DUCKER

RESEARCH & CONSULTING

Member of Ducker Carlisle LLC

DETROIT | PARIS | BERLIN | SHANGHAI | BANGALORE | LONDON | BOSTON

DUCKER.com

Aluminum Content in Passenger Vehicles (Europe)

Assessment 2022

and Outlook 2026, 2030

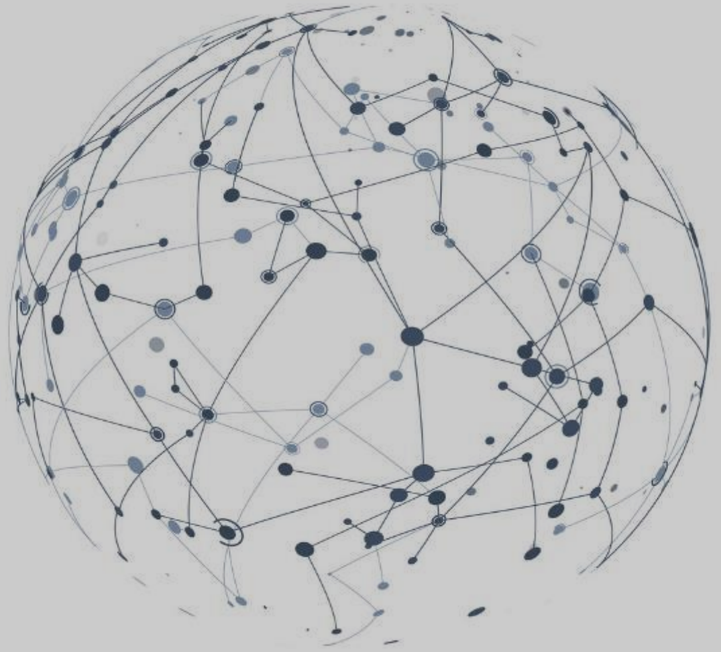
- Public Summary -

April, 2023

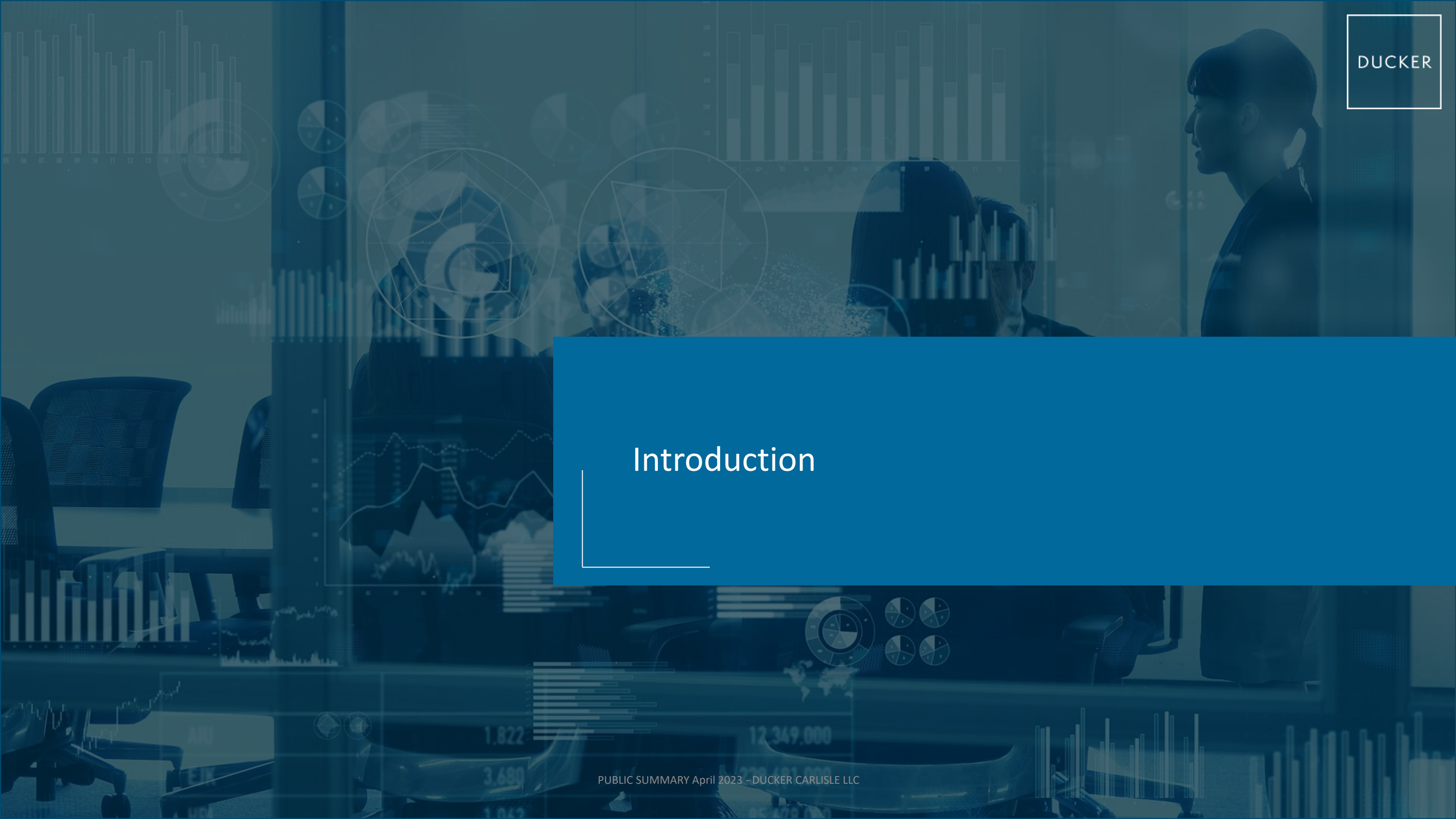
Prepared for:

European Aluminium

ANYTHING BUT BASIC



AGENDA



Introduction

Starting Point

Ducker has been providing EA with analyses of the Aluminum Content in Cars since 2012. The 2022 edition of this study considers the market in its entirety and highlights the evolutions linked to the electrification of the car market

EUROPEAN ALUMINIUM represents the aluminum industry in Europe, encompassing primary aluminum producers, downstream manufacturers, producers of recycled aluminum and national aluminum associations.

Through environmental and technical expertise, economic and statistical analysis, scientific research, education and sharing of best practices, public affairs and communication activities, EUROPEAN ALUMINIUM aims to promote aluminum's contribution to sustainable development whilst maintaining and improving the image of the industry, of the material and of its applications.

The Automotive & Transport group of EUROPEAN ALUMINIUM specifically focuses on accelerating the aluminum penetration in the transportation sector, with regular communication about the benefits of aluminum in mobility applications, outreaching activities, as well as frequent updates on the demand growth for vehicles.

Since 2012, DUCKER has been a strategic research partner to EUROPEAN ALUMINIUM's Automotive & Transport group, providing comprehensive European Automotive Aluminum Content estimates, analysis, and forecasts. Throughout the three previous editions (2012, 2016, and 2019), the "Aluminum Content in Cars" study has evolved and been enhanced in scope, scale, and detail with the objective to continuously increase accuracy in measurement of aluminum content in vehicles being produced in Europe.

In its 2022 edition, the study scope embraces the full car market - including the electric car market in its entirety – enabling to identify in which respect the profound transformation of the car market toward electrification impacts the aluminum utilization and demand.

This study includes a comprehensive, segmented, and detailed mapping of aluminum content in cars produced in Europe today, as well as growth forecasts of the aluminum content by 2030.

EA Automotive Group Members

Alcoa, AD, AMAG AUSTRIA METALL, AssanAlüminyum, BOHAI TRIMET, Constellium, EURAL GNUTTI S.p.A., HAI, Hydro, Novelis, RAFFMETAL, RioTinto, speira

Source: Ducker

Project Scope

In order to reflect the strong electrification trend, the 2022 European assessment of the Aluminum Content in Cars includes all powertrain variants and all electric vehicle models

DUCKER

PROJECT SCOPE

Geography

EU27 + UK

OEM passenger car production taking place in EU27+UK

CKD assembly is not part of the scope

Vehicle Segment

Passenger Vehicles

- All powertrain variants (ICE only, MHEV, FHEV, PHEV, BEV, FCEV)
- All car size segments (A to F)
- All car body types

Light commercial vehicles are not part of the scope

Component Families

1. Body-in-white (BIW)
2. Brakes
3. Chassis
4. Closures
5. Driveline
6. EV-Specific
7. Powertrain
8. Steering
9. Thermal management
10. Transmission
11. Trim
12. Wheels

Extra category “Other miscellaneous parts” accounts for the aluminum weight associated with small parts that are difficult to track

Product Forms

Aluminum:

- **Castings**
- **Sheet**
- **Extrusions**
- **Forgings**

Aluminum foil is not part of the scope

Source: Ducker

Aluminum content is distributed between 12 component families, each of which encompasses a various number of components – adding up to a total of 96 components

DUCKER

1. BIW (13 components)
- ▶ **Crash Management System (CMS)**
- ▶ **Cross members**
- ▶ **Door beams**
- ▶ **Door sills/rockers**
- ▶ **Front longitudinals**
- ▶ **Rear longitudinals**
- ▶ **Front-end structure (incl. radiator support)**
- Instrument panel structure
- Pillars
- Roof bows (incl. windshield header, actual roof bow, and rear header)
- ▶ **Shock towers**
- Truck bed rail
- Floor group (incl. firewall and rear panel)
- Other BIW components

2. BRAKES (6 components)
- ABS/ESP housings
- ▶ **Brake calipers**
- Rotor hats/Bells
- Brake booster vacuum parts
- Electric brake boosters
- ▶ **Master cylinders**
- Other brake components

3. CHASSIS (4 components)
- Control arms/links
- Knuckles
- ▶ **Subframes/cradles**
- Bushings
- Other chassis components

4. CLOSURES (7 components)
- ▶ **Body side panels**
- ▶ **Fenders**
- ▶ **Front doors**
- ▶ **Hood**
- ▶ **Rear doors**
- ▶ **Roof**
- ▶ **Tailgate/Trunk**
- Other closure components

5. DRIVELINE (4 components)
- Differential carriers (incl. case)
- Drive shaft
- Transmission mounts
- Yokes
- Other driveline components

6. EV SPECIFIC (5 components)
- ▶ **Ballistic protection**
- ▶ **Battery cooling plates**
- ▶ **Battery pack housing (may incl. sills)**
- ▶ **Electric motor housing(s)**
- EV gearbox housing
- Other EV specific components (cables, connectors, HV devices housings)

Battery foil, battery cell/module housings are not part of the scope

7. POWERTRAIN (19 components)
- Accessory brackets
- Alternator case
- Bed plates
- ▶ **Engine block**
- Head/Cam covers
- ▶ **Cylinder heads**
- Front covers
- Fuel rails
- Intake manifolds
- Mounts
- Oil filter adapters
- Oil pans
- Pistons
- Starter motor housings
- Thermostat housings
- Timing chain covers
- Turbochargers
- Water outlet tubes
- Water pump housings
- Other powertrain components

8. STEERING (4 components)
- Universal joint / Yoke
- Column housings
- Rack & pinion housings
- Tie Rod Ends
- Other steering components

9. THERMAL MANAGEMENT (10 components)
- Compressor housings (incl. scrolls, pistons)
- Condensers
- Connection hardware (incl. heat transfer lines)
- Evaporators
- Heat shields
- Heat sinks
- Heater cores
- Intercooler (charge-air cooler)*
- ▶ **Oil coolers**
- ▶ **Radiator**
- Other thermal management components

**Intercooler has been included in the component list after project kick-off*

10. TRANSMISSION (9 components)
- Automatic & CVT cases
- Brackets
- Extension covers
- Manual clutch housings
- Manual transmission cases
- Transfer cases/PTUs
- Transfer plates
- ▶ **Transmission valves**
- ▶ **Valve bodies**
- Other transmission components

11. TRIM (14 components)
- Adjustment motor housings
- Airbag canisters
- Computer/sensor housings
- Overhead/luggage rails
- Running boards
- Seat belt spools/retractors
- Seat frames
- Seat motor housings
- Seat pans
- Seat tracks
- Sunroof motor housings
- Sunroof rails
- ▶ **Decorative trim**
- Wiper arms
- Other trim components

12. WHEELS (1 component)
- ▶ **Road wheels**

OTHER MISCELLANEOUS PARTS

▶ Components (total of 30) selected to be focus components for a detailed analysis

To analyze and forecast the Aluminum Content in Passenger Vehicles, Ducker combines primary research (expert interviews with OEMs and suppliers, including EA member input), secondary research, LMC production data and internal proprietary datasets

DUCKER

Secondary Research & Data Mining

- Leverage existing DUCKER expertise and datasets
- Utilize LMC vehicle production and powertrain data[1]
- Collect publicly available data and insights via desk research

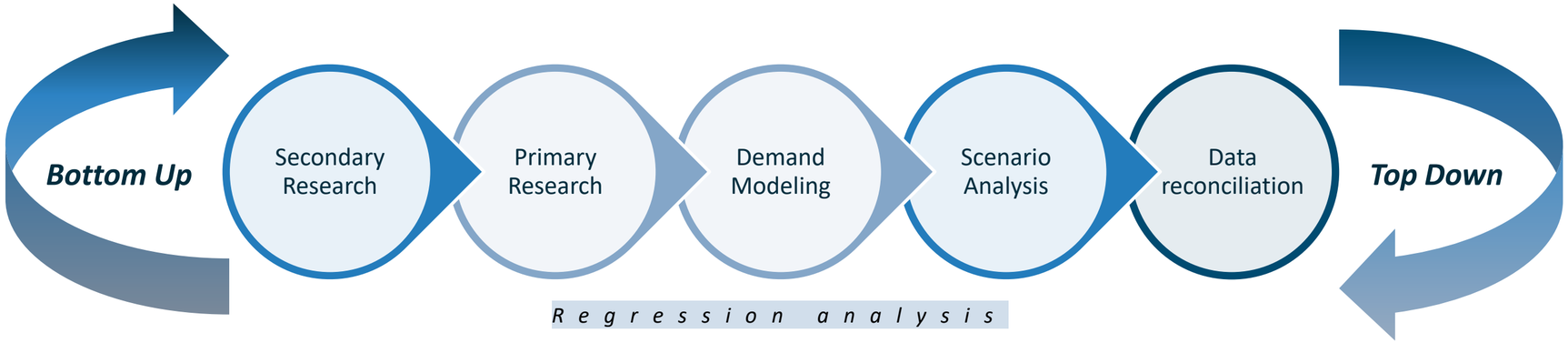
Primary Research

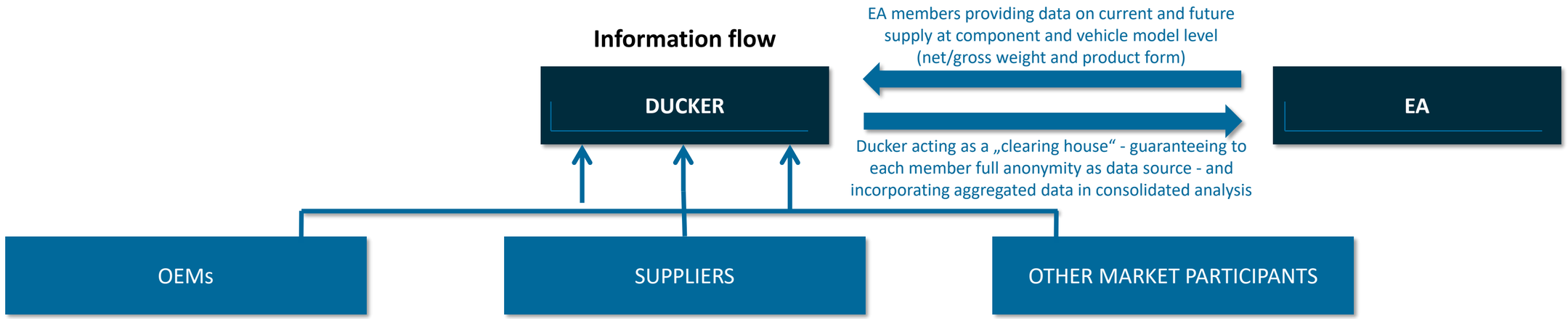
- Interview-based primary research
- Explorative, high-quality discussions with industry decision-makers within key market participants
- Combined top-down and bottom-up approach

Analysis

- Data triangulation (on-going cross check)
- Market modeling building upon fact-base rationale
- Data consolidation and reconciliation
- Actionable insight development

[1] Ducker started the analysis based on LMC Powertrain Q1 2022 (released end of April 2022) and updated with LMC Powertrain Q3 2022 (released end of October 2022) for final analysis





Source: Ducker

Project Core Team

A European core project team from our 'Automotive & Materials' practice served this engagement, and worked in close collaboration with the US project team assigned to the North American Aluminum Content Study for the American Aluminum association

DUCKER

Project Director

Hélène Wagnies
Principal

hwagnies@duckercarlisle.com

Project Advisor

Abey Abraham
Principal

aabraham@duckercarlisle.com

Project Advisor

Bertrand Rakoto
Global Automotive Practice Leader

brakoto@duckercarlisle.com

Research & Analysis

Judith Hansen
Engagement Manager Automotive

jhansen@duckercarlisle.com

Knowledge & Data Management

Leonard Ling
Global Automotive Knowledge Manager

lling@duckercarlisle.com

Research & Analysis

Isabelle Kraft
Senior Analyst Automotive

ikraft@duckercarlisle.com

Research & Data Management

Théo Castel
Market Analyst Automotive

tcastel@duckercarlisle.com

60 years of experience advising the industry in the aluminum and transportation sectors

Key Takeaways

Aluminum Gains/Losses by Component Family

The highest aluminum gains will come from the 'EV Specific' family - nearly 54 kg more aluminum per vehicle will be needed in 2030 compared to 2022 for EV specific components. The need for additional aluminum content in BIW will also be significant - more than 15 additional kg

DUCKER

Aluminum CPV* Gains and Losses by Component Family (kg)

For the forecast period 2022-2030

* The component family ‘Thermal Management’ does not include battery cooling plates, which are accounted in the component family ‘EV Specific’. If battery cooling plates were included in the ‘Thermal Management’ component family, the Thermal Management CPV would show a growth from 20.5 kg in 2022 to 24.1 kg in 2030 (2.1% CAGR)

Sources: Ducker; *CPV = Content Per Vehicle; *Ducker applied the 2026–2029 CAGR to estimate the 2030 values

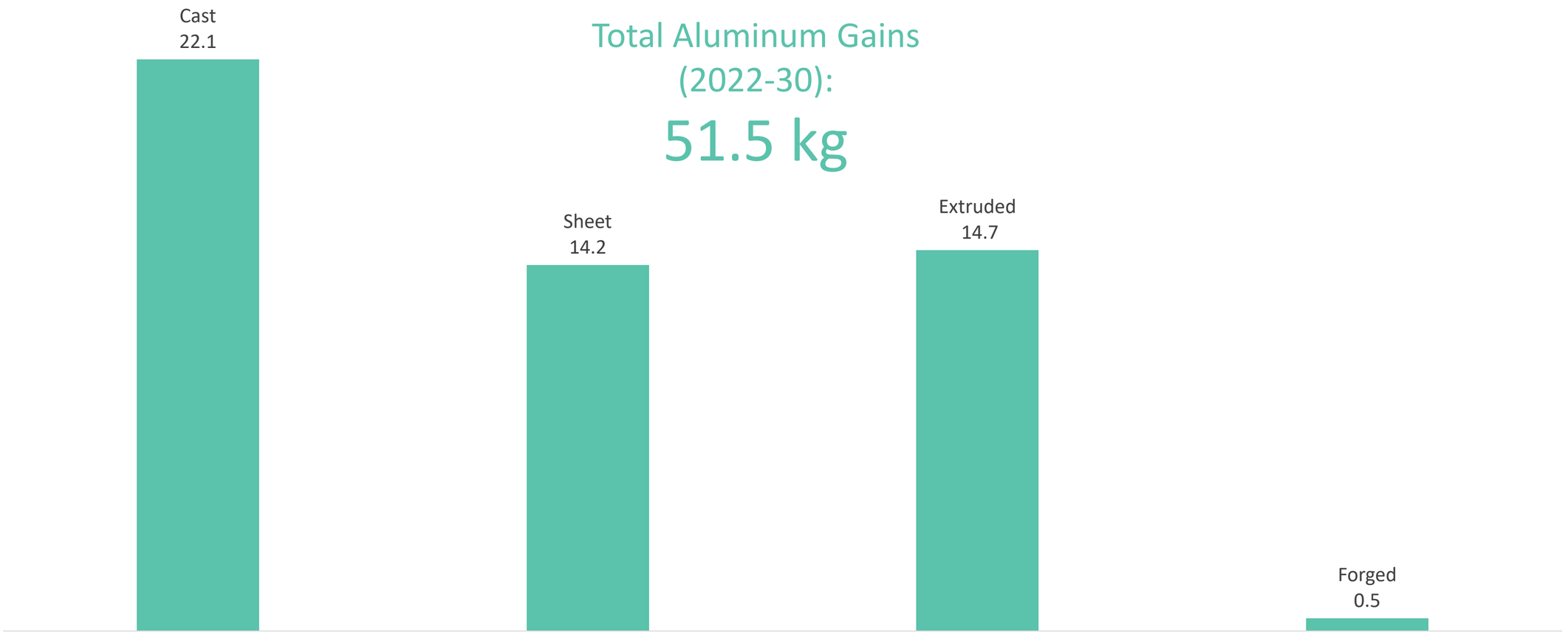
Aluminum Gains/Losses by Forming Process

All aluminum product forms will see their CPV increase by 2030. Castings will have the highest aluminum gains: 22 kg between 2022 and 2030. Extrusions and sheet are expected to achieve significant content gains as well (14-15 kg each). Sole forgings will have a limited gain of 0.5 kg by 2030

DUCKER

Aluminum CPV* Gains by Forming Process (kg)

For the forecast period 2022-2030



Sources: Ducker; *CPV = Content Per Vehicle; *Ducker applied the 2026–2029 CAGR to estimate the 2030 values

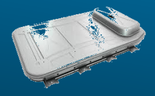
The Top 5 growth components driving the highest aluminum content increase are E-drive housings, battery pack housings, large and mega castings, ballistic protection and battery cooling plates. All of them are linked to electrification

DUCKER

1 E-drive Housings

+22.7 kg 2022-30

2 Battery Pack Housings



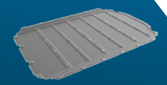
+11.8 kg 2022-30

3 Large/ Mega Castings

+8.4 kg 2022-30

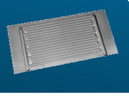
Large and mega castings in BIW will allow to decrease assembly complexity, reduce costs and achieve weight saving

4 Ballistic Protection



+7.0 kg 2022-30

5 Battery Cooling Plates



+5.1 kg 2022-30

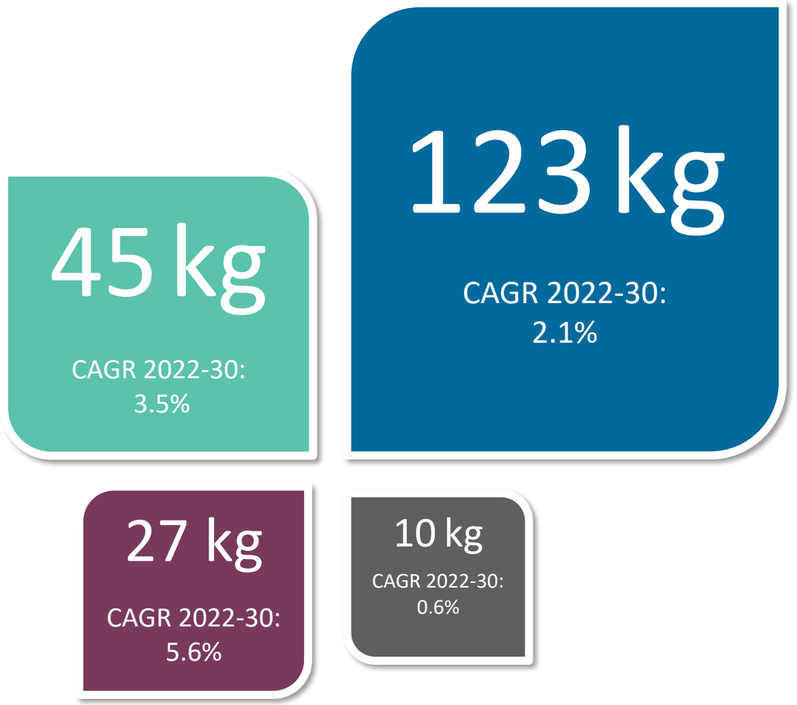
EV Specific components drive tremendous aluminum content increase – their aluminum-intensity contributes to compensate the weight of the EV battery

Sources: Ducker

Castings are by far the largest aluminum product form with 123 kg per vehicle, expected to reach 145 kg per vehicle in 2030. Strongest growth is expected from extrusions due to increasing penetration in EV Specific, BIW and Brakes

DUCKER

Average Aluminum Content per Vehicle in 2022



Sheet (+14 kg by 2030)

Aluminum sheet demand continues its growth, driven by electrification and weight reduction targets, as well as product mix leaning towards larger vehicles. Growth mainly comes from:

- EV Specific – primarily ballistic protection and battery cooling plates
- Closures - especially front and rear doors

Extrusions (+15 kg by 2030)

The fastest growing aluminum product form due to increasing penetration in:

- EV Specific – battery pack housing
- BIW – mainly sills and CMS
- Brakes - electric brake booster one-box-system

Castings (+22 kg by 2030)

Remain the leading product form for aluminum components. Decreasing powertrain, transmission and driveline components are overcompensated by:

- new EV components (e-drive housings, battery pack housings, high voltage device housings, etc.)
- large and mega castings for body-in-white, and shock towers
- rising share of cast aluminum subframes

Forgings (+0.5 kg by 2030)

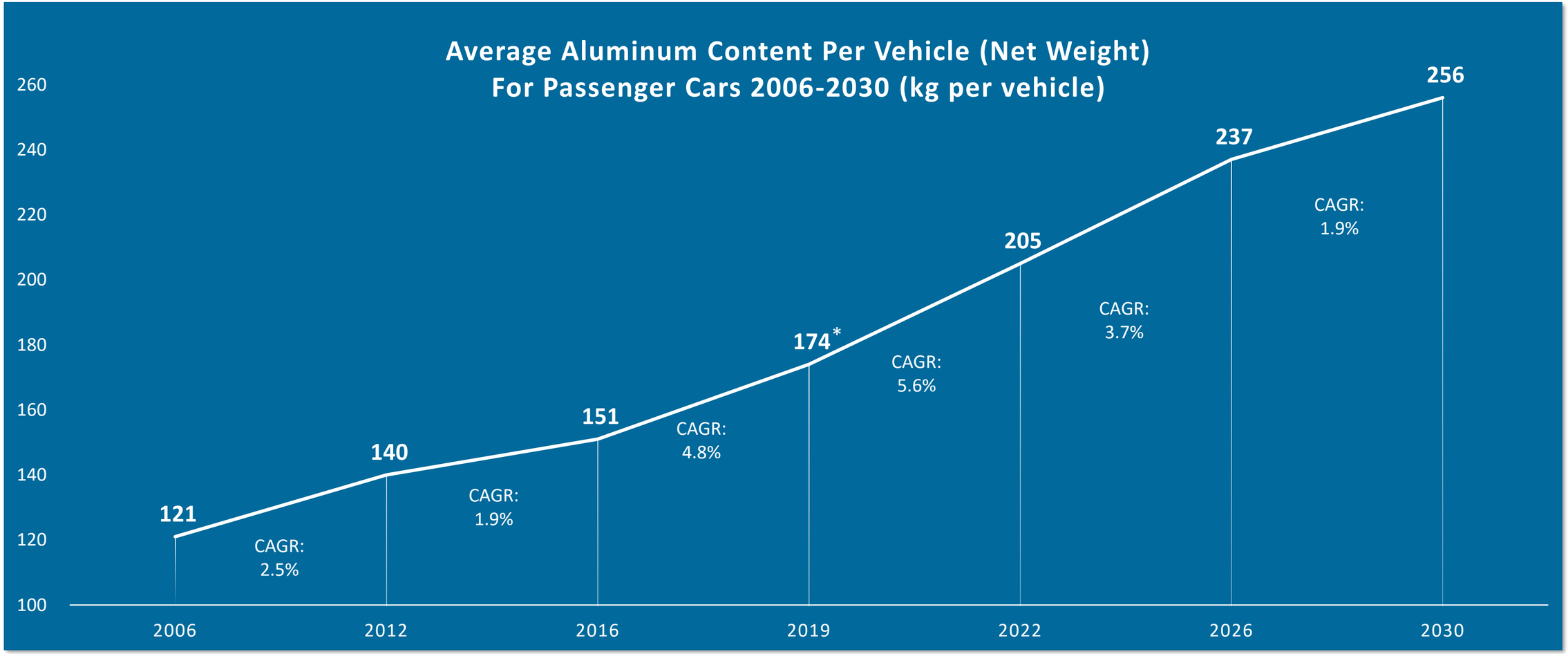
Least growing product form. Only applicable for chassis, wheels and steering components

- stable in wheels and steering
- slightly increasing in chassis (for knuckles and 2-point links)

Sources: Ducker

Regardless of vehicle production growth, the average aluminum Content Per Vehicle (CPV) has steadily been increasing in passenger cars since 2006 (time when Ducker started monitoring the CPV in the EU). With further lightweighting needs, electrification as well as a rising share of larger and premium vehicles, the CPV increase is expected to accelerate by 2026

DUCKER



Sources: Ducker; *CPV of 179 kg in EA study 2019 as second set of OE wheels was included

Aluminum will continue its uninterrupted growth path in Automotive. Regulatory requirements for CO2 emission reduction pave the way to electrification, which contributes to higher aluminum intensity

DUCKER

A. Continuous aluminum growth

- Aluminum content to continue growing, but at a slower pace
  - CAGR 2022-2026: 3.8%
  - CAGR 2026-2030: 1.9%
- Growth will primarily come from new applications and innovation (e.g. electrification and large/mega castings)
- Overall content per vehicle is expected to grow from 205kg in 2022 to 256kg in 2030

B. Regulation drives growth

- Stricter EU fleet-wide CO2 emission targets set by EU regulations - defined as % reduction from 2021 starting point, with specific target set annually for each OEM – push OEMs towards BEV strategy
  - 15% reduction from 2025 on
  - 55% reduction from 2030 on (new target)
  - Zero emission starting 2035
  - Climate neutrality by 2050

C. Electrification benefits aluminum

- Electrification positively affects aluminum content and compensates the loss from powertrain components
- New components include e-drives, battery housings, and multiple high voltage device housings
- Weight reduction is key to meet range expectations and to lower battery associated costs

D. Production mix impacts content

- Supply chain disruptions have led OEMs to lower production of smaller and less profitable models
- Aluminum content will overall increase between 2022 to 2030 due to a shift towards higher car segments and premium brands

E. Slow car production recovery

- COVID 19, supply chain disruptions, Ukraine war and energy crisis having significant negative impact on production volumes
- But European car production is expected to recover and get back to 2019 production levels by 2026

F. Sustained competitive pressure

- In a dynamic and competitive environment, innovation is steadily required for all materials
- Beyond on-going improvement of technical properties, innovation will focus on sustainability with low-carbon production, increased share of recycled content, and high-quality scrap

Sources: Ducker; *CPV = Content Per Vehicle

Automotive Market Primer

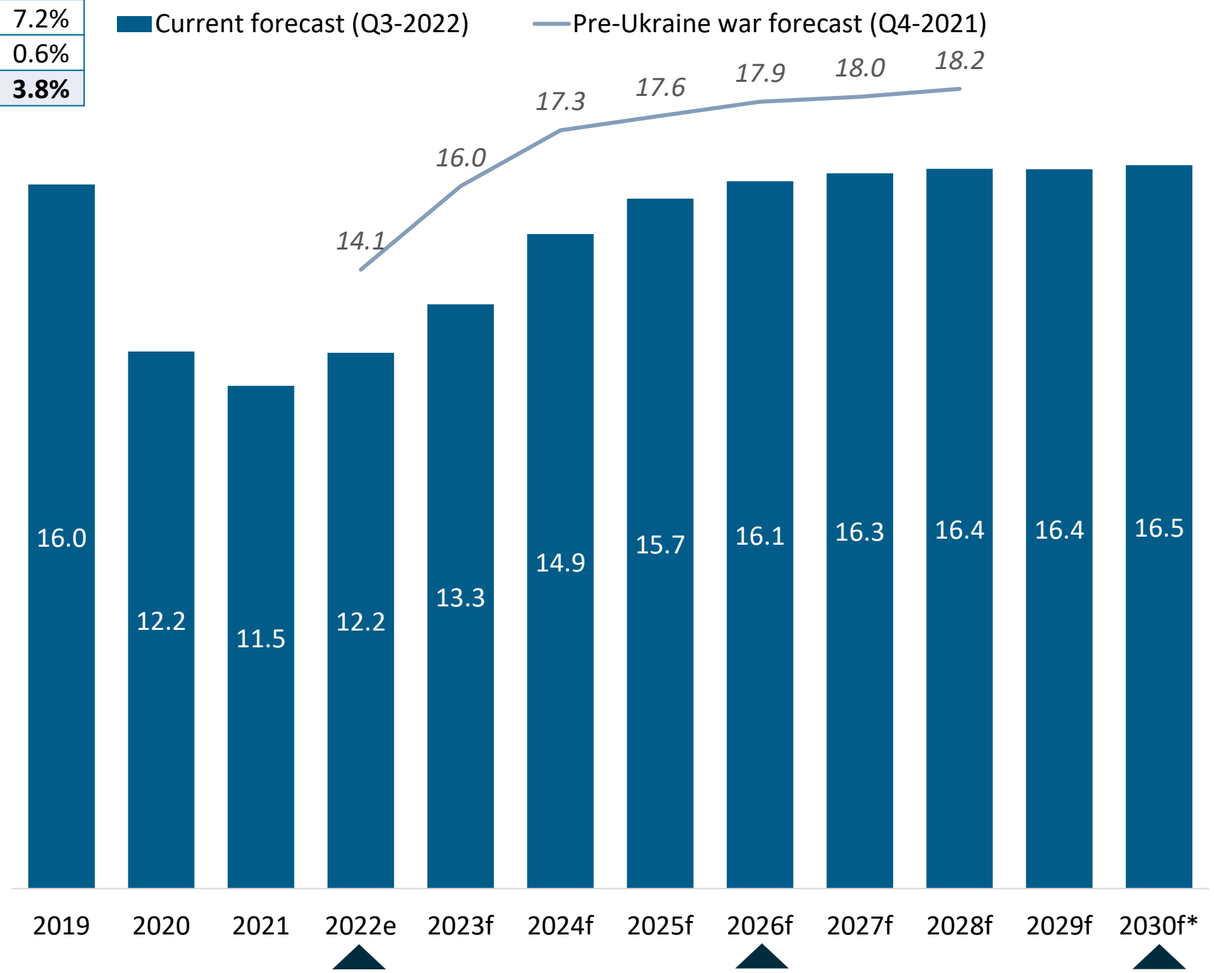
The European Automotive industry is slowly recovering from the Covid crisis and supply chain disruptions. It still suffers from high uncertainties and the energy crisis linked to the Ukraine war

DUCKER

CAGR	
2022-2026	7.2%
2026-2030	0.6%
2022-2030	**3.8%**

EU27+UK Passenger Vehicle Production Forecast

Million Units of Passenger Cars (Light Commercial Vehicles excluded)



- 2020-2021: COVID-19 made industry stall
  - Production stops
  - Lockdowns
  - Lower mobility needs
- 2020-onward: Semiconductor shortage causing major sourcing issues, leading to supply chain disruptions
  - Automotive sector is a relatively small customer for the semiconductor industry (only 11% of global demand – meaning limited negotiation power)
  - Semiconductor shortages expected to last into 2023
- 2022: Ukraine war having a significant impact on European economies and Automotive industry
  - Additional material shortages (e.g. power harnesses)
  - Material price increases (e.g. palladium for catalysts)
  - Tremendous increase of energy prices and upcoming energy shortages due to high dependency on gas and oil from Russia – a major concern for the aluminum industry
  - Overall geopolitical uncertainties
- European Automotive production not expected to reach back to 2019 production level before 2026
  - Vehicle production forecasts are likely to be subject to significant adjustments
  - Final version of this assessment will be updated with LMC Powertrain Q3 2022 data (release end of Oct)

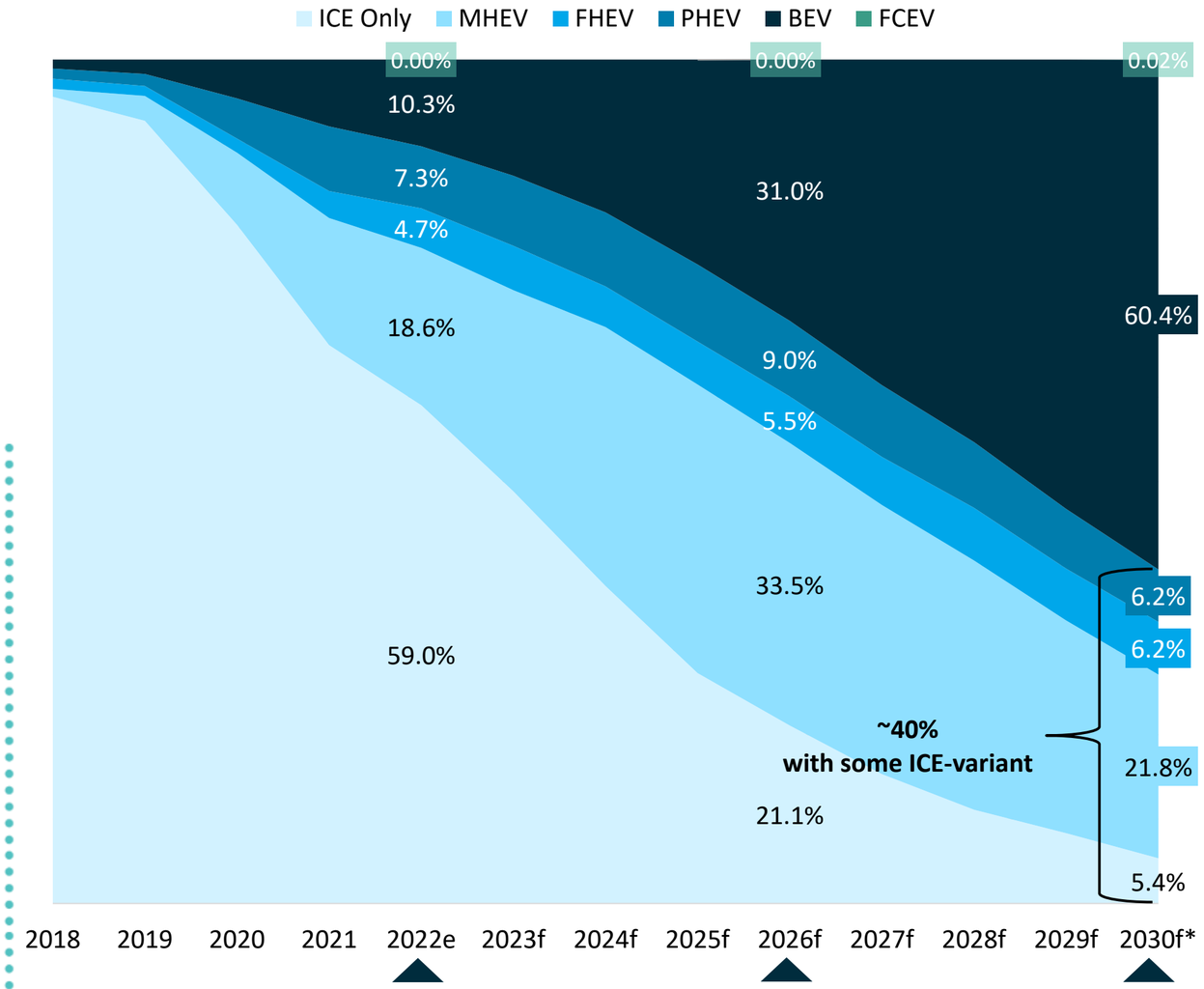
Data Source	EU27+UK Passenger Vehicle Production Forecast		
	2022e	2026f	2030f*
LMC Q1 2022	13,447,691 units	17,471,180 units	17,702,133 units
LMC Q2 2022	12,433,521 units	16,492,421 units	16,644,791 units
LMC Q3 2022	12,207,189 units	16,115,535 units	16,482,537 units
Change in Q3 vs. Q1	-1,240,502 (-9.2%)	-1,355,645 (-7.8%)	-1,219,596 (-6.9%)
Change in Q3 vs. Q2	-226,332 (-1.8%)	-376,886 (-2.3%)	-162,254 (-1.0%)

Sources: Ducker, LMC Automotive Q3-2022, Q4-2021; *Ducker applied the 2026–2029 CAGR to estimate the 2030 production volume which is not yet available in LMC forecasts

Driven by regulation, the electrification trend has strongly accelerated in the last few years. 31% of EU passenger car production is forecasted to be BEVs in 2026, potentially up to 60% by 2030

DUCKER

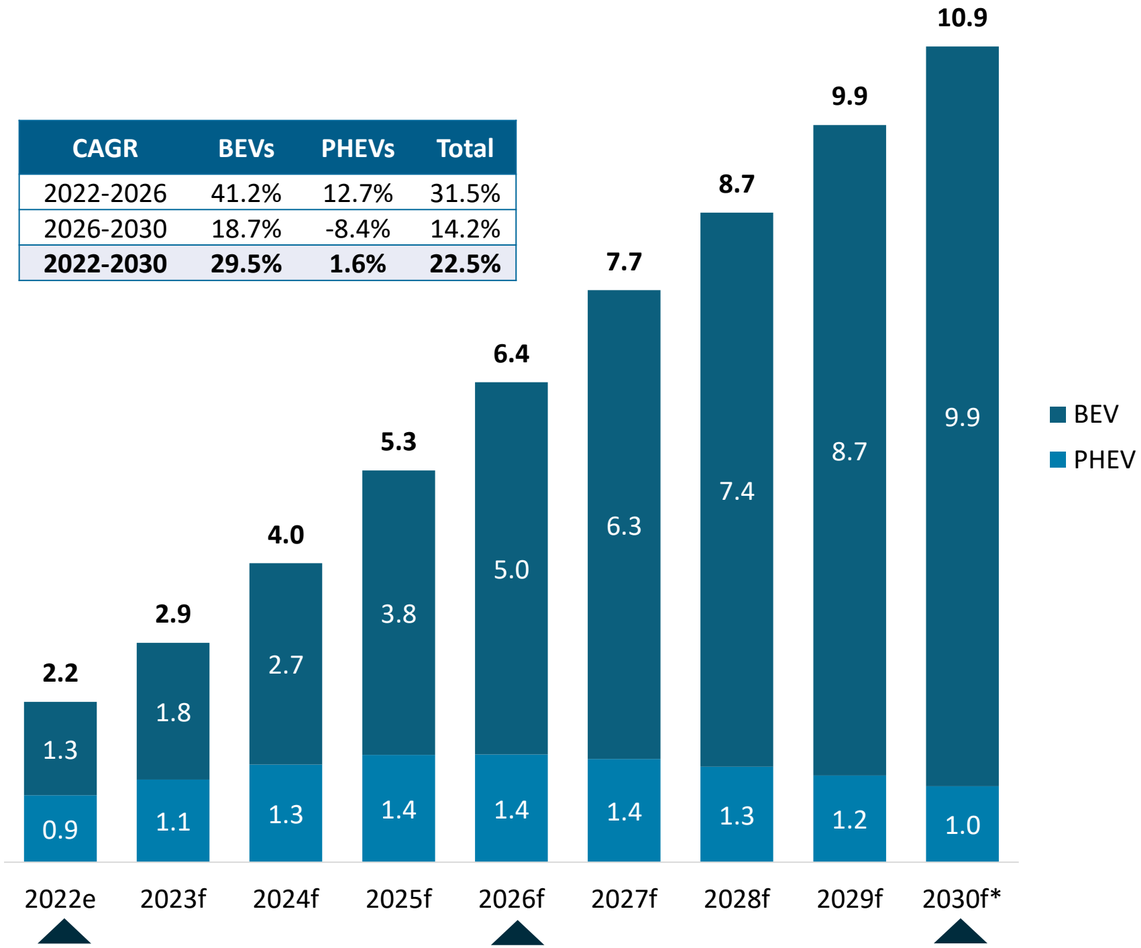
EU27+UK Passenger Car Powertrain Shares



EU27+UK Passenger Car BEV-PHEV Production Forecast

Million units

CAGR	BEVs	PHEVs	Total
2022-2026	41.2%	12.7%	31.5%
2026-2030	18.7%	-8.4%	14.2%
2022-2030	**29.5%**	**1.6%**	**22.5%**

