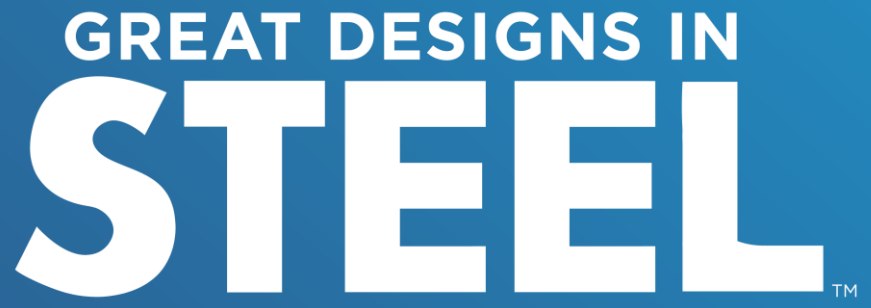
The Power of Less
ArcelorMittal Multipart Integration®

FOR IMPROVED EFFICIENCY, SUSTAINABILITY, AND PERFORMANCE

Ram Iyer, ArcelorMittal Global R&D &

Gagan Tandon, ArcelorMittal Tailored Blanks



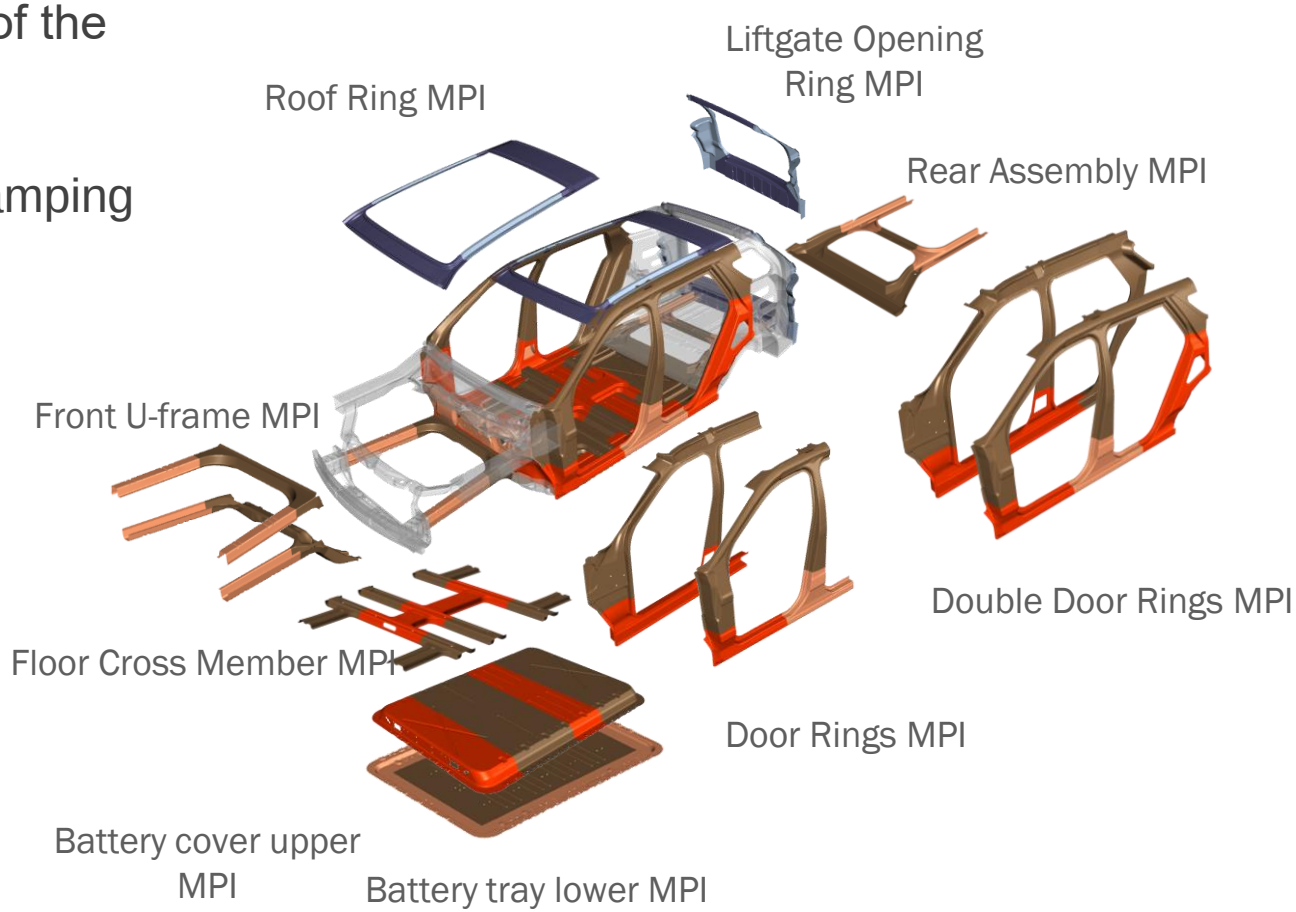
ArcelorMittal Multi Part Integration™

GDIS

ArcelorMittal's solutions meet the emerging needs of the automotive industry

Mature and proven technologies of hot and cold stamping and laser welded blanks

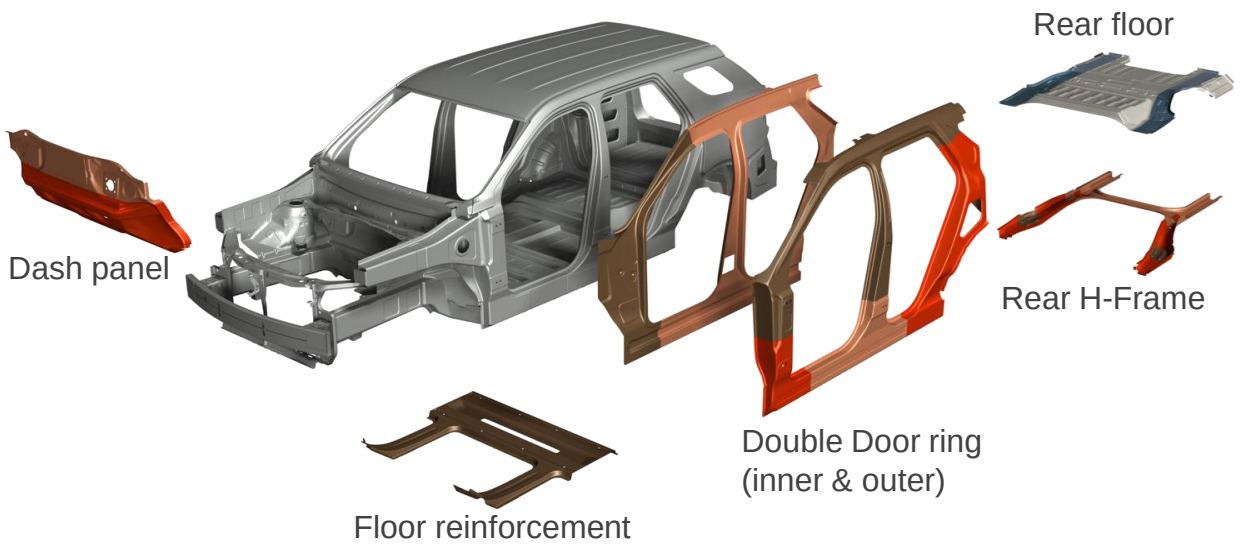
- Part count reduction
- Crashworthiness Optimization
- CO_2eq reduction
- Body shop simplification
- Material usage optimization



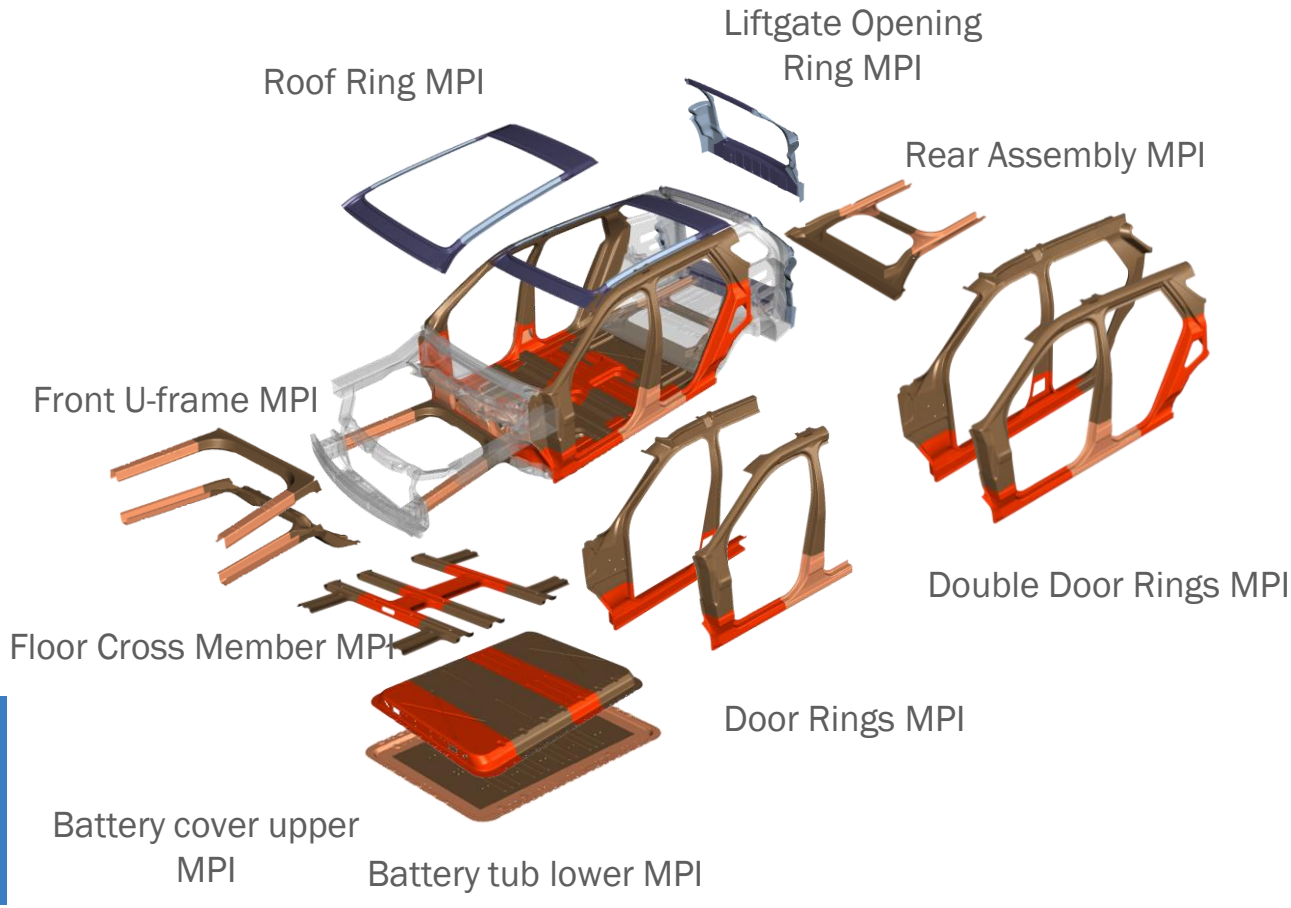
ArcelorMittal

Potential MPI solutions for BEV BIW

MPI solutions with in-depth analysis of the assembly sequence



Catalog of MPI solutions

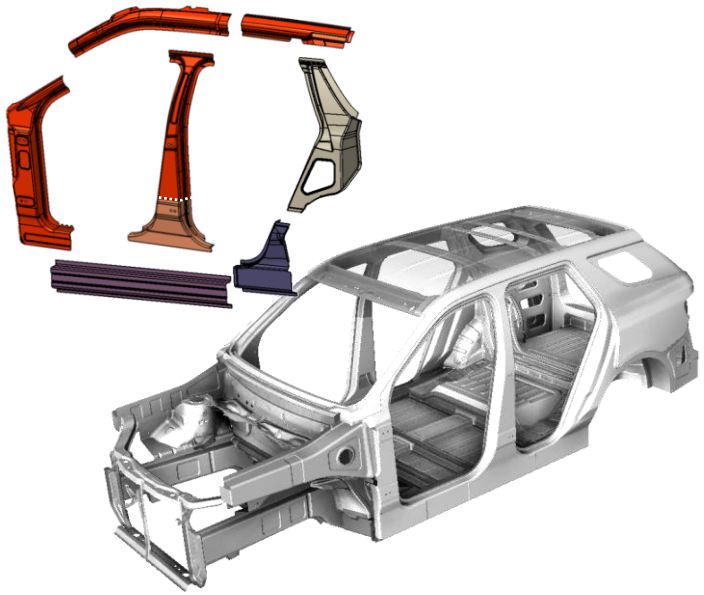


A catalogue of MPI solutions has been developed

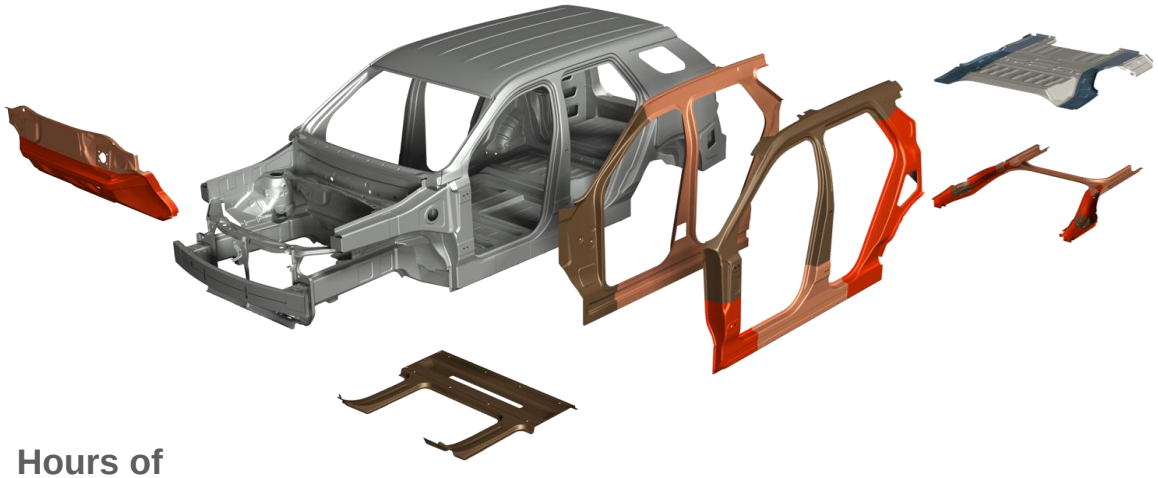
MPI Solutions can be adapted to specific OEM structure and assembly sequence

Benefits to the OEM

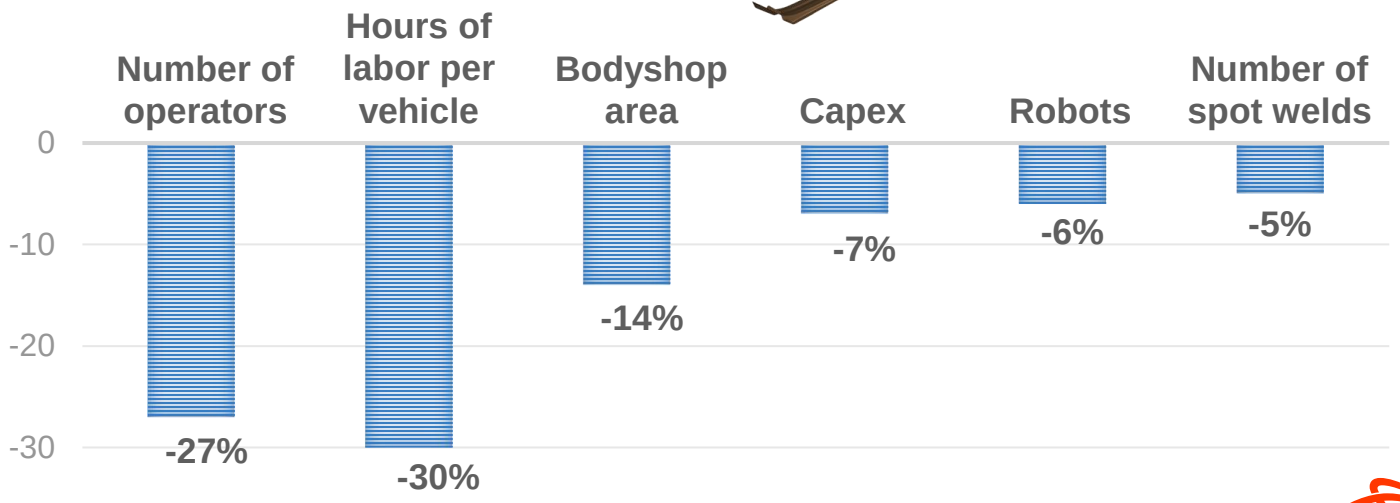
Conventional BEV
With multiple stampings



BEV MPI
With 6 MPI solutions

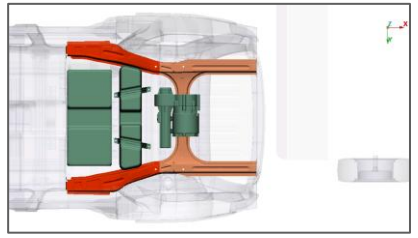


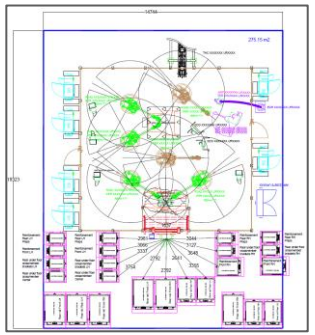
Assembly process cost estimates performed by independent 3rd party factory tooling and automation experts

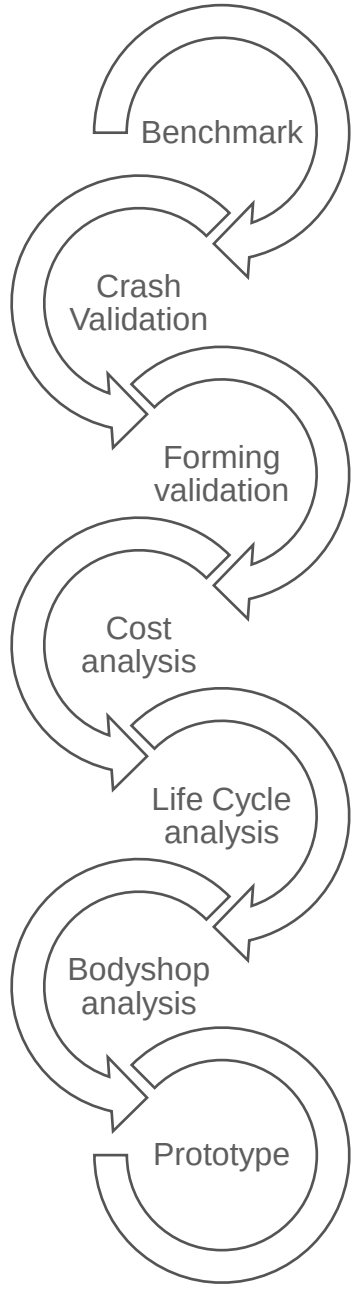


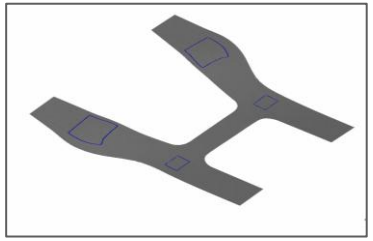
Solutions Development Methodology

- **Benchmark**
  - Reference design representative of the current market
- **Crash validation**
  - Validation of all relevant safety requirements for worldwide market
- **Forming validation**
  - Formability validated using simulations with AutoForm®
- **Cost analysis**
  - Comparative cost evaluation between reference design and MPI solution performed by an independent external partner
- **Life Cycle Analysis**
  - Assessment of CO_2 eq savings on Cradle to Gate scope (Steel manufacturing, Part manufacturing and Recycling credit)
- **Bodyshop analysis**
  - Evaluation of the impact of MPI solutions on OEM plant (press shop and body shop)
- **Prototype**
  - Hot stamping of physical demonstrators









Body Shop Simplification

A scenario has been designed with well-known automotive contractors to compare the assembly of **a conventional vehicle** to the assembly of an **MPI intensive vehicle**

We designed from scratch a virtual assembly Body shop including all the tools needed to build a BiW

This scenario is designed to bring more information about the gains expected when using ArcelorMittal Multi Part Integration™ to OEMs building a plant from scratch

To assess the Body shop simplification **MPI** can offer, the following KPIs have been considered:

- **Number of operators**
- **Number of spotwelds**
- **Bodyshop area**
- **Number of robots**
- **CAPEX**

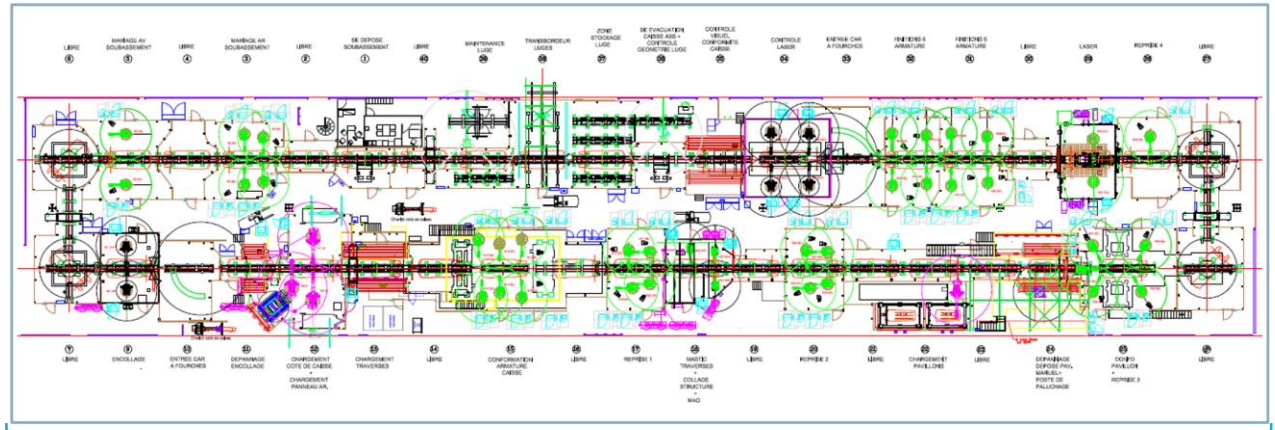
Conventional BEV 1

VS

BEV **MPI**

Design from scratch of a virtual assembly Body shop manufacturing a conventional BiW **made of conventional steel parts**

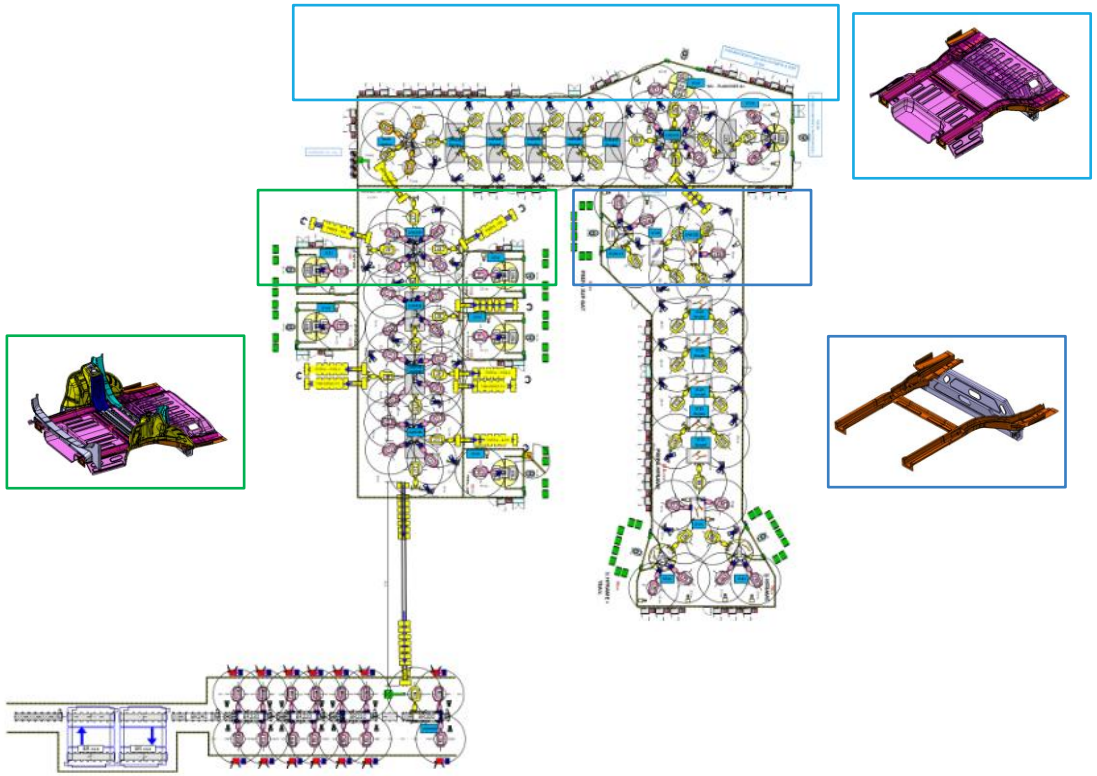
Design from scratch of a virtual assembly Body shop manufacturing an **MPI intensive BiW including all 6 MPI applications**



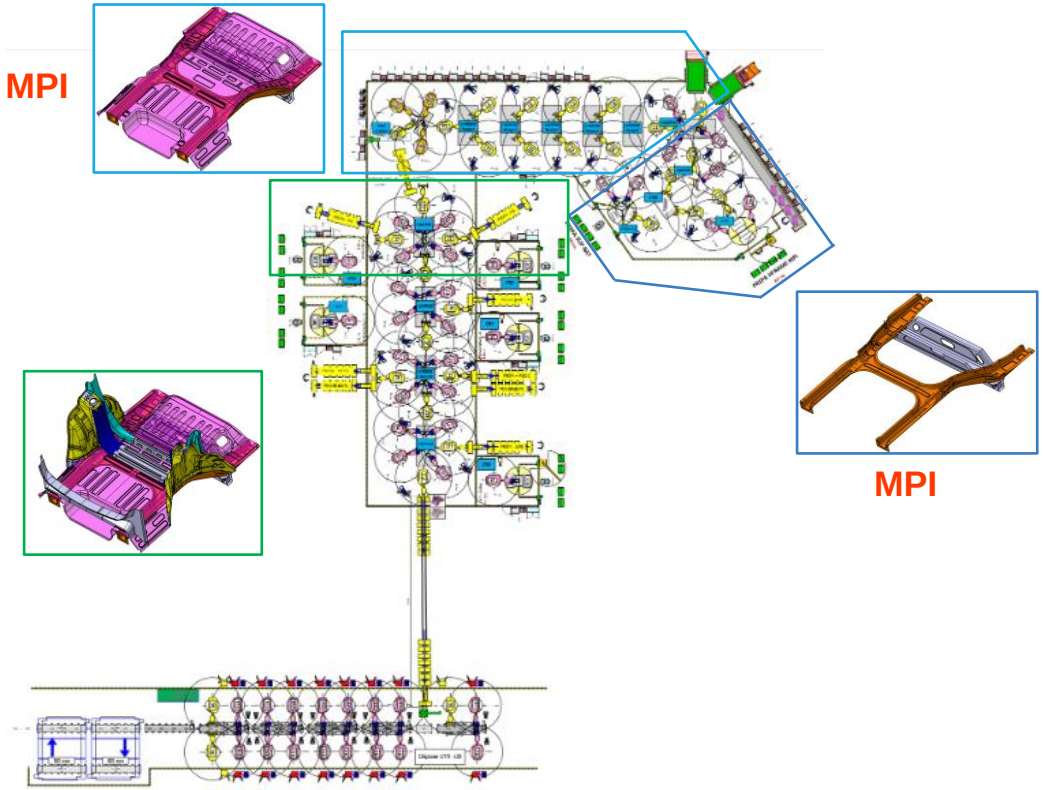
Operators, Spot welds
Area (m²), Robots, CAPEX

Conventional vs MPI rear underbody plant layout

Conventional Baseline: 2 695 m²



MPI Solution: 1 816 m² (-33% vs Baseline)

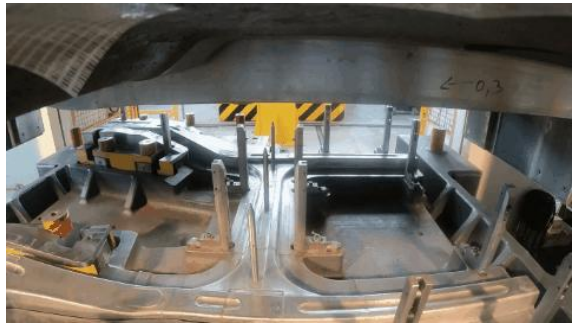


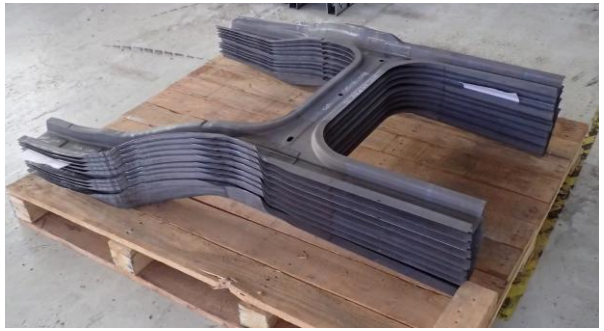
The Body shop area is significantly reduced thanks to the two MPI solutions

From Design Engineering to Prototyping

Rear H-Frame

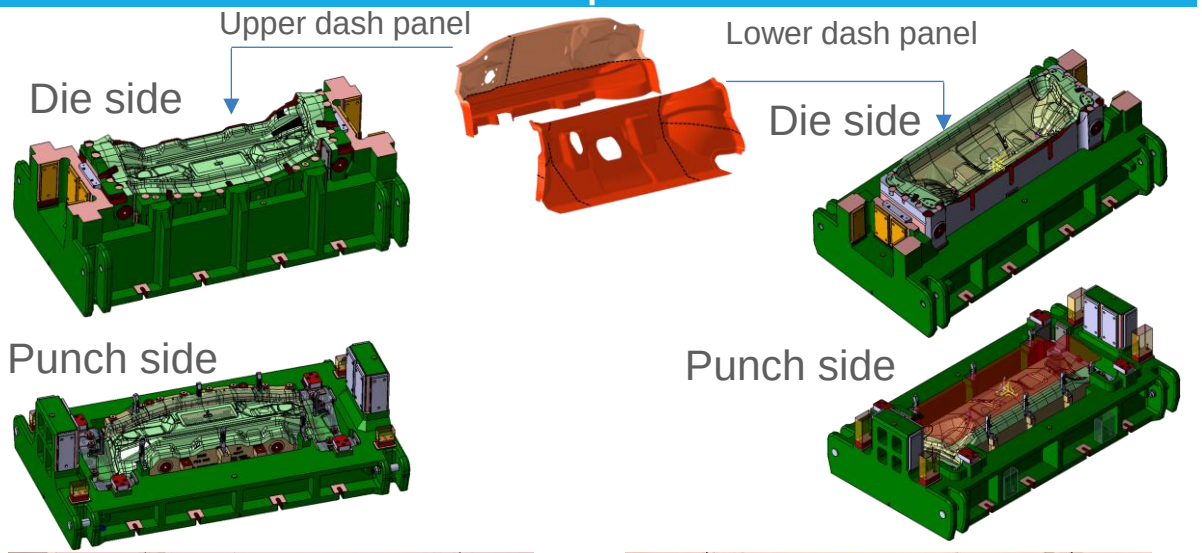
Prototype parts performed by ArcelorMittal R&D





First industrial project with Chinese OEