

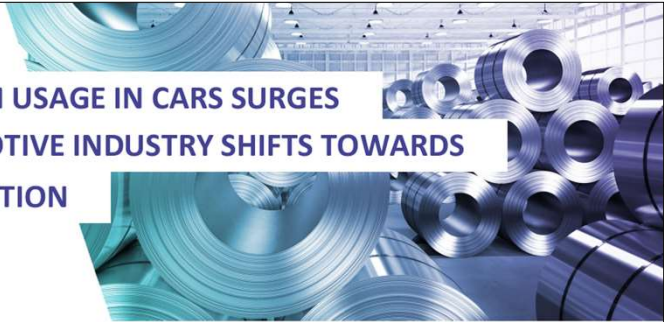


ZINC | international
zinc association

Outlook for Zinc in Galvanized Autosteel (2022-2030)

Martin van Leeuwen, International Zinc Association

Industry Advisory Panel (IAP) Meeting, ILZSG 70th Session
Lisbon, Portugal
9 October 2025



ZINC | international
zinc association

**ALUMINIUM USAGE IN CARS SURGES
AS AUTOMOTIVE INDUSTRY SHIFTS TOWARDS
ELECTRIFICATION**

Brussels, 2 May 2023

Press Release

A recent [study](#) commissioned by [European Aluminium](#) and conducted by [Ducker Carlisle](#) has found that the average amount of aluminium used in European cars has increased by 18% from 174 kg in 2019 to 205 kg in 2022. The study predicts this trend is set to continue, with the average aluminium content projected to increase from 205 kg in 2022 to 237 kg by 2026 (+15.6%) and 256 kg per vehicle by 2030 (+24.9%).



Aluminium is incredibly important to the development of sustainable and energy-efficient transportation solutions. From EV batteries to body construction, this versatile metal plays a critical role in the development of EVs, thanks to its **lightweight, high-strength, and low-cost** properties.

Aluminium Demand

Projections for Electric Vehicle (EV) market revenue

reach USD 79.08 billion by 2030

EV devices is a major factor

for Electric Vehicle (EV) market revenue

gen Research [Follow](#)

Objectives of IZA's study



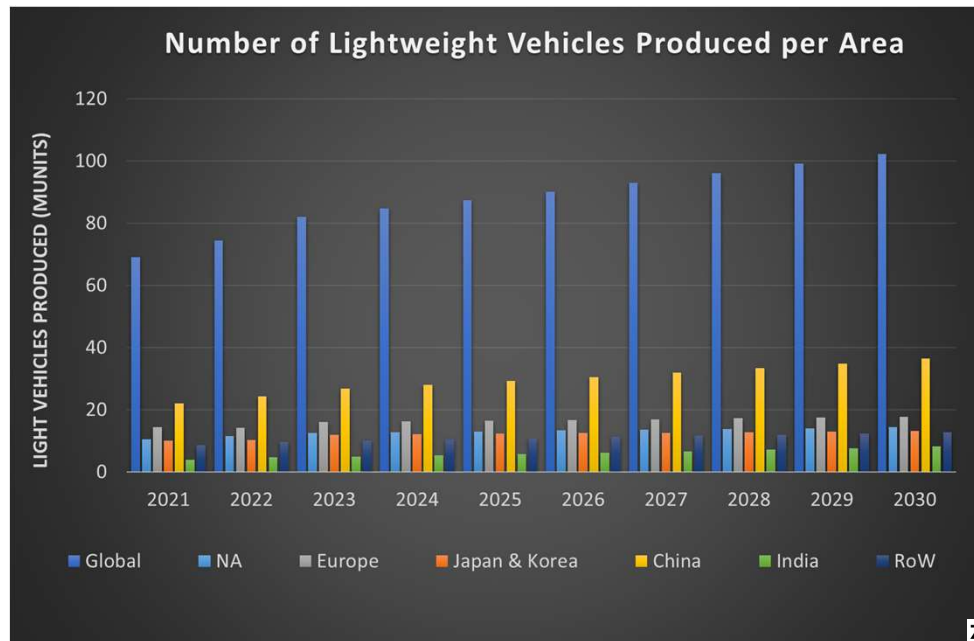
- ✓ To estimate the current and future market for light weight vehicles
- ✓ To distinct between various regions with different growth & transition paths for ICE and xEV vehicles
- ✓ To understand the effect of the ICE to xEV transition for galvanized automotive steel sheet
- ✓ To determine developments in manufacturing technologies for automotive parts for ICEs and xEVs
- ✓ To identify trends in galvanized coating types used in vehicles
- ✓ To calculate the outlook for zinc use for automotive coatings until 2030

Agenda



1. Transition of ICE to xEV
2. General lightweighting and substitution trends
3. xEV market introduction: from expensive premium to economical mass-produced
4. Adoption of galvanized steel in xEV: examples and opportunities (battery frame)
5. Effect of new automotive alloy coatings
6. Adoption of galvanized vs non-galvanized sheet in China and India
7. What does this all mean for galvanized steel and for zinc?
8. Cars have a weight problem; SUV & trucks are fastest growing segments
9. What else can we expect?
10. Key take-aways

Historically, vehicle production followed GDP growth



Transition of ICE to xEV

Figure 1: Global short-term EV share of new passenger vehicle sales by region

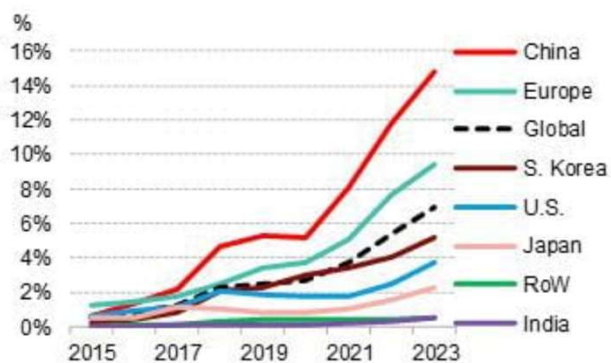
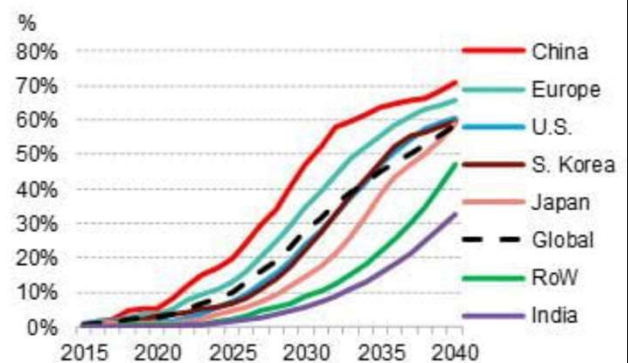
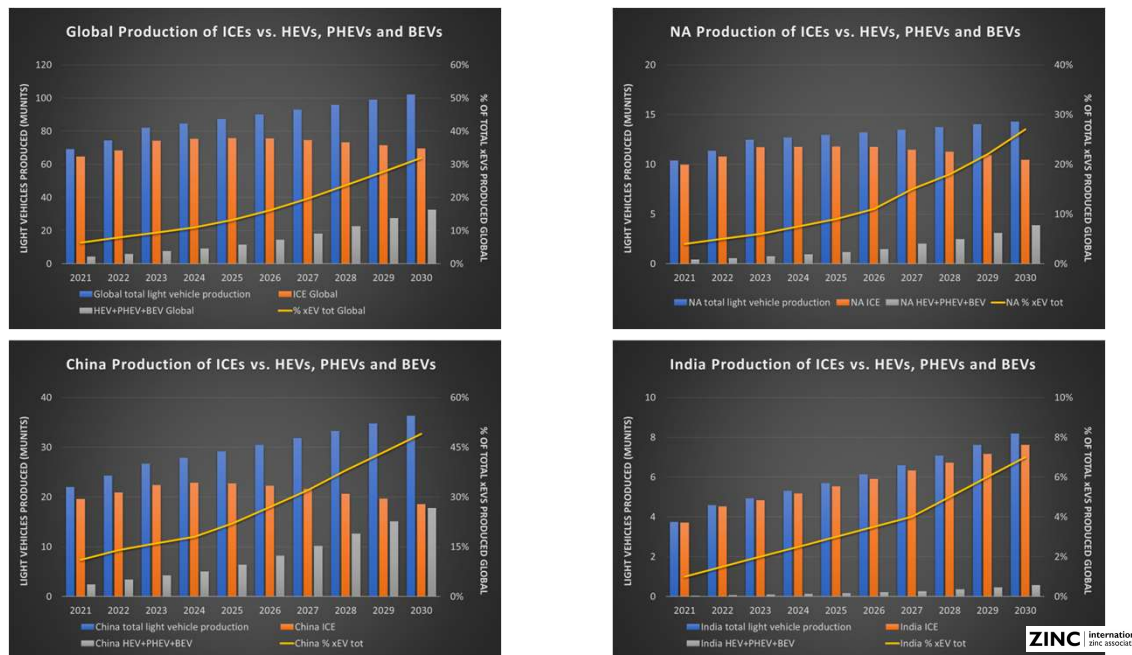


Figure 2: Global long-term EV share of new passenger vehicle sales by region



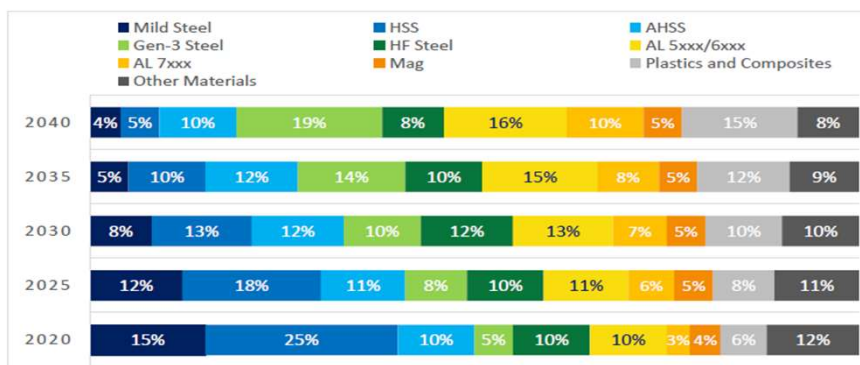
Transition of ICE to xEV



General lightweighting and substitution trends

- ✓ Use of lightweight materials is expected to increase for both ICE and xEV
- ✓ Mild steel & HSS will be substituted by both UHSS/AHSS, PHS and 3rd gen. steels
- ✓ Trade-off between weight savings vs. extra costs

Figure 3: Average Vehicle Structure (Body-in-White and Closures) - Material Percentage by curb weight per vehicle



Other materials include dampeners, static sealers, adhesives, and glass

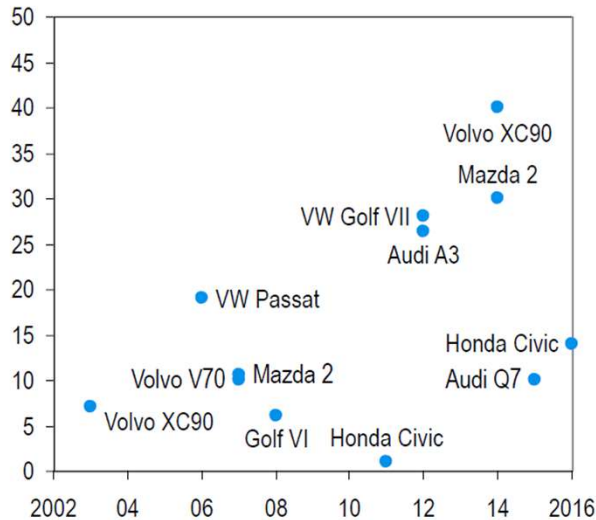
Note: 100% includes Body-in-White and Closures Only. Not included are powertrain/chassis, interiors, windshield, and dynamic sealers

