



ArcelorMittal

ArcelorMittal Multi Part Integration®



White paper

The power of less

ArcelorMittal Automotive

By Jérôme Favero, head of automotive steel solutions,
Global R&D

MPI: addressing the complex automotive context

Electrification is a revolutionary change in road transport with new car design and newcomers in the automotive industry. As the global leader in automotive steel technology, ArcelorMittal is dedicated to helping car manufacturers tackle new challenges with innovative materials and solutions. Jérôme Favero, head of automotive steel solutions at ArcelorMittal Global R&D explains how ArcelorMittal Multi Part Integration® (MPI), aims to simplify operations, maintain high flexibility, and ensure lightweighting and crash performance while reducing the CO₂ footprint.

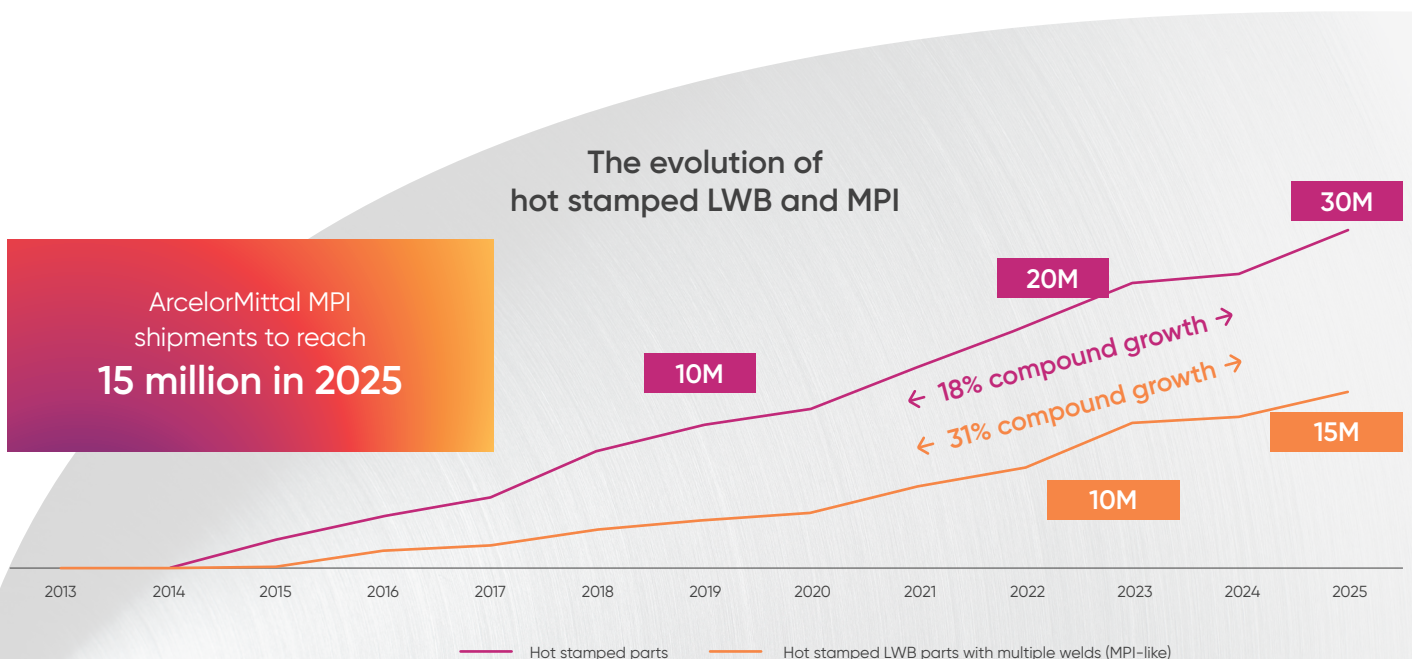
Governments and cities have introduced regulations and incentives to accelerate the shift to sustainable mobility, prompting carmakers to develop and produce Battery Electric Vehicles (BEVs). This shift in technology has lowered the barriers for new entrants, making it easier to bridge the technological gap compared to internal combustion engines (ICEs).

As a result, market requirements are increasingly shifting from ICE to alternative drive systems and BEVs.

Established OEMs are therefore having to balance the need to produce ICEs and BEVs, resulting in a range of modular platforms for mixed powertrains and dedicated BEV platforms. In the context of these transformational changes to vehicle architecture, embracing flexibility has become a strategic imperative for all carmakers.

Currently, the automotive industry is focused on several key drivers, including cost, time to market, sustainability, flexibility, and safety. These drivers are central to the value proposition of ArcelorMittal Multi Part Integration®. Our solutions enable automotive manufacturers to adapt with fewer parts, streamlined processes, reduced space, and lower material needs, all while delivering best-in-class structural performance.

ArcelorMittal Multi Part Integration® is already proving to be a winning solution, with 15 million blanks forecast to be delivered by 2025.



Pillar one

Smart simplification for OEMs

ArcelorMittal Multi Part Integration® simplifies automotive manufacturing, saving costs and time while boosting efficiency.