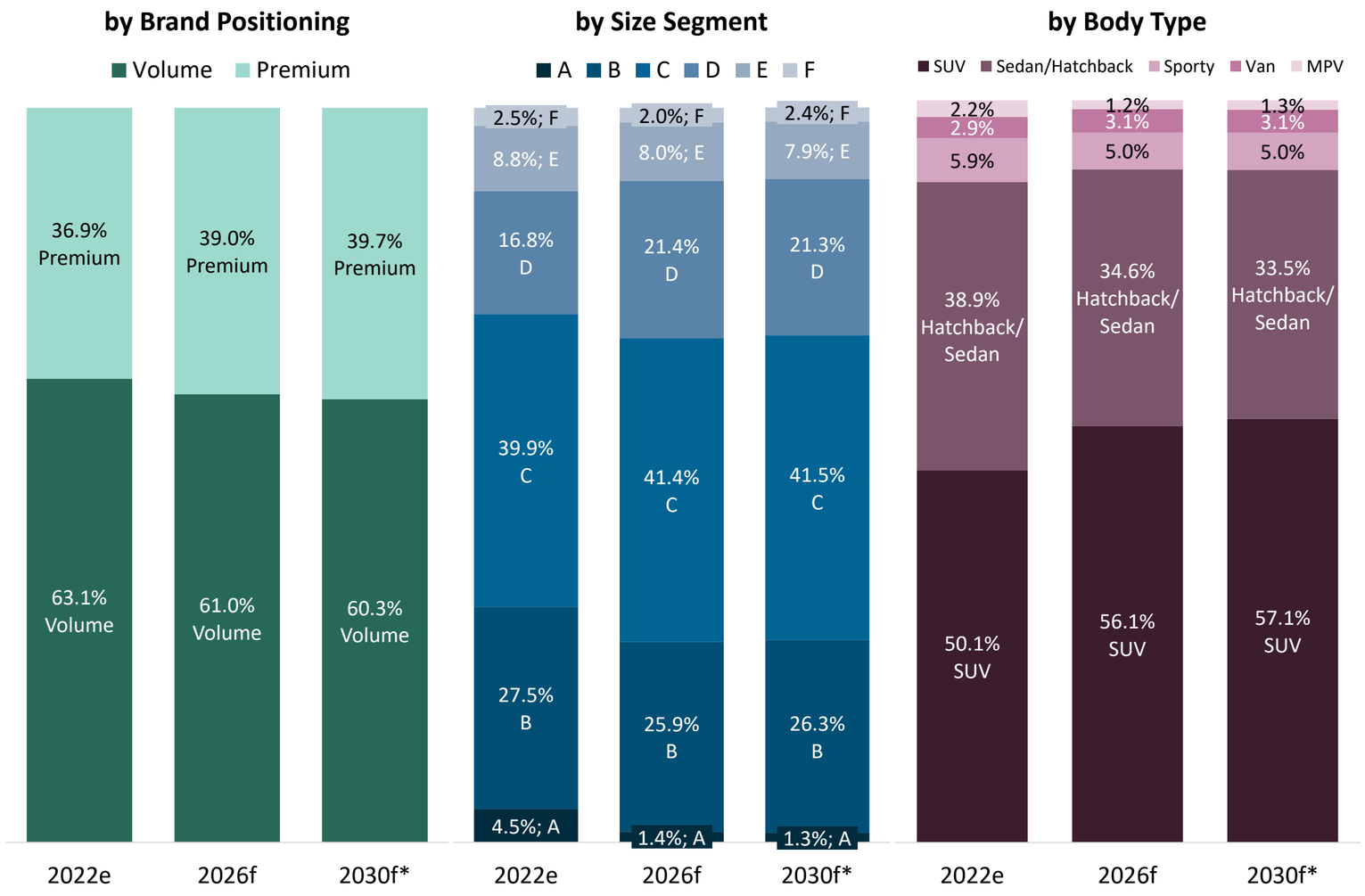


Sources: Ducker, LMC Automotive Q3-2022; *Ducker applied the 2026–2029 CAGR to estimate the 2030 production volume which is not yet available in LMC forecasts

Premium brands will continue to grow their share. D and C segment will gain shares over B and A. SUVs - already more than 50% of EU production today - will further increase. All in all, production mix evolution will foster increased aluminum usage

DUCKER

EU27+UK Passenger Vehicle Production

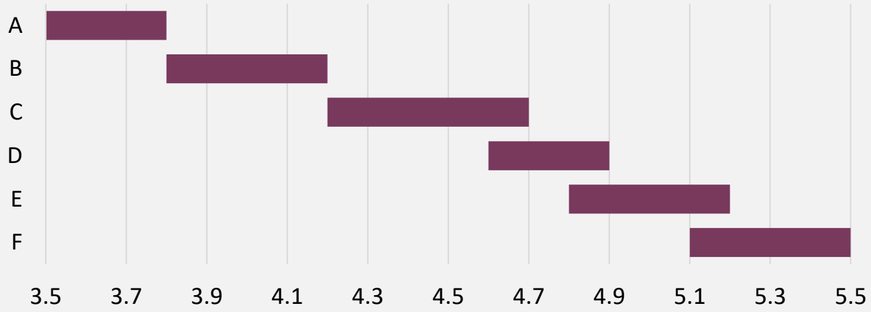


Sources: Ducker, LMC Automotive Q3-2022; *Ducker applied the 2026–2029 CAGR to estimate the 2030 production volume which is not yet available in LMC forecasts

Definitions

Premium brands: Alfa Romeo, Aston Martin, Audi, Bentley, BMW, DS, Ferrari, Fisker, INEOS, Infiniti, Jaguar, Lamborghini, Land Rover, Lotus, Maserati, McLaren, Mercedes-Benz, MINI, Morgan, Pininfarina, Porsche, Renault, Rimac, Rolls-Royce, Smart, Tesla, TVR, Volkswagen, Volvo

Size Segment Indicative Vehicle Lengths (m)

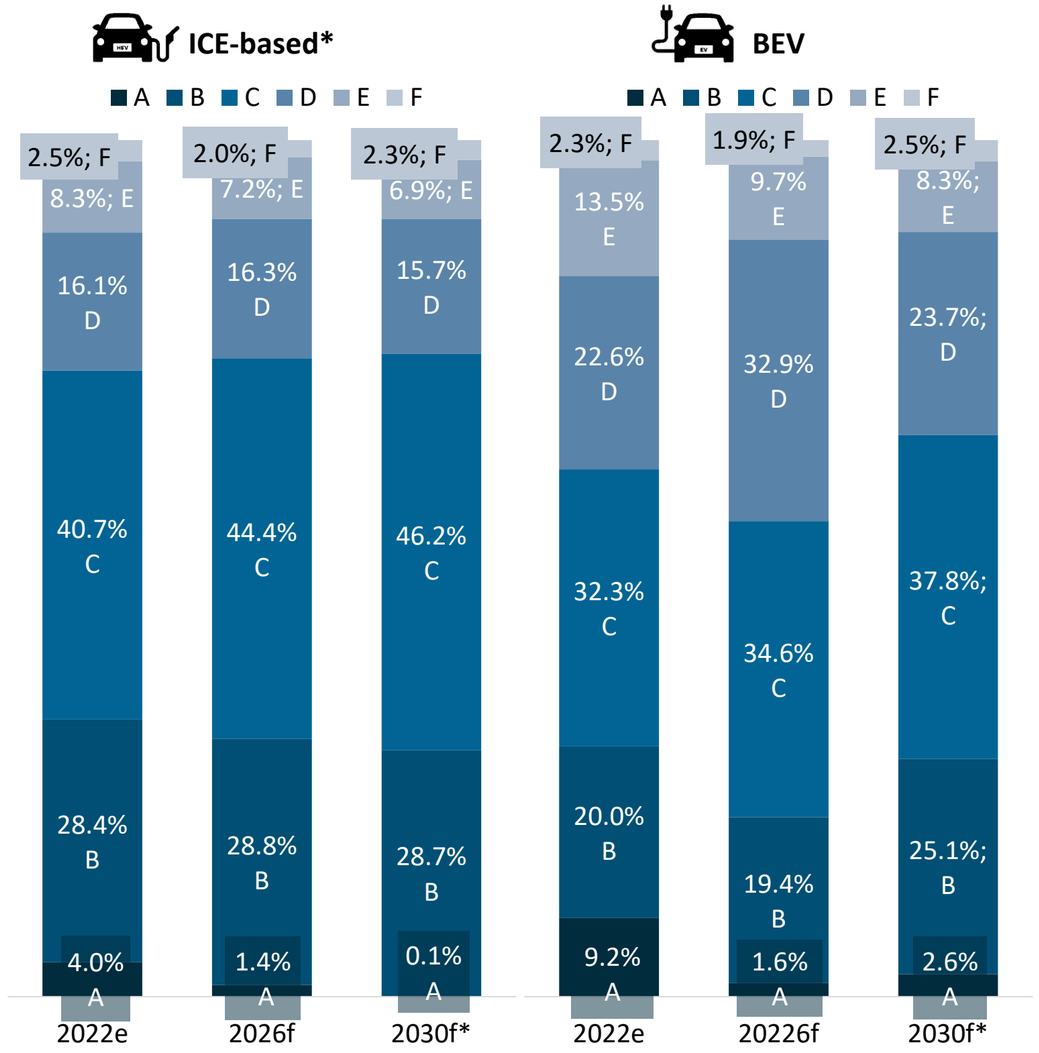


SUV		**Van**	
Sedan/ Hatchback		**MPV**	
Sporty			

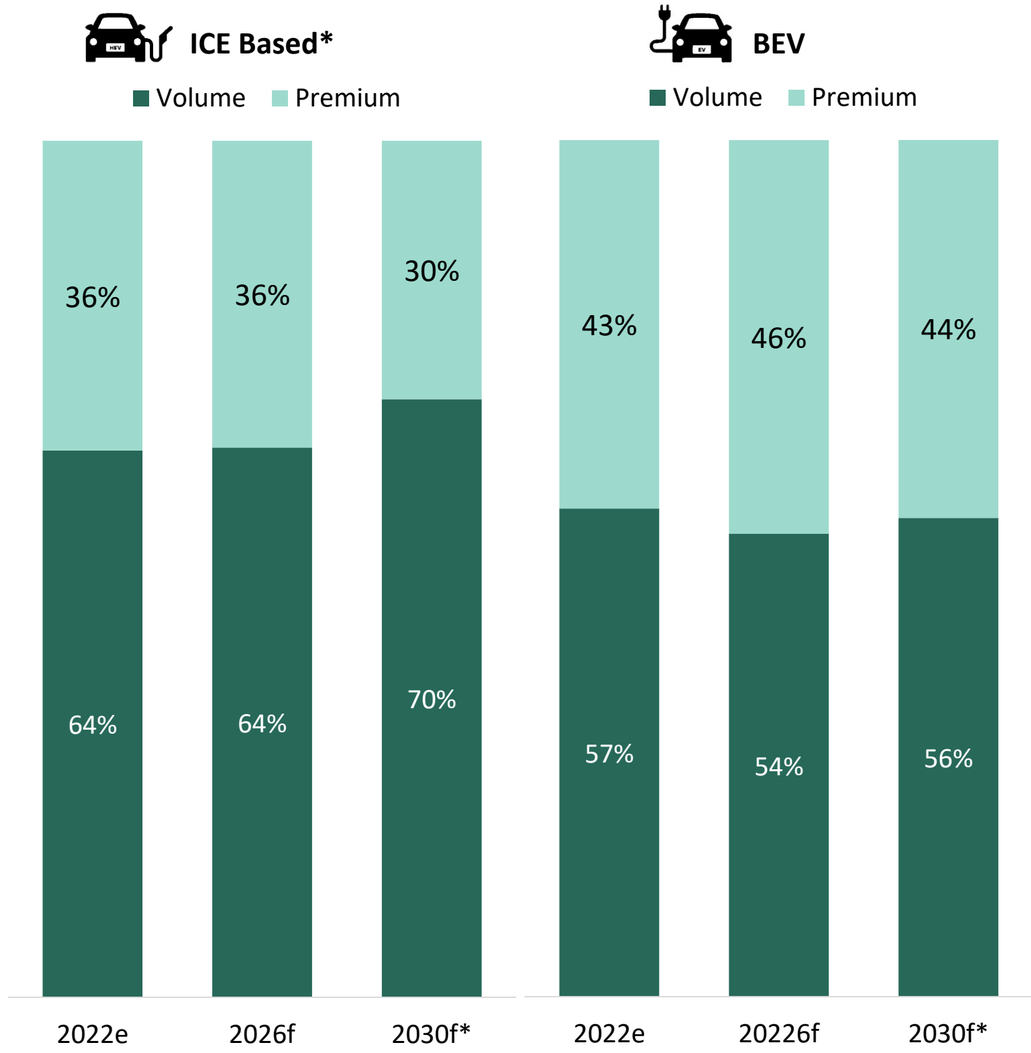
BEVs produced in the EU are positioned in higher size segments than ICE-based vehicles (significantly more D and E) and are more premium-positioned than ICE-based vehicles. This will continue to be the case through 2030, even though BEV production will grow the most in the B and C size segments

DUCKER

EU27+UK Passenger Vehicle Production by Size Segment



EU27+UK Passenger Vehicle Production by Brand Positioning



Sources: Ducker, LMC Automotive Q3-2022; *Ducker applied the 2026–2029 CAGR to estimate the 2030 production volume which is not yet available in LMC forecasts; *ICE-based= FHEV, ICE, PHEV, MHEV

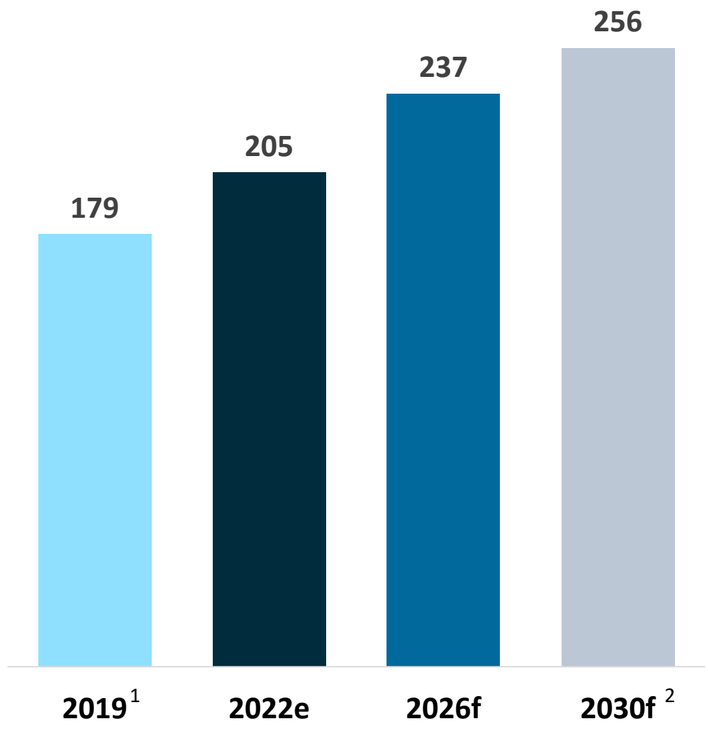
Consolidated Market Data

Overall AL CPV & Gross Demand

Driven by electrification and further lightweighting requirements, the average aluminum Content Per Vehicle (CPV) will keep on increasing. The period 2022-2026 will show strong growth in both CPV and gross demand. Growth is expected to slow down after 2026

DUCKER

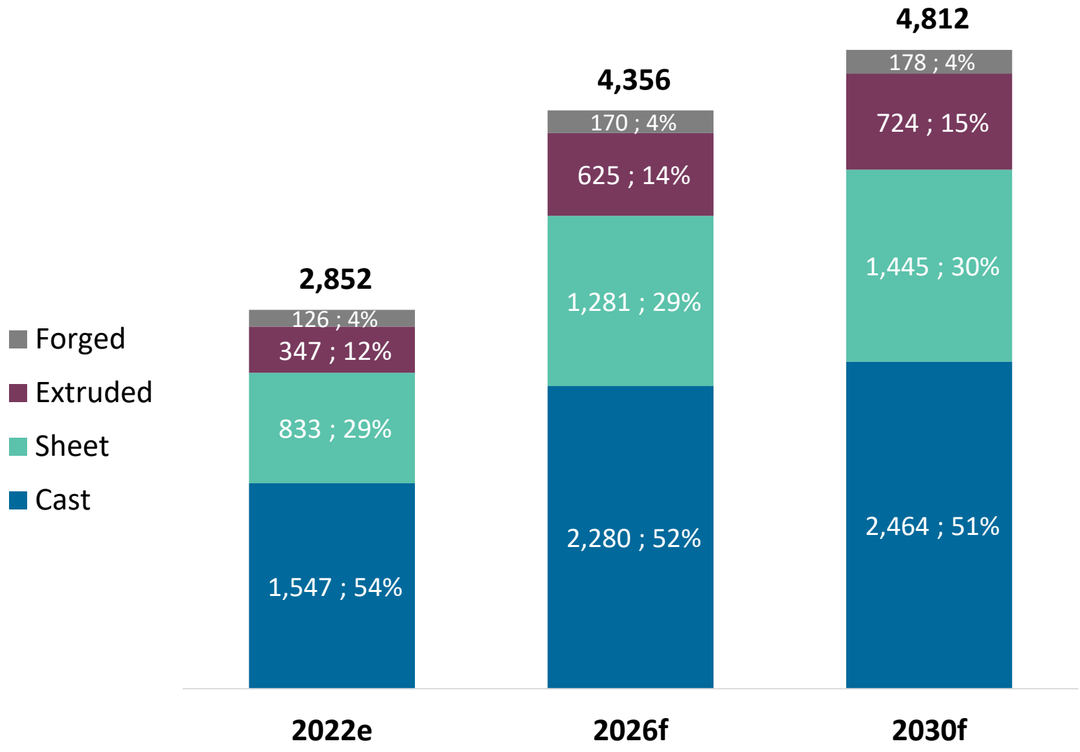
Total Aluminum CPV* (kg)



Total	AL CPV Growth (kg)				CPV CAGR			
	19-22	22-26	26-30	**22-30**	19-22	22-26	26-30	**22-30**
Market	+26	+32	+19	**+51**	4.5%	3.8%	1.9%	**2.8%**

Total Aluminum Gross Demand by Forming Process (kT)

incl. machining scrap as well as blanking/stamping scrap for sheet [3]



Forming Process	GROSS AL Demand Growth in kT			Tonnage CAGR		
	2022-26	2026-30	**2022-30**	2022-26	2026-30	**2022-30**
Cast	+733	+184	**+917**	10.2%	2.0%	**6.0%**
Sheet	+448	+164	**+613**	11.4%	3.1%	**7.1%**
Extruded	+278	+99	**+377**	15.8%	3.8%	**9.6%**
Forged	+45	+7	**+52**	7.9%	1.1%	**4.5%**
Market	**+1,504**	**+455**	**+1,960**	**11.2%**	**2.5%**	**6.8%**

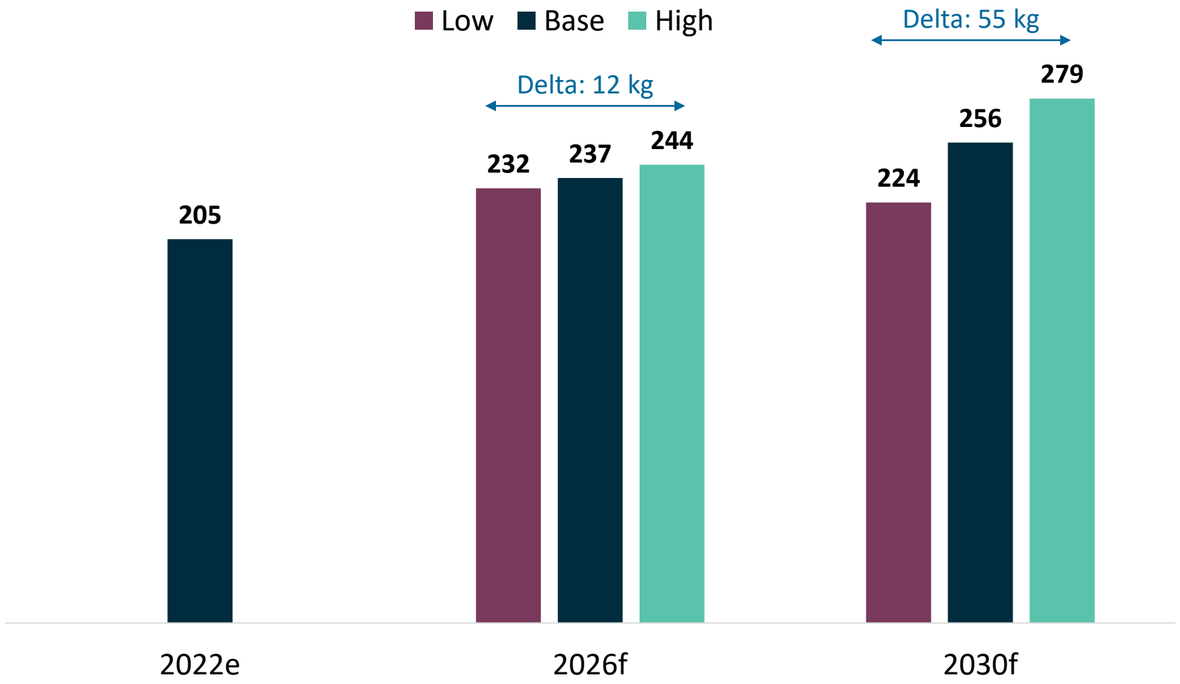
Sources: Ducker; *CPV = Content Per Vehicle

[1] EA study 2019 included second set of OE wheels; [2] Ducker applied the 2026–2029 CAGR to estimate the 2030 values; [3] Average machining scrap does not exceed 5%, while blanking/stamping scrap can reach up to 60% for sheet components

Resulting from modelled variations in the powertrain mix, the car size segment distribution, and the material decisions for Battery Pack Housings as well as Large/Mega Castings, the CPV forecasts can differ from Base Scenario – slightly in 2026, or significantly in 2030. Aluminum Net Demand forecasts are subject to higher variations than CPV forecasts as vehicle production volumes are likely to change

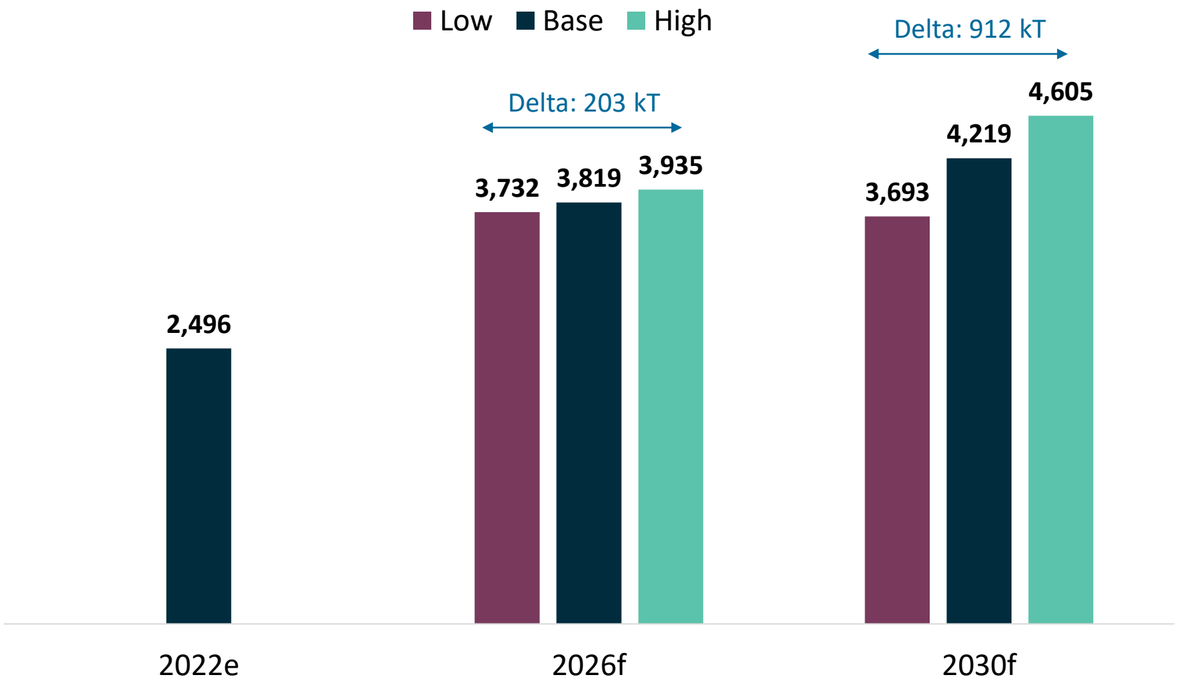
DUCKER

Aluminum CPV* Scenarios (kg)



Scenario	CAGR	AL CPV
Low	2022-2026	3.2%
	2026-2030	-0.8%
Base	2022-2026	3.8%
	2026-2030	1.9%
High	2022-2026	4.5%
	2026-2030	3.4%

Total Aluminum Net Demand Scenarios (kT)



Scenario	CAGR	AL Net Demand
Low	2022-2026	10.6%
	2026-2030	-0.3%
Base	2022-2026	11.2%
	2026-2030	2.5%
High	2022-2026	12.1%
	2026-2030	4.0%

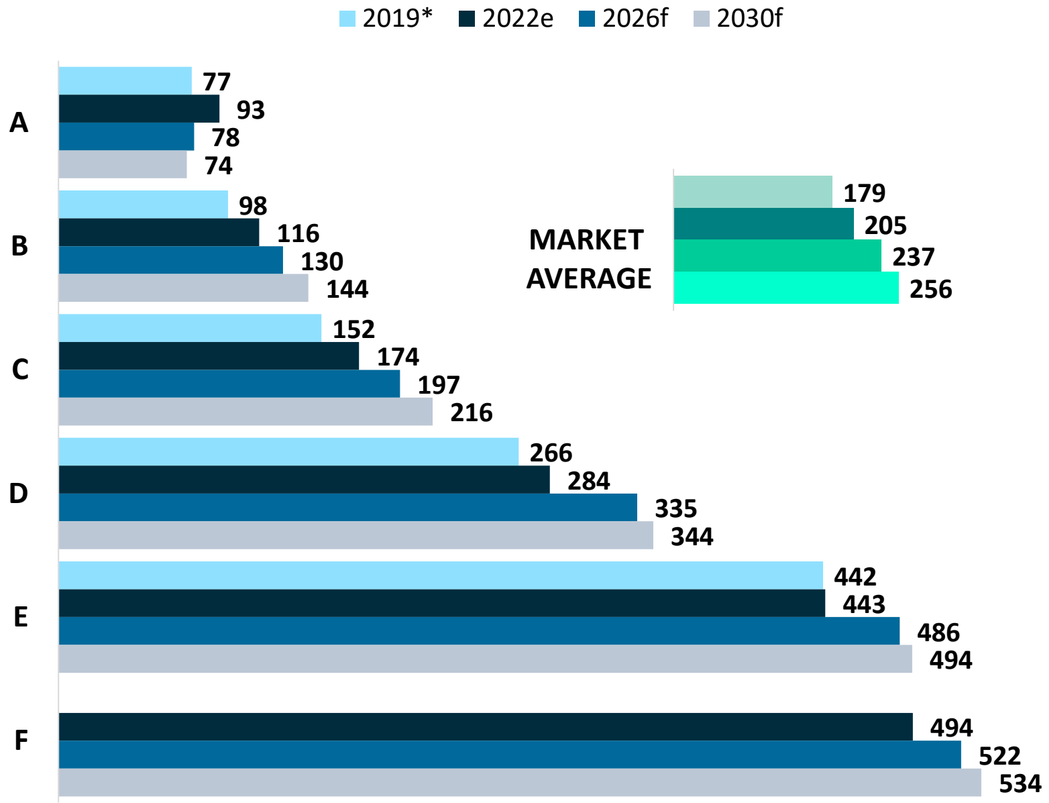
Sources: Ducker; *CPV = Content Per Vehicle; *ICE-based = ICE only, MHEV, FHEV, PHEV; *Ducker applied the 2026–2029 CAGR to estimate the 2030 values

AL CPV by Size Segment & by Forming Process

The higher the size segment, the higher the aluminum intensity. B and C segments will experience the strongest CPV growth by 2030. Castings will remain the leading aluminum product form in cars and will continue to grow. However, aluminum extrusions and sheet, will show stronger CPV growth rates than castings

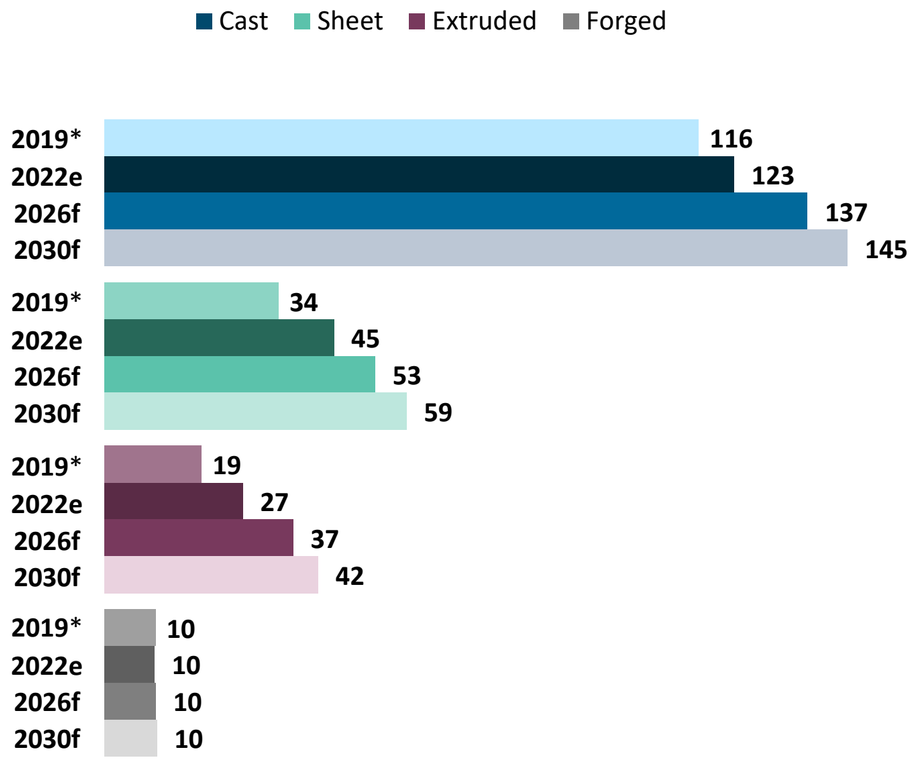
DUCKER

Aluminum CPV* by Size Segment (kg)



Size Segment	AL CPV Growth in kg				CPV CAGR			
	2019-22	2022-26	2026-30	**2022-30**	2019-22	2022-26	2026-30	**2022-30**
A	**+16**	-15	-4	**-19**	6.5%	-4.2%	-1.3%	**-2.8%**
B	**+18**	+14	+15	**+28**	5.8%	2.8%	2.7%	**2.8%**
C	**+22**	+24	+19	**+43**	4.6%	3.2%	2.3%	**2.8%**
D	**+18**	+50	+9	**+60**	2.2%	4.2%	0.7%	**2.4%**
E	**+1**	+43	+7	**+50**	0.1%	2.3%	0.4%	**1.4%**
F	-	+28	+12	**+40**	n.a.	1.4%	0.6%	**1.0%**
Market	**+25**	**+32**	**+19**	**+51**	**4.5%**	**3.8%**	**1.9%**	**2.8%**

Aluminum CPV* by Forming Process (kg)



Forming Process	AL CPV Growth in kg				CPV CAGR			
	2019-22	2022-26	2026-30	**2022-30**	2019-22	2022-26	2026-30	**2022-30**
Cast	+7	+14	+8	**+22**	1,9%	2.8%	1.4%	**2.1%**
Sheet	+11	+8	+6	**+14**	9,6%	4.2%	2.8%	**3.5%**
Extruded	+8	+10	+5	**+15**	12,5%	8.1%	3.2%	**5.6%**
Forged	0	+0.3	+0.2	**+0.5**	-0,8%	0.7%	0.5%	**0.6%**
Market	**+26**	**+32**	**+19**	**+51**	**4,5%**	**3.8%**	**1.9%**	**2.8%**

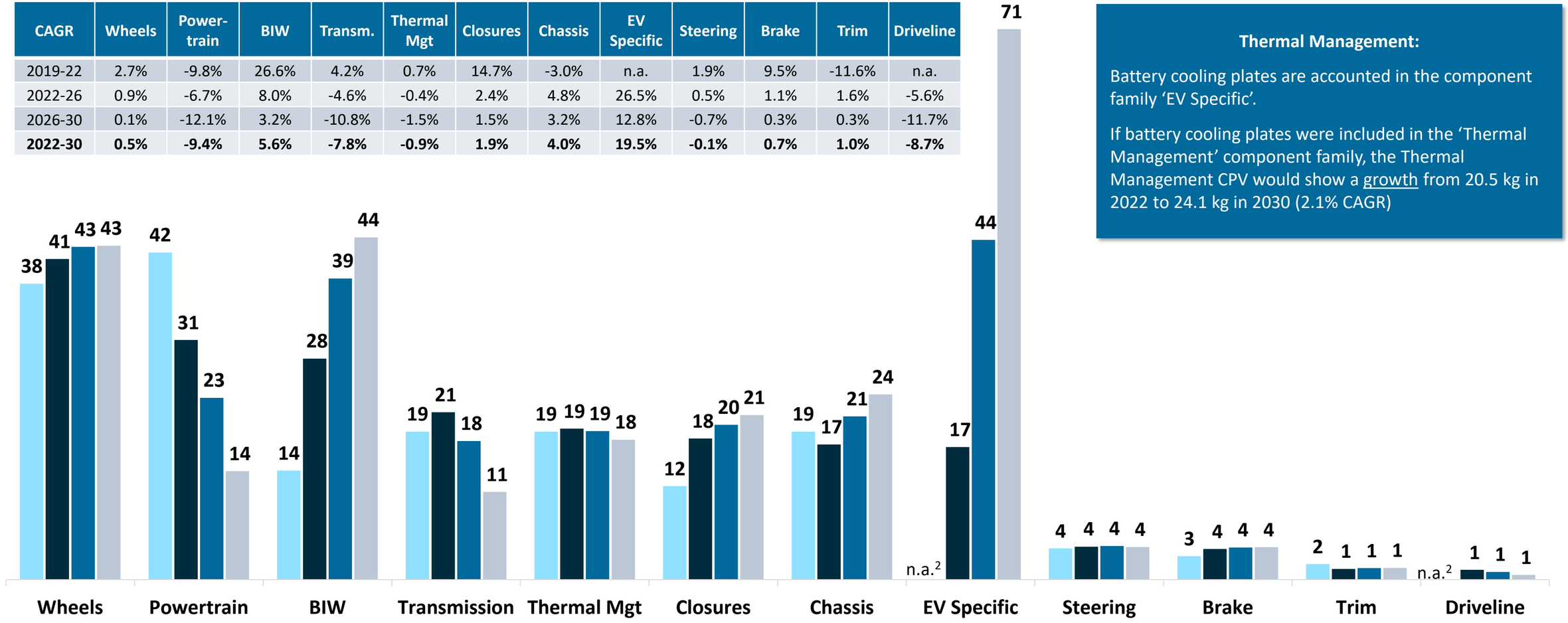
Sources: Ducker; *CPV = Content Per Vehicle / *In the EA 2019 study, E and F segments were combined; *Ducker applied the 2026–2029 CAGR to estimate the 2030 values; *EA study 2019 included second set of OE wheels

The component family ‘EV Specific’ will skyrocket and reach, already by 2026-2027, the CPV level of Wheels, before pursuing its tremendous growth. BIW will also experience steep growth by 2026

DUCKER

Aluminum CPV* by Component Family (kg)

CAGR	Wheels	Power-train	BIW	Transm.	Thermal Mgt	Closures	Chassis	EV Specific	Steering	Brake	Trim	Driveline
2019-22	2.7%	-9.8%	26.6%	4.2%	0.7%	14.7%	-3.0%	n.a.	1.9%	9.5%	-11.6%	n.a.
2022-26	0.9%	-6.7%	8.0%	-4.6%	-0.4%	2.4%	4.8%	26.5%	0.5%	1.1%	1.6%	-5.6%
2026-30	0.1%	-12.1%	3.2%	-10.8%	-1.5%	1.5%	3.2%	12.8%	-0.7%	0.3%	0.3%	-11.7%
2022-30	**0.5%**	**-9.4%**	**5.6%**	**-7.8%**	**-0.9%**	**1.9%**	**4.0%**	**19.5%**	**-0.1%**	**0.7%**	**1.0%**	**-8.7%**



Thermal Management:

Battery cooling plates are accounted in the component family ‘EV Specific’.

If battery cooling plates were included in the ‘Thermal Management’ component family, the Thermal Management CPV would show a growth from 20.5 kg in 2022 to 24.1 kg in 2030 (2.1% CAGR)

Sources: Ducker; *CPV = Content Per Vehicle

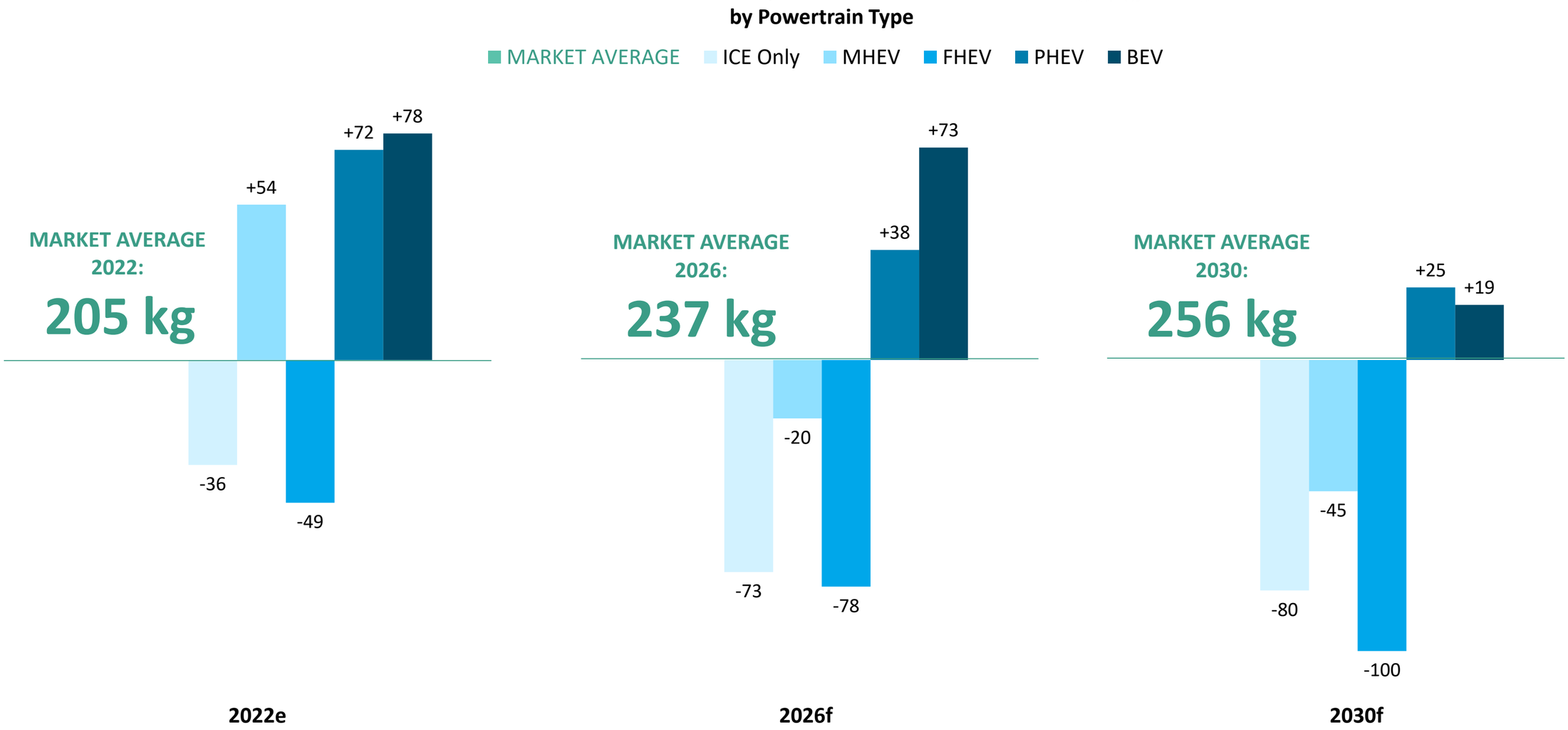
[1] EA study 2019 included the potential second set of OE aluminum wheels; [2] n.a. stands for ‘not available’; in the 2019 EA study the EV-Specific components were only assessed for a sample of 10 BEV models, and ‘Driveline’ is a new component family in the 2022 study

AL Content Addition/Loss by Powertrain Type

While the average aluminum CPV will remain about stable for PHEVs through 2030, it will increase for BEVs by 2026 before going down due to the BEV mix evolving toward smaller and non-premium models. FHEVs have the lowest AL CPV as the model range mainly relates to B and C segments, and to Japanese or Korean OEMs with low AL usage

DUCKER

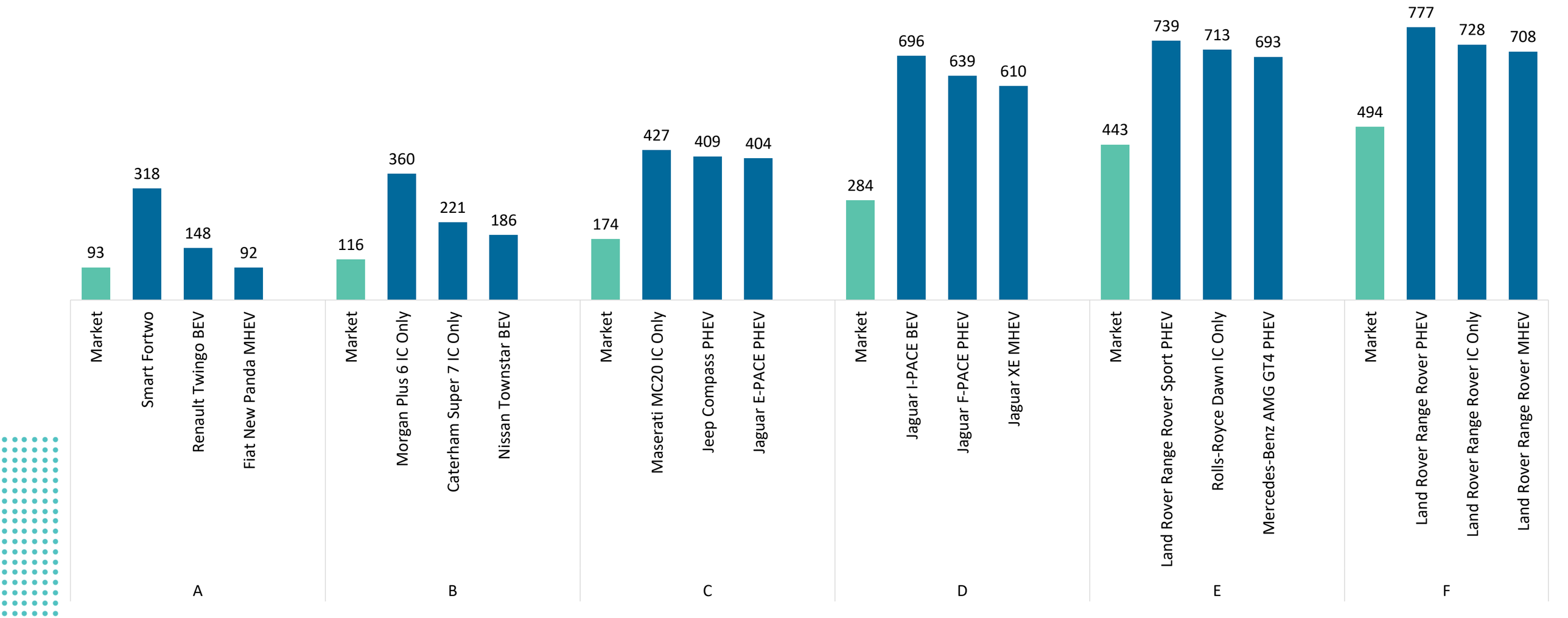
Aluminum Content Addition/Loss compared to Market Average (kg) by Powertrain Type



Sources: Ducker; *CPV = Content Per Vehicle; *Ducker applied the 2026–2029 CAGR to estimate the 2030 values

Beside the Jaguar and Land Rover brands which are particularly aluminum-intensive, volume and new brands appear in the Top 3 model list by size segment

DUCKER



THIS CONCLUDES OUR SUMMARY REPORT.
THANK YOU.

DUCKER

RESEARCH & CONSULTING

DETROIT | PARIS | BERLIN | SHANGHAI | BANGALORE | LONDON | BOSTON

www.ducker.com