Source: CAR Research

Material use in BIW and closures:
 2020: 65% steel
 2025: 59% steel
 2030: 55% steel

Adoption of PHS in automotive (hot formed)

Share of hot-stamped steel in BIW – Sample vehicles [%]



Source: Roland Berger (2017)

Comments

- > Increasing share of hot-stamped steel in BIW is driven by certain beneficial attributes, including
 - High strength and crash resistance at relatively low cost
 - Low weight due to reduced material thickness
 - Reduced spring-back during manufacturing process (common in cold-forming process)
 - **Best weight savings per additional cost compared to aluminum and plastic composites**
- > Also within specific models: e.g. in the Mazda 2, the current model has an approx. 30% share of hot-stamped steel, beating its predecessor model (approx. 10%) – parts made of hot steel include A-pillar, roof frame, rocker panels

ZINC international zinc association

Lightweighting comes at a cost...

Assessment of lightweight materials

Material	Relative weight	Cost of weight saving [EUR/kg]	Key advantages	Key disadvantages
Traditional steel	100%	None	> Proven material, in use for decades > Good forming capabilities > Good availability	> High specific weight > Large number of process steps required (incl. tooling)
Hot-formed steel	75-85%	low to high	> Very high strength with good formability > Attractive cost-benefit ratio for weight-saving > Variable strength through sophisticated processing (e.g. tailored tempering)	> Higher investment, sourcing and operation costs > Use limited to structural BIW components
Aluminum	50-60%	low to high	> Low specific weight and good formability > Quite high strength when semi-hot or hot-forming (7.000 series)	> Greater technical effort to join with steel parts (rivet piercing vs. spot welding) > More sensitive to surface defects > Lower formability and higher spring back¹
Magnesium	45-55%	low to high	> Lightest specific weight for metals used in automotive applications	> Very effective coating required to avoid magnesium oxidation > Lowest formability
Composite materials	Up to 25%	low to high	> Highest performance to weight > Lower parts count (higher amount of functional integrated parts)	> Bad recyclability > Very expensive > Limited crash performance (no structural integrity)

Further detailed
¹) Compared to steel

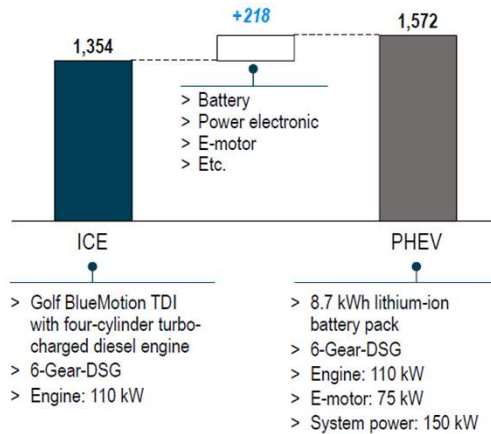
Source: Roland Berger (2017)

ZINC international zinc association

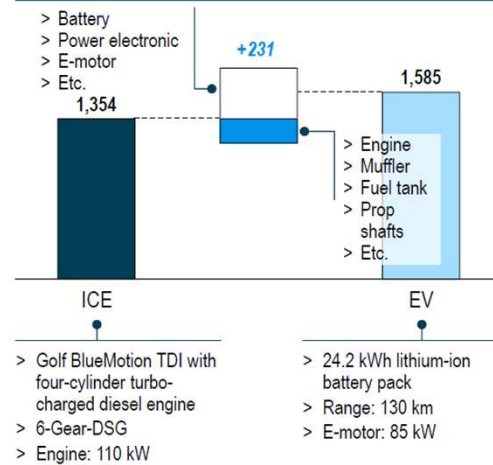
...but is required to compensate for the battery weight

Weight comparison of ICE, PHEV and EV – Example: VW Golf [kg]

Vehicle weight ICE-PHEV



Vehicle weight ICE-EV

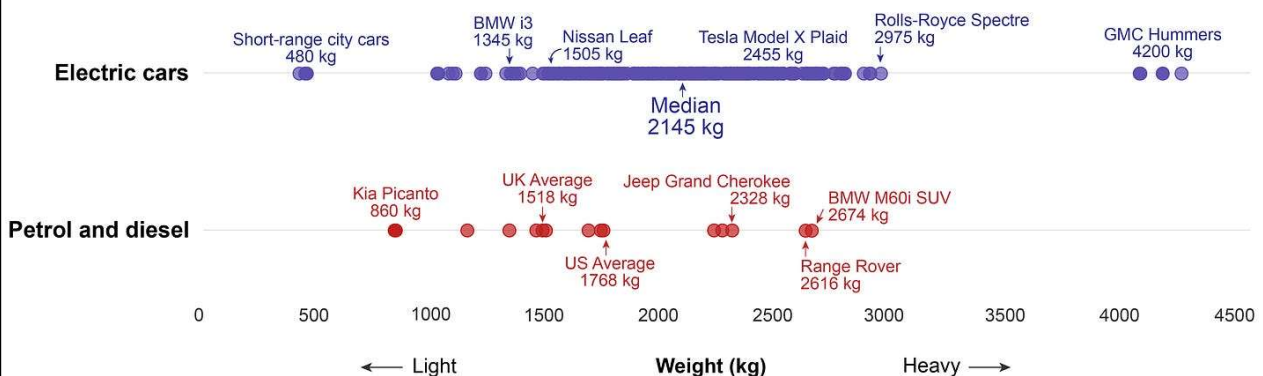


Source: Roland Berger (2017)

ZINC international zinc association

Are electric cars heavier than petrol and diesel cars?