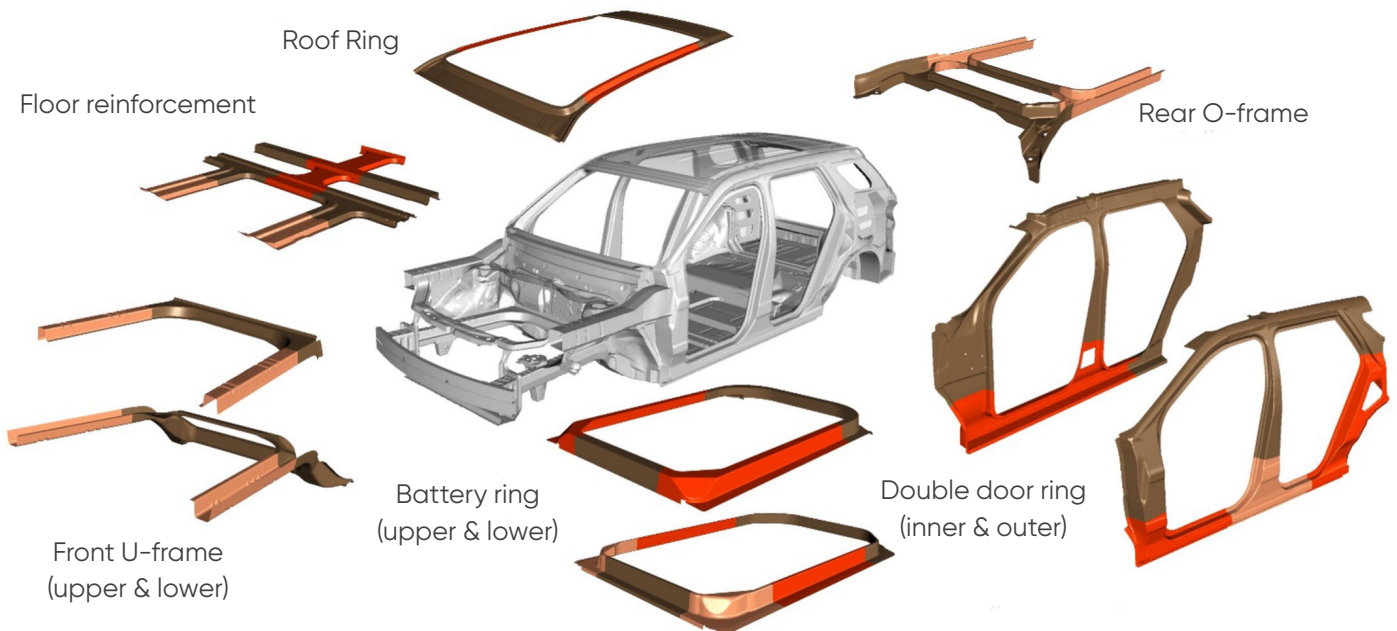
ArcelorMittal Multi Part Integration® is a versatile solution that can be tailored to meet the dynamic requirements of OEMs, providing simplification and efficiency benefits in cost, space, and time by reducing the number of parts and processes in assembly.

For over a decade, we have recognised part consolidation as an effective strategy. Our initial success came with the Door ring, which was first introduced in North America in the early 2010s. Since then, we have consistently refined the Door ring concept, enhancing

its performance with new materials and innovative approaches.

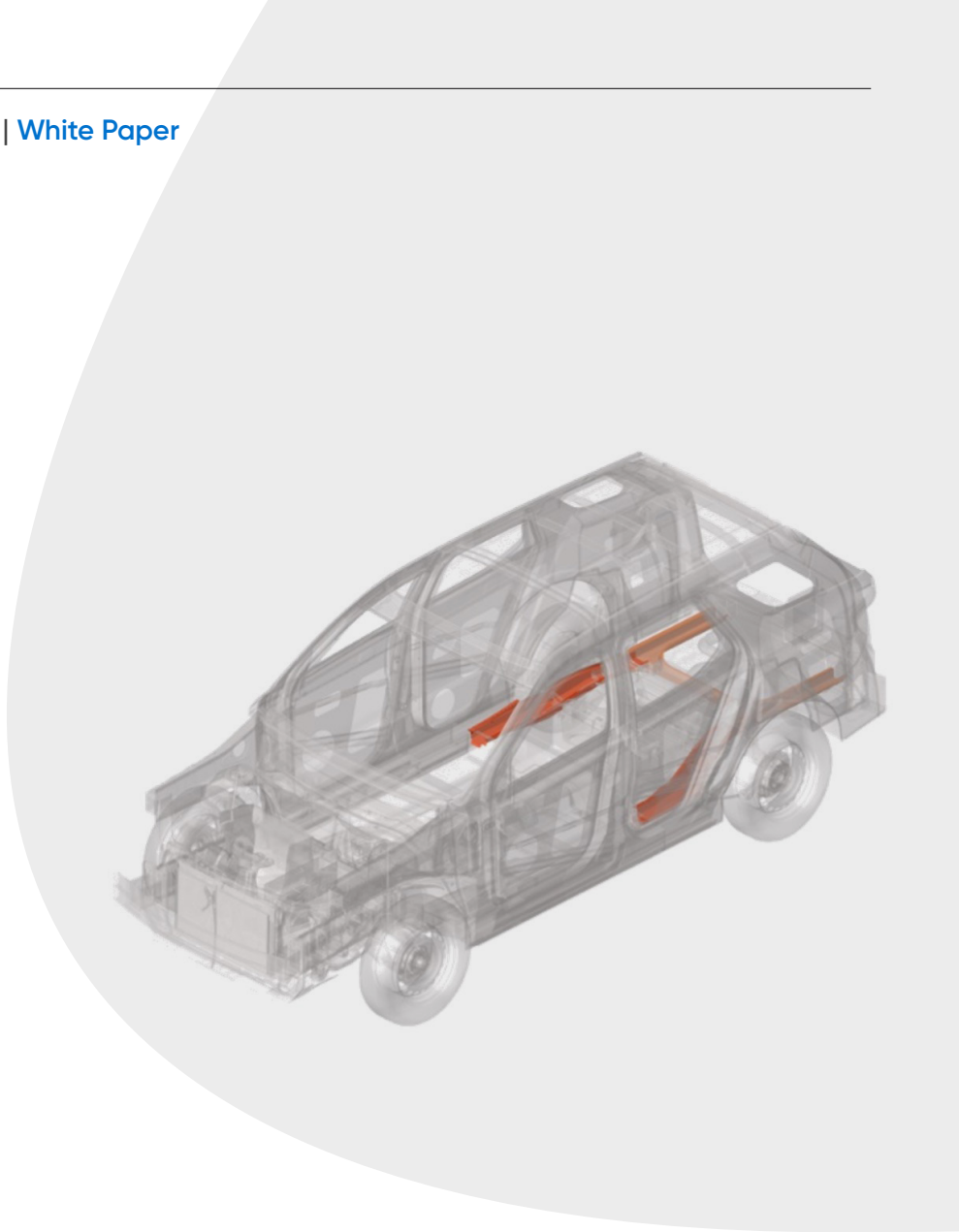
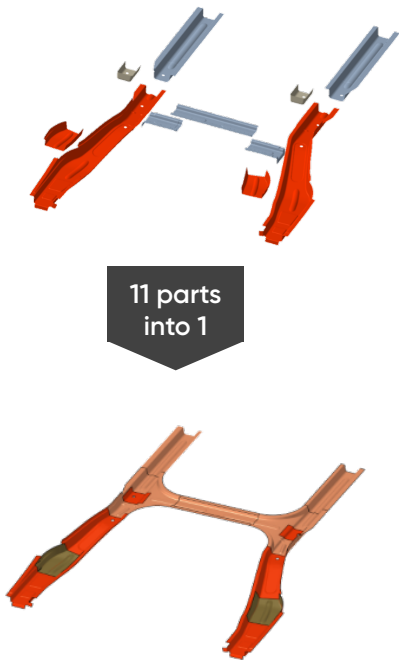
Recently, we have expanded the concept of part consolidation, and the portfolio of ArcelorMittal Multi Part Integration® solutions continues to grow. Within the ArcelorMittal group, we have various initiatives focused on local design constraints and specificities. We have developed an ArcelorMittal Multi Part Integration® solution for nearly all modules of a body-in-white (BIW). Our catalogue now features numerous solutions, each offering varying levels of innovation—both incremental and breakthrough—in architecture to address diverse design strategies.

Typical MPI applications



Numerous MPI applications are available and can be tailored to customer requirements.

Focus on part level



The H-frame is a prime example of how MPI transforms the manufacturing process through simplification.

The H-frame concept, invented by ArcelorMittal in 2020, consolidates 11 parts into a single component in the rear underbody of a body-in-white (BIW). Analysis of assembly plants indicates that this solution can lead to a 29% reduction in capital expenditure and a 40% decrease in number of operators in this area. This is

achieved through a substantial reduction in complexity and the number of operations. Within the defined scope, 136 spot welds are eliminated while maintaining the same performance and crash management properties of the part. As a result of this integration, both the number of operations and the required robots are significantly reduced.



