDs, MBAs, and subject matter experts. Head quarter in Dallas, USA.

Conducted 500+ consulting projects across industries for 3M, Audi, Dupont, Carlyle, GE, etc.

Consulting Services



Why Lucintel

Trusted insights: Reliable insights. Widely cited in Wall Street Journal, Financial Times, Forbes, etc.

Clients we serve: Over 1000 clients from 70 countries – Fortune 500 companies

Strategic advice: Over 20 years of proven global strategic management consulting experience

Industries Served



1000+ Clients in 70 Countries Value Our Service



Case Study 1: Growth Opportunity for a Leading Prepreg Manufacturer

Challenge

- A leading prepreg supplier wanted to know about the opportunity for glass and carbon fiber prepreg in Europe and North America across various sectors

Objectives

- To estimate growth opportunities for glass and carbon fiber prepreg across sectors including rail, marine, construction, automotive, defense, infrastructure, and sporting goods in NA and Europe
- Find out prepreg consumption by molders in each sector by application and prepreg type
- Conduct ***Voice of Market analysis*** and ***Go To Customer List*** in North America and Europe

Solutions

- Lucintel identified the most attractive target applications in each region for the client based on the client's core competency
- Lucintel conducted interviews with **>700 companies** to find out their prepreg consumption patterns and provided Go To Customer List of **>250 molders**
- Lucintel developed short, medium & long term strategy in the most attractive markets with action plan

Results

- The **company's sales** for the relative growth segments grew by **25%** over **2 years**

Case Study 2: Growth Opportunity for a Leading Pipe Manufacturer in Composite Pipes

Challenge

- A leading FRP pipe manufacturer in the US wanted to know about the opportunity existing for them in composite pipes applications in the US and Canada

Objectives

- To identify total opportunity for FRP pipe and steel pipes
- Identify the addressable market (new/replacement) for FRP pipes for the client based on their core competencies (Diameter, pressure rating, etc.)
- Conduct market share analysis, price vs performance analysis with competing materials, customer identification, and customer requirement analysis in various diameter ranges

Solutions

- Lucintel identified addressable market opportunity based on client core competencies and looked into competing materials performance over the last 10 years
- Lucintel provided Go To Customer List with **\$50 million dollar sales opportunity in next 10 years**
- Lucintel developed short, medium and long term strategy with detail actionable plan

Results

- The **company's sales** grew by **35%** over **2 years**

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