Each blue dot is one model of electric car. In red is the average weight of cars across various countries, plus some of the lightest and heaviest vehicles on the market to show the range.



Note: Weights are given as the curb weight, which includes the weight of the battery, fuel and coolants. It does not include the weight of passengers or cargo.

Data sources: My EV Review; International Energy Agency (IEA); and industry market data.

Source: <https://www.sustainabilitybynumbers.com/p/weighty-issue-of-electric-cars>

ZINC international zinc association

xEV market introduction: from expensive premium models to economical mass-market models

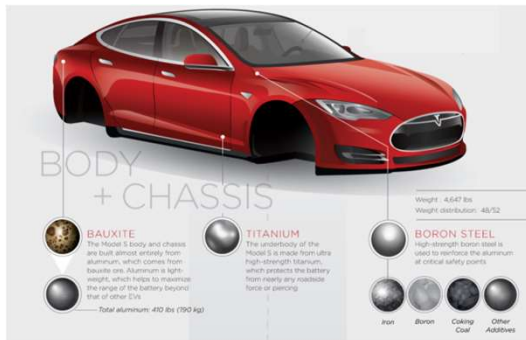
2016 Tesla Model S

End User News - Automobiles (Cars)

Tesla Model S electric car packs in 410 lbs aluminium

06 Mar 2016, AL Circle, 

The Tesla Model S body and chassis are built almost entirely from aluminium, which comes from bauxite ore. Aluminium is lightweight, which helps to maximize the range of the battery beyond that of other EVs. The total amount of aluminium used in the car is 410 lbs (190 kg).



2018 Tesla Model 3

Tesla Model 3: here's the alloy mix of the Model 3 body

 Fred Lambert | Aug 22 2017 - 4:02 pm PT |  0 Comments

With the Model 3, Tesla is moving away from the mostly aluminum chassis that it designed for Model S and Model X with some high-grade steel reinforcements.



ZINC international
zinc association

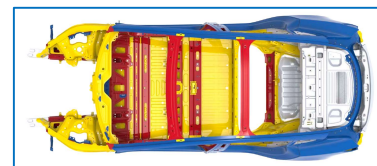
Galvanized steel: stronger, safer and lower costs

Tesla Model 3 in more detail

The Tesla Model 3 is primarily constructed from high-strength steel, with some aluminum components, while the Model S uses a predominantly aluminum structure. This choice is influenced by several factors:

1. **Cost:** Steel is generally **less expensive than aluminum**, which helps keep production costs lower for the Model 3, aimed at a more affordable market segment.
2. **Manufacturing Complexity:** Aluminum requires different manufacturing processes, which can complicate assembly. Using high-strength steel allows Tesla to **streamline production and maintain efficiency**.
3. **Weight Considerations:** Although aluminum is lighter, the high-strength steel used in the Model 3 is designed to be strong and safe. The weight difference is mitigated by the Model 3's **compact design and battery placement**.
4. **Market Positioning:** The Model 3 is positioned as a **more affordable, mass-market vehicle**, while the Model S is a premium offering. The materials used reflect their **target audiences and price points**.
5. **Structural Integrity:** The choice of materials also depends on safety and performance requirements. The steel structure of the Model 3 has been designed to **meet safety standards** while providing a good balance of weight and rigidity.

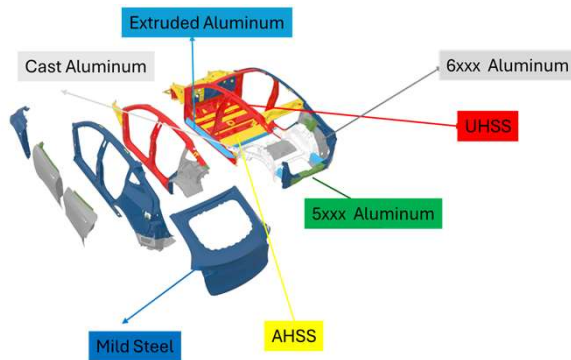
The grey-colored sections are aluminum. The rest are different grades of steel.



ZINC international
zinc association

Galvanized steel: stronger, safer and lower costs

2025 Tesla Model Y



Body structure is composed mainly of Steel to allow repair operations

No Front Casting

Tesla has gone back to building a common body across the globe, increasing part interchangeability and reducing supply chain complexity across the four factories that produce the Model Y

[Body Structure Materials and Allowed Operations](#)

[Tesla Eliminates Front Casting on New Model Y; Improves Rear Casting](#) (March 2025)

Source: Tesla website

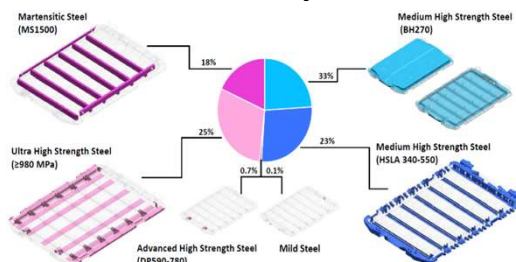
ZINC | international zinc association

Galvanized steel: stronger, safer and lower costs

2024 Chevrolet Blazer EV Body Structure

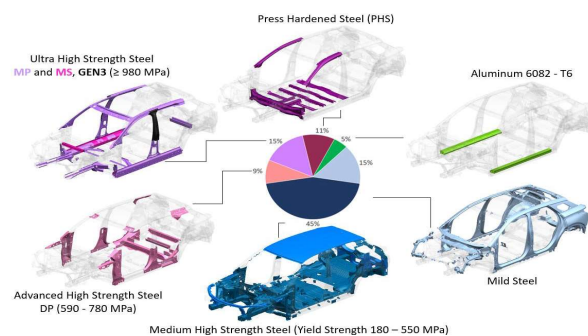


Steel in Battery Rack



Source: GDIS (2024)

Steel in BIW



Weight of steel per vehicle: ~900 kg

- BIW + battery rack
- AHSS, UHSS, PHS and gen.3 steel

Zn used per vehicle in coated sheet ~ 13.5 - 14 kg

ZINC | international zinc association

Galvanized steel: stronger, safer and lower costs

2025 BYD SEAL U



High-strength body and battery Pack

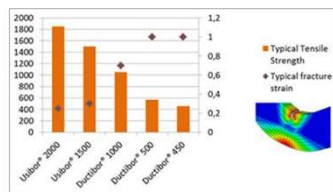
Key components are all made of high-strength steel with a tensile strength exceeding 1180MPa to ensure that, after a collision, there is space for the passenger compartment and improved passive safety



ZINC | international
zinc association

Automotive coating developments

From AlSi coatings for PHS....
(ArcelorMittal, late 1990s)



ArcelorMittal

Usibor®
Ductibor®



No cathodic protection

Source: ArcelorMittal, voestalpine

...to Zn coatings for PHS
(voestalpine, 2023)

voestalpine

ONE STEP AHEAD.



phs-scalefree®
THE FIRST HOT FORMING STEEL UP TO 2000 MPa
WITH A THIN ZINC COATING

Cathodic protection

ZINC | international
zinc association

Automotive coating developments

AUTOMOTIVE

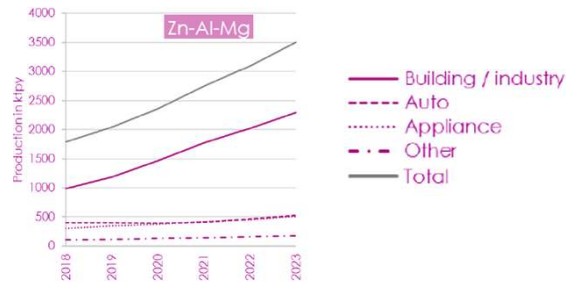
- Bare: Al 1-3% - Mg 1-2%

Requirements (at least as good as GI)

- Corrosion protection
- Global stamping, welding, bonding, painting process compatibility
- Surface quality for exposed part
- Cost saving

Typical applications

- Exposed surface



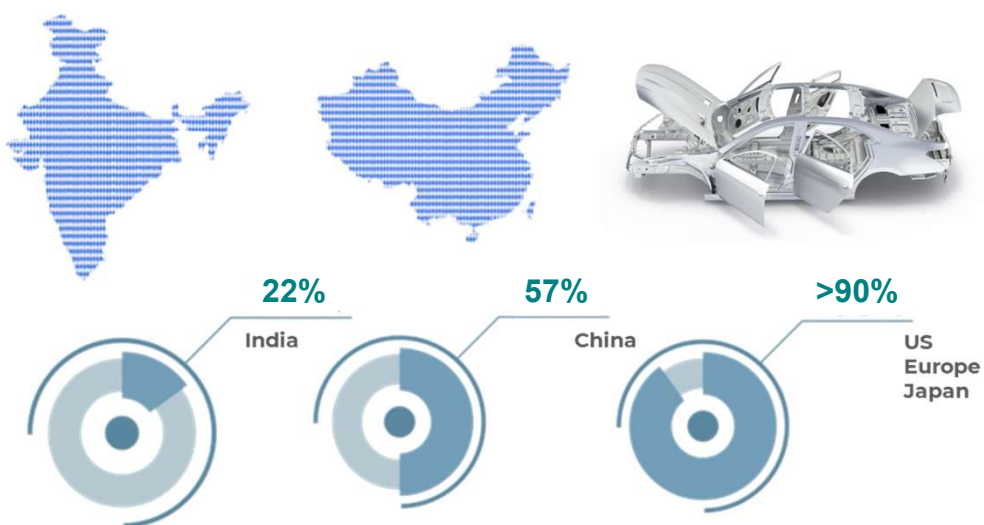
- ✓ 500ktpy ZM coated automotive steel is 1.3% of total zinc coated automotive steel production
- ✓ Coating weight of Zn-Al-Mg automotive coatings are typically 30-40% lower than pure zinc (GI or GA)
- ✓ A ZnAl1.5%Mg1.5% coating has 3% less zinc



Source: Fives (2024)

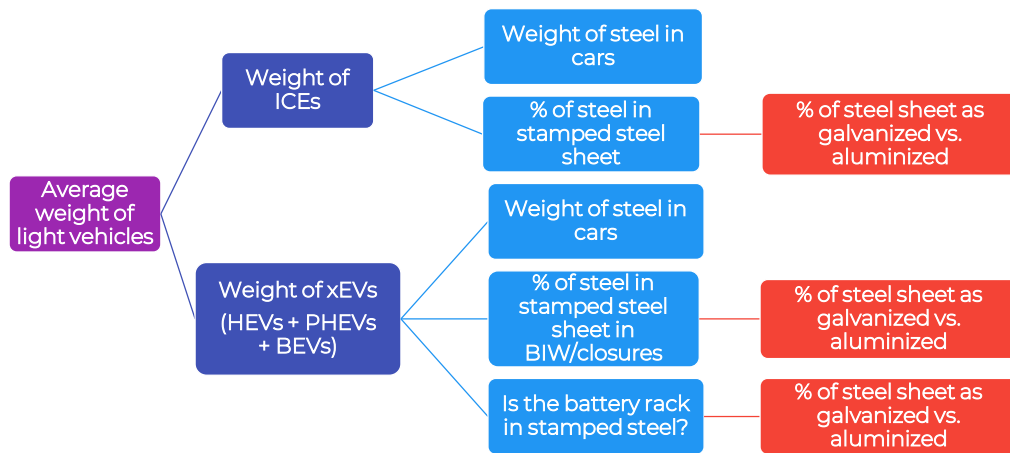
ZINC international zinc association

Adoption of galvanized automotive steel in China and India

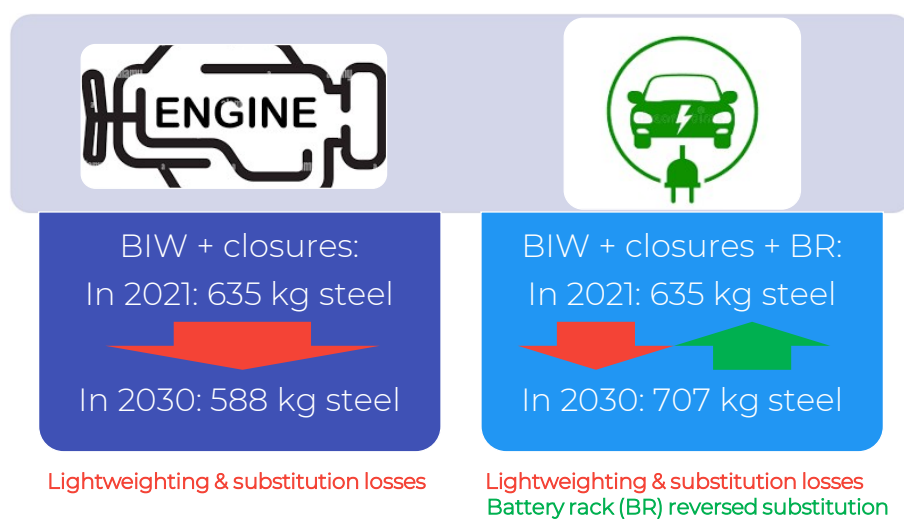


ZINC international zinc association

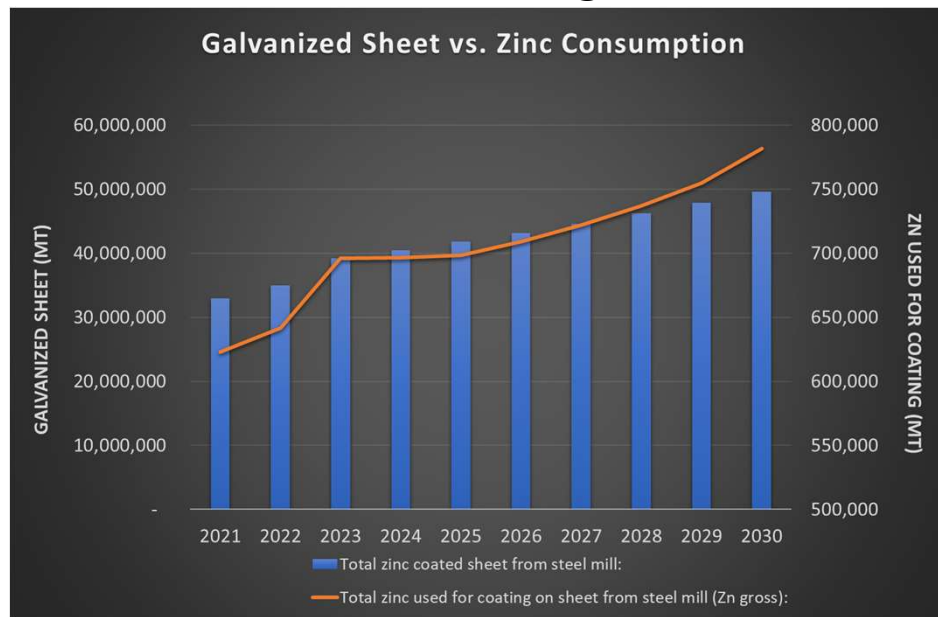
IZA's model assumptions – material choices



IZA's model assumptions – steel intensity

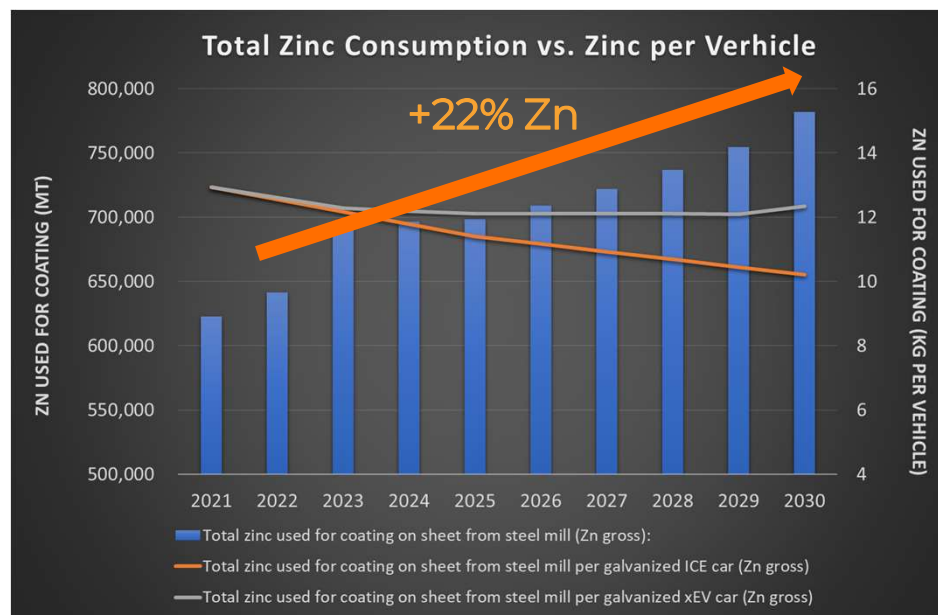


What does this all mean for galvanized steel?



ZINC international zinc association

What does this all mean for zinc?



ZINC international zinc association

ZINC international zinc association

Zinc in the Automotive Sector: Driving Demand Through Value

Zinc plays an important role in the automotive industry, with a forecast for a **22% increase** — approximately 140,000 tonnes — in demand by 2030. In its role in galvanizing steel, zinc protects against corrosion and ensures long-lasting structural integrity.



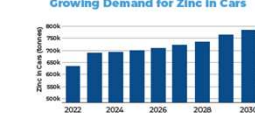
Zinc + Steel Advantages:

- Stronger
- Safer
- Easily Formable
- Sustainable & Recyclable
- Less Expensive

Zinc in Your Car (average 16 kg zinc per car)

What is sparking zinc's 22% growth? More people are buying cars, especially in Asia, where more car manufacturers are adopting galvanized steel.

Growing Demand for Zinc In Cars



Graph Source: IAH, OECD, Reuters, and the World Bank

The Story In China

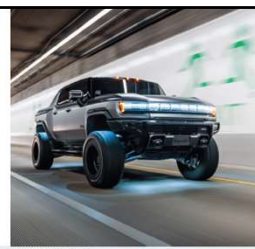
- Largest car manufacturer in the world
- More consumers buying first cars
- 57% of automotive market galvanized and growing versus global average of 50%

The Story In India

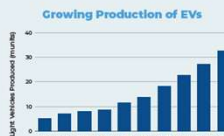
- Third largest car manufacturer in the world
- More consumers buying first cars
- 22% of automotive market galvanized and growing versus global average of 50%
- Largest manufacturer Maruti Suzuki committed to galvanized steel in all 2024 cars

Bigger is Better for Zinc

Cars are getting larger every year, and that means more zinc is being used to protect the steel in these cars. The SUV segment is the fastest growing segment in many regions. According to the U.S. Environmental Protection Agency and the VIAS Institute in Belgium, cars in the U.S. and Europe have increased between 11 and 30% respectively over 20 years. As car manufacturers turn to thinner, lighter high-strength steel grades, zinc's protective function becomes even more critical.



Growing Production of EVs

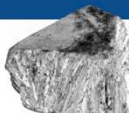


Graph Source: IAH, OECD, Reuters, and the World Bank

Zinc: Charging up the EV Supply Chain

With the development of lightweight Advanced High-Strength Steel and 3rd generation Ultra High-Strength Steel, more EV manufacturers are substituting aluminum with less expensive, stronger, and lighter steel to provide enhanced safety performance, greater fuel efficiency, and reduced emissions. Virtually all automakers have adopted galvanized steel for their high-volume EV models. With zinc in both the body and battery rack of EVs, annual demand for zinc in EVs will more than quadruple from 2022 to 2030, from 63,500 to 304,000 tonnes.

The growing car sales and use of galvanized steel across Asia, the trend in larger vehicles, and the expansion of galvanized steel in electric vehicles have catalyzed a 22% increase in zinc demand by 2030 amounting to 140,000 additional tonnes. Learn more about zinc's value proposition here: www.zinc.org



ZINC international zinc association

FOR MORE INFORMATION:
Email: info@zinc.org
Website: www.zinc.org

Copyright © 2024, International Zinc Association. All rights reserved.

Rust never sleeps...

BUSINESS NEWS AUSTRALIA

Australia Sydney Melbourne Brisbane Perth Adelaide Gold Coast Young Entrepreneur

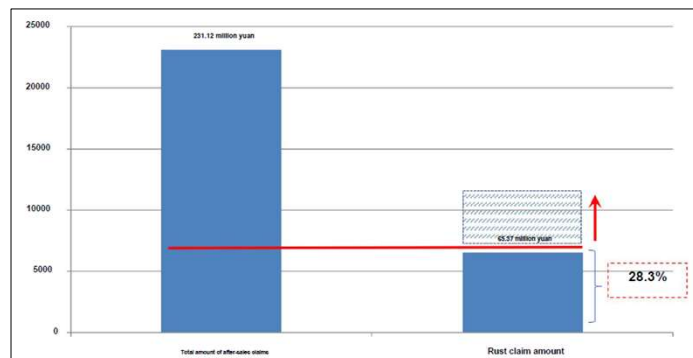
LDV faces ACCC allegations that its 'durable' utes and vans were prone to rusting

By Business News Australia 23 April 2025



Photo: LDV, via Facebook.

The consumer watchdog is suing Australasia's largest independent automotive distributor, Ateco Automotive, over allegations that LDV-branded vehicles it had promoted as tough and durable had a propensity to rust or corrode within five years of manufacture.

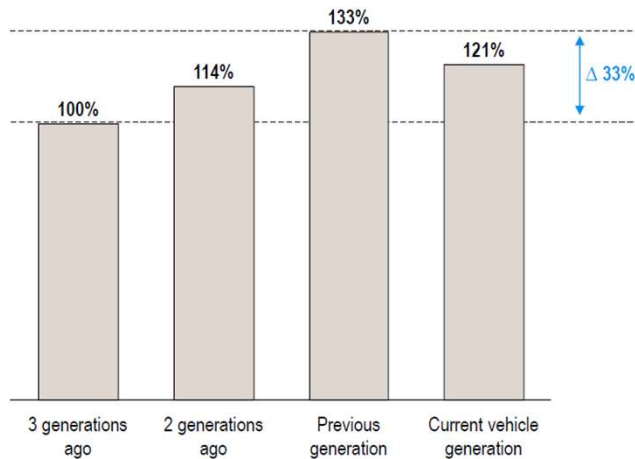


Common Corrosion Issues in Chinese Brand X:
"In 2010, the automaker's first three-box sedan suffered frequent complaints of corrosion after sales due to insufficient early design experience. Statistics of after-sales data from 2010 to 2017, a total of 570,000 vehicles were sold. The amount of claims due to rust in the domestic after-sales market alone was 65.37 million yuan for 114,680 vehicles, accounting for 28.3% of the total after-sales costs." (~US\$100 per vehicle)

Source: China Auto Lightweight (Jiangsu) Automotive Technology Co., Ltd. (2025)

Cars have a weight problem...

Average curb¹⁾ weight development in Europe [mid sized volume vehicle – Indexed]



Comments

- > Major drivers of additional weight in previous vehicle generations in the past
 - Stricter crash regulations
 - Increased safety features (e.g. ABS, ESP, higher brake performance)
 - Increased number of functions and convenience features (e.g. HVAC modules, electric window lifters, NVH dampening)
 - Increased vehicle dimensions
- > Current tendency to reduce weight driven by various trends
 - Engine downsizing
 - Increased use of lightweight materials
 - Weight optimization-oriented vehicle design

1) Curb analysis based on following vehicles: Golf (Volkswagen); Astra (General Motors); 308, 306, 309 II (PSA); Megane (Renault/Nissan); Clio (Renault/Nissan)

Source: Roland Berger (2017)

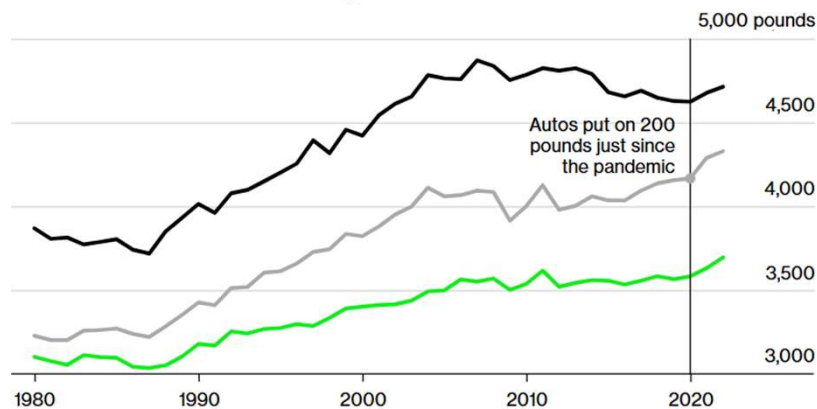
ZINC | international zinc association

...and the SUV & truck segments are the fastest growing markets, not only in America

American Cars Have a Weight Problem

The average vehicle weight is looking more and more like a truck

✓ Cars / Trucks / Total fleet average



Source: Bloomberg (2023)

ZINC | international zinc association

What else?

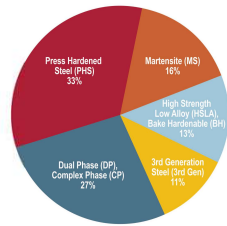


✓ Mobility-as-a-Service (MaaS):

- ✓ Increased car utilization
- ✓ Higher mileage?
- ✓ Lifetime? **Corrosion impact?**

✓ Autonomous Driving:

- ✓ Less human intervention
- ✓ Increased safety systems
- ✓ New safety concepts? **Design impact?**



Source & picture credits: Steel E-Motive (WorldAutoSteel)

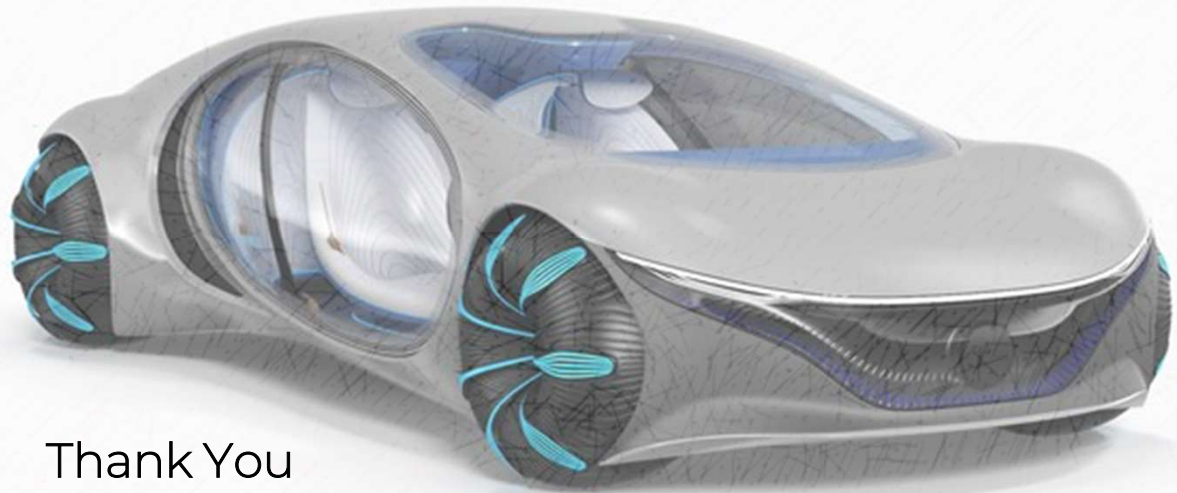
ZINC international
zinc association

6 key take-aways to take home

1. Large regional variations in adoption and growth of xEV vehicles
2. Lightweighting of vehicles results in substitution of mild sheet & HSS into UHSS/AHSS, PHS and 3rd gen. steels, but also in non-steel lightweight materials
3. xEV segment adopts galvanized steel as a strong and cost-effective material for BIW, in particular for affordable, mass-market vehicles
4. Battery racks in xEVs are a large development potential for galvanized steel sheet (reversed substitution)
5. Strong growth in adoption of galvanized steel sheet, replacing non-galvanized steel sheet, in China and India
6. Zinc remains to play an important role in the automotive industry, and IZA forecasts a 22% increase — approx. 140,000 tonnes — in demand by 2030



ZINC international
zinc association



Thank You
mvanleeuwen@zinc.org