40% saved
Operators

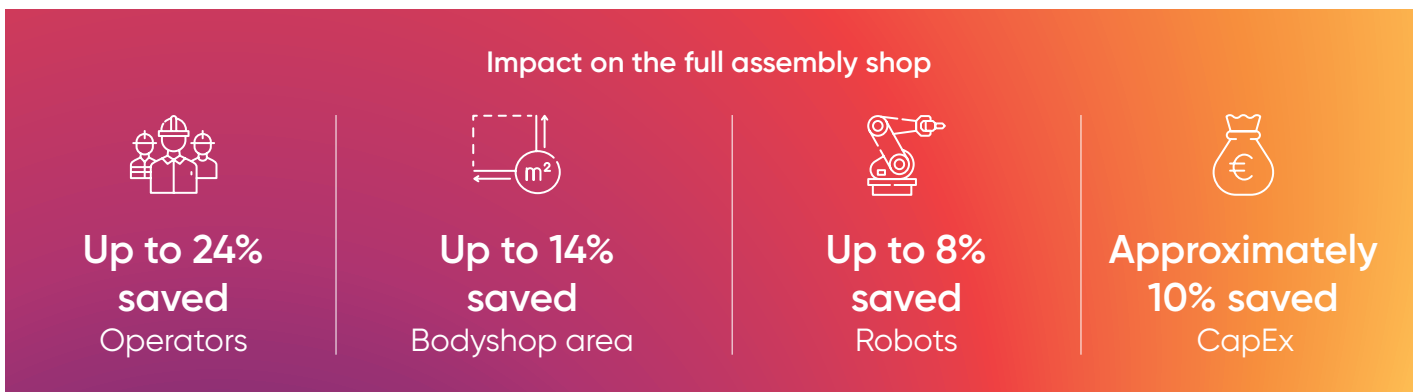
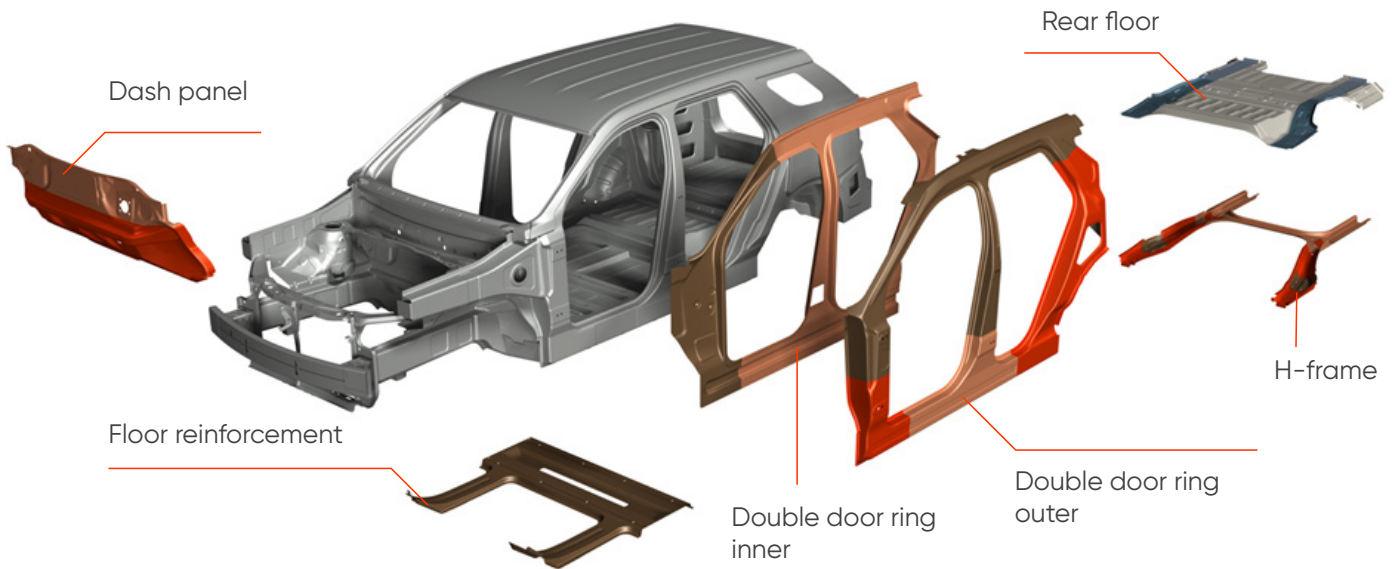


44% saved
Bodyshop area



29% saved
CapEx

H-frame application provides interesting simplification potential.



The higher the amount of MPI, the more savings are achieved at the assembly plants.

We tested the integration of multiple MPI solutions and observed significant gains.

We conducted a holistic analysis involving independent and experienced engineering consulting firms specialised in automotive production and assembly line setup. This study demonstrates that the accumulation of MPI maximises gains; within the scope of six MPIs covering the full body-in-white (BIW), we achieved a 75% reduction in part count and a 24% reduction in the number of operators at the assembly plant level.

The six MPIs analysed included the H-frame, Rear floor, Double door ring (inner & outer), Dash panel and Floor reinforcement. Our partners designed the assembly shop and sequences, leading to a reduction of 567 spot welds, approximately 10% of the total welds in a BIW. This change allows for a 14% reduction in assembly floor size and a 10% decrease in capital expenditure.

While the approach remains generic, it provides a robust analysis applicable across different assembly lines, confirming similar results whether using a pre-assembled body side or sequential body side assembly.

Greenfield and brownfield assembly advantages

ArcelorMittal Multi Part Integration® provides gains for both new greenfield assembly operations and existing brownfield assembly operations.

In a greenfield setup, the full potential for savings is readily achievable. However, in brownfield scenarios, the benefits are more gradual and full benefits are realized as MPI is applied to all vehicles produced on a shared assembly line.

Our simulations involving the Double door ring demonstrates that MPI smoothly integrates into the assembly sequence, where traditionally designed components would need to be assembled individually.

It shows that the introduction of new MPIs does not inherently burden the production process, as it bypasses the traditional step-by-step assembly of individual body side components. This approach effectively creates a shortcut in the assembly line, allowing the double door ring to pass through as a single unit. Once all models on the production line adopt MPI, unnecessary intermediate steps can be eliminated, enabling a more efficient use of robotics in other areas.

Focus on chassis

ArcelorMittal Multi Part Integration® goes beyond the body-in-white (BIW) to encompass chassis applications, pushing lightweighting to new limits.

The applications of ArcelorMittal Multi Part Integration® (MPI) extend beyond the structural components of the body-in-white (BIW) to include chassis applications. This approach is particularly advantageous, as MPI not only simplifies the manufacturing process but also offers a cost-effective solution for further lightweighting the chassis.

Standard chassis components are typically assembled using Metal Active Gas (MAG) technology, which is among the more expensive methods in the automotive sector. Transitioning to laser welding with MPI presents a compelling alternative. Additionally, MPI enhances lightweighting potential by eliminating part-by-part assembly overlaps, which often impose limitations on in-use properties.



ArcelorMittal Multi Part Integration® applications for chassis not only streamline production through simplification but also offer significant technical advantages in design.

Pillar two

Unlocking flexible manufacturing

ArcelorMittal Multi Part Integration® offers compatibility with multiple OEM platforms and all Press Hardenable Steel (PHS) grades and thicknesses, enabling versatile and flexible manufacturing. This adaptability allows OEMs to seamlessly integrate solutions across various vehicle types while efficiently utilising both existing and new manufacturing lines.

ArcelorMittal Multi Part Integration® is a versatile manufacturing solution that enhances flexibility within the part integration concept.

ArcelorMittal Multi Part Integration® offers significant simplification potential while maintaining exceptional flexibility. Its design can be tailored and finetuned, and the forming process is compatible with existing facilities, allowing for quick tool changes and production adjustments. This flexibility is crucial, especially given the challenges in forecasting EV sales.

There is an increasing gap between regulatory expectations and market evolution, compounded by uncertainties surrounding the development of efficient charging infrastructure. Additionally, competitive technologies like hybrids may gain traction in the coming years. Car manufacturers must remain agile,

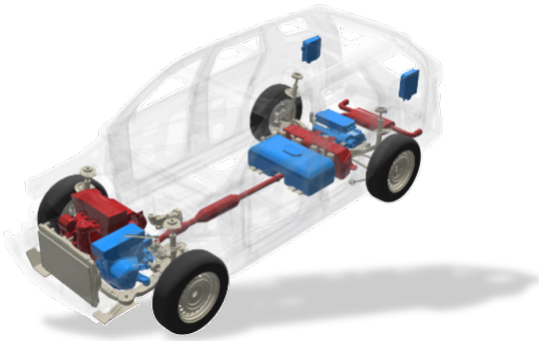
adapting their production dynamically to balance the output of different powertrain technologies without compromising part performance.

The H-frame serves as an exemplary business case showcasing the design and production flexibility we offer. We have developed this concept with variations compatible with both PHEV and BEV models, while maintaining a high level of weight optimisation in both cases. The size of the blank and, consequently, the hot stamping process remain similar, although differences in material and thickness combinations may occur.

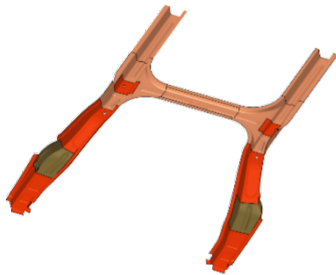
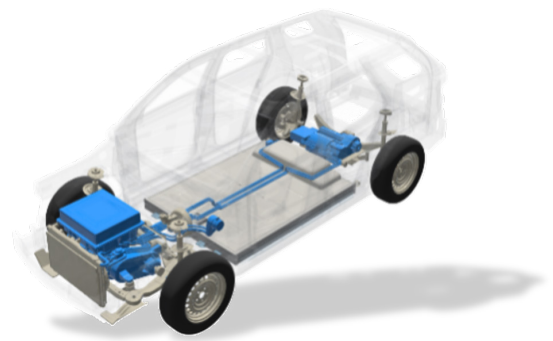
Due to these similarities, both solutions can operate interchangeably on the same production line. If the volume of one vehicle needs to increase significantly at the expense of another, this transition can be made seamlessly with Multi Part Integrations (MPIs). Since the technology remains consistent, there's no need to switch production routes on the press shop floor or assembly line. Only the press hardening tool needs to be changed, a straightforward operation that can be completed in minutes compared to other technologies that rely on much larger, heavier, and more expensive tools.



PHEV Vehicle

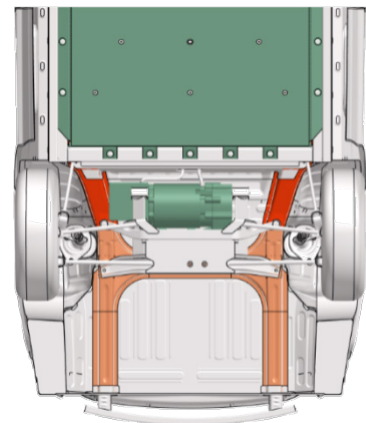
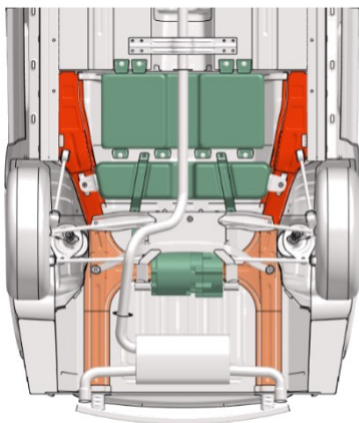


BEV Vehicle



Commonality of the solutions:
similar part shapes and
material distribution

Only the patches in the front
are specific



Flexibility is a key asset of ArcelorMittal Multi Part Integration®.

Unparalleled flexibility in design

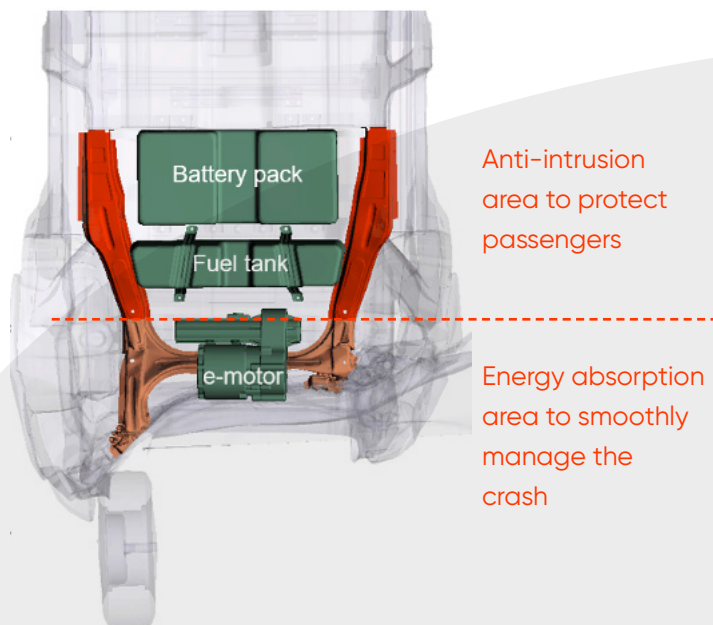
With ArcelorMittal Multi Part Integration®, lightweighting is achieved without compromise, thanks to Laser Welded Blanks technology.

A notable technical feature of Multi Part Integration (MPI) is its ability to maintain optimal weight performance without compromising on design simplicity through part integration. This is made possible by the compatibility of Laser Welded Blanks technology with all Press Hardenable Steel grades in the ArcelorMittal portfolio: Usibor® 1500 and Usibor® 2000 for anti-intrusion performance, and Ductibor® 1000 for energy absorption areas within the structure.

The extensive manufacturing possibilities are enabled by the proprietary Combibeam™ process portfolio. These processes ensure a good crash behaviour under all conditions of the vehicle. The Combibeam™ process portfolio embeds the best processes issued from 15+

years experience, which were validated using the toughest automotive standards and an ArcelorMittal specific test, which is the most efficient way to ensure a robust crash worthiness whatever the weather and speed conditions. On top of final product performances, Combibeam™ offers also a wide process window to the part maker, to ensure a robust production.

This high compatibility with the entire ArcelorMittal portfolio offers unparalleled flexibility in design, as all crash management strategies are represented in our range of Press Hardenable Steels. It is indeed possible to apply the principle of the right material in the right place on MPI, achieving finely tuned part behaviour without any compromises due to manufacturing or process limitations throughout the production chain. Over 14 million Door rings have already been produced, and the story continues.



Anti-intrusion area to protect passengers

Energy absorption area to smoothly manage the crash

ArcelorMittal Multi Part Integration® combines grades with varying properties to achieve finely tuned part behaviour in the event of a crash, optimising energy absorption and anti-intrusion performance.

No compromise on weight with ArcelorMittal Multi Part Integration®.

Pillar three

Innovation with impact

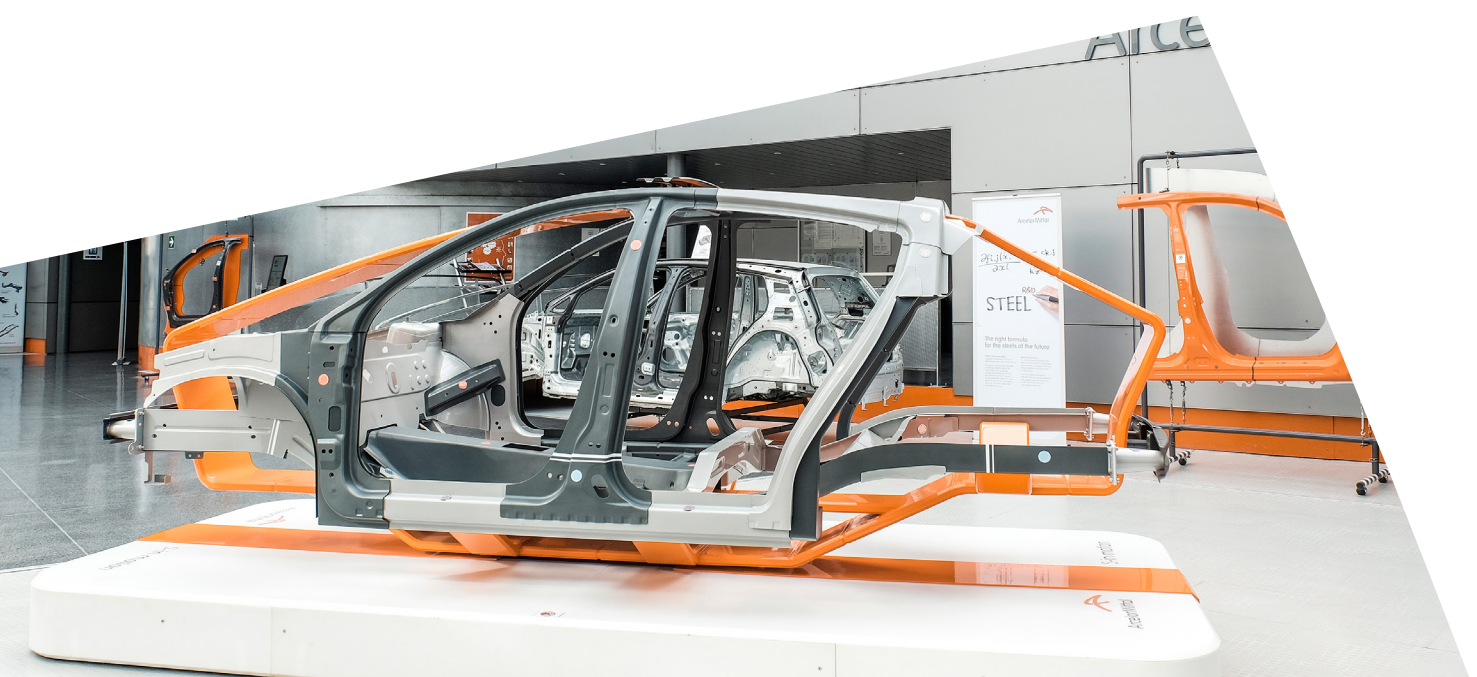
At the forefront of automotive steel innovation, ArcelorMittal develops solutions that anticipate and address the challenges faced by OEMs. ArcelorMittal Multi Part Integration® is the latest addition to our solution portfolio, leveraging steel's proven durability and circularity.

With a strong history of customer-driven innovation, ArcelorMittal creates solutions that meet the evolving demands of the automotive industry. Today, we are recognised as the leading steel supplier in the automotive sector, offering the broadest portfolio of steel grades with global availability.

ArcelorMittal has successfully addressed market requirements by developing modern steel solutions for the automotive industry, helping car manufacturers tackle their challenges. Automotive design began to evolve significantly approximately three decades ago when the need for higher safety and reduced tailpipe emissions emerged. The development of Advanced High Strength Steel was a significant response to this demand, enabling the car industry to produce safer and lighter vehicles at an affordable cost.

As car manufacturers encountered difficulties in producing parts with steels exhibiting very high mechanical resistance, ArcelorMittal introduced a proprietary solution: the hot stamping of boron steel grades, notably the renowned Usibor® 1500 grade, followed by Ductibor® 500. These grades unlocked substantial lightweighting potential by overcoming the production challenges faced by car manufacturers and tier-one suppliers. Indeed, the formability roadblocks associated with steels of very high mechanical properties were eliminated.

More recently, the family of press hardenable steels has been expanded with the introduction of Usibor® 2000 and Ductibor® 1000 grades. These new press hardenable steel grades further push the limits of lightweighting in the automotive industry, offering unparalleled mechanical properties that enhance car design efficiency. Importantly, these grades have paved the way for large Multi Part Integrations (MPIs). By combining various properties and crash management scenarios into a single part, we can eliminate design boundaries and integrate multiple crash functions into one piece all without compromising weight.



Advanced engineering and decarbonisation

A deep understanding of the automotive industry's needs is at the core of the ArcelorMittal group. To better comprehend the technical requirements for automotive steel, we have developed Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE) capabilities. This expertise is invaluable, allowing ArcelorMittal to closely address the challenges in automotive design while understanding customer needs and requirements.

This approach is central to the S-in-motion® project series, which aims to showcase the best-in-class ArcelorMittal solutions by demonstrating technical potential while considering all main design constraints, from crash scenarios to manufacturing limitations such as spot weldability and formability. These generic solutions serve as excellent entry points for deeper integration into customer projects during engineering collaborations.

Our simulation and calculation capacities and methodologies are entering a new dimension thanks to artificial intelligence, with an increasing focus on the impact of manufacturing processes, total production costs, and design simplification. ArcelorMittal continuously adapts its tools and R&D to address industry trends in the most agile manner possible.

Driving decarbonisation in automotive with XCarb® and sustainable ArcelorMittal Multi Part Integration® solutions.

Decarbonisation is currently a key focus for the automotive industry. As a leading supplier, ArcelorMittal has prioritised the decarbonisation of automotive products through the XCarb® initiative. In Europe, Usibor® 1500, our flagship product, is already available as XCarb® recycled and renewably produced, containing a guaranteed scrap amount of minimal

75% and produced with renewable electricity for the steelmaking process. Other Press Hardenable Steels (PHS) products will be introduced in the coming years under the XCarb® brand.

ArcelorMittal Multi Part Integration® (MPI) also positively impacts sustainability, as it enables a reduction in gross weight consumption through a higher material utilisation rate. The Laser Welded Blanks (LWB) process reduces production scrap by 20% compared to standard designs. This improvement is primarily due to the elimination of overlap areas, which leads to more optimised part nesting in a coil.

In addition to the higher utilisation rate, we can highlight the best-in-class lightweighting potential of the second generation of Press Hardenable Steel (PHS), which contributes to further gross weight reduction through thickness reduction. Our evaluations indicate that MPI can reduce material consumption by 14% compared to an initial design fully optimised in PHS, which is already a commendable benchmark.

By using XCarb® recycled and renewably produced substrate, the CO₂ footprint per tonne of Usibor® 1500 is reduced by up to 70%. However, when applied to the following six MPI applications—dash panel, floor reinforcement, double door ring inner and outer, rear floor, and H-frame—these savings can lead to CO₂ reductions of up to 31%, as other press hardenable steel grades are also used. The decarbonisation potential could be even greater if the use of Usibor® 1500 XCarb® is maximised, as current MPIs focus on lightweighting with products that are not yet available with XCarb®. However, this will be addressed soon. Some XCarb® door rings have already been produced, demonstrating the feasibility of very low CO₂ equivalent MPIs in industrial production environment. Moreover, other PHS grades will become available in XCarb®.

Pillar four

Global presence & expertise

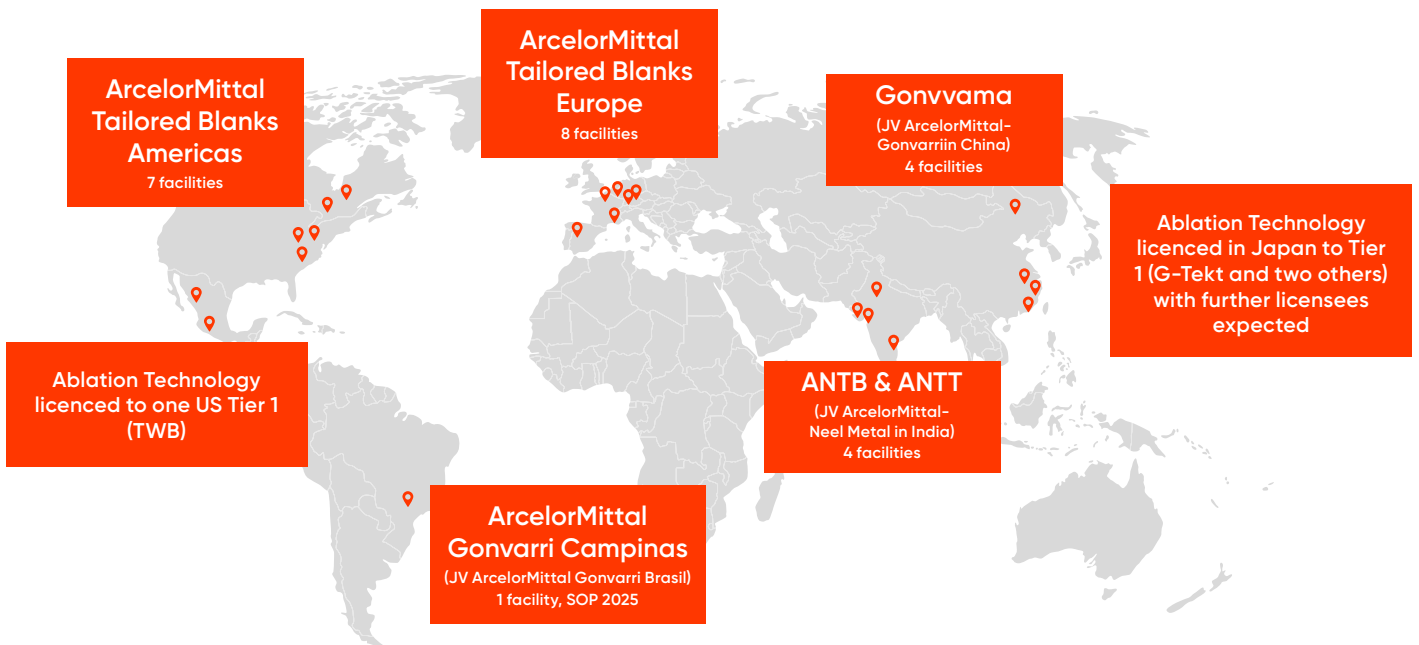
With unmatched global reach, extensive market knowledge, and robust supply chains, ArcelorMittal supports the international expansion of OEMs, meeting market-specific needs and regulatory requirements.

As the leading producer of automotive steels, our business is centred on creating advanced steel solutions and making them accessible wherever our customers operate. ArcelorMittal has a truly global presence, with automotive operations spanning Asia, Africa, Europe, and North and South America. This proximity to our customers allows us to deliver solutions on a global

scale. Our network of Global Account Managers, Global Technology Coordinators, and Resident Engineers operates across these regions, ensuring activities are coordinated to maintain a global perspective.

ArcelorMittal Multi Part Integration® (MPI) can be manufactured through our Laser Welded Blanks (LWB) facilities in Europe, China, North America, India, and starting in the course of 2025, Brazil.

ArcelorMittal press hardened steel LWB, a truly global offer



In 2024, we have global manufacturing and licensing, serving customers in all regions. As a leading supplier to the global automotive industry, we deliver 11.5 million tonnes of steel annually and offer the broadest product range in the industry.

Pillar five

Collaboration for excellence

With dedication and conviction, ArcelorMittal collaborates closely with OEM customers and premium Tier 1 suppliers, combining expertise to deliver maximum value through reliable and comprehensive solutions.

For decades, we have built strong collaborations with car manufacturers, launching co-development initiatives to fine-tune new product properties, identify future product targets, and test our steel solutions within the full context and constraints of car manufacturing. These collaborations have enabled our partners and ArcelorMittal to combine our strengths, reduce lead times, and deliver the most relevant solutions based on manufacturers' objectives. This approach led to the introduction of the first Door ring in North America over a decade ago. Today, we continue to partner with customers across the region to develop ArcelorMittal Multi Part Integration® (MPI), including a recent collaboration with a Chinese car manufacturer on the H-frame. Through these partnerships, ArcelorMittal offers comprehensive material consulting and supports crash and cost modelling.

ArcelorMittal is structured to provide highly valuable, tailored technical support, drawing on some of the most talented automotive material and application experts. Our customers rate us as the top provider for technology and support across Europe and North America. Please get in touch!



Explore our advanced materials, success stories, and videos at automotive.arcelormittal.com/MPI

For more information, reach us at contact.automotive@arcelormittal.com

We also partner with a network of automotive suppliers to ensure our solution's compatibility across the entire production and supply chain, on a global scale. In collaboration with major hot stamping process companies like AP&T and Trumpf, we evaluate the compatibility and robustness of ArcelorMittal Multi Part Integration® (MPI) with both existing and developing production lines. Several MPI prototypes have been successfully produced and are available for viewing in our showrooms.

ArcelorMittal recently opened a Laser Welded Blanks prototyping line compatible with the ArcelorMittal Multi Part Integration® concept, to support customers interested in testing and validating the concept.

The power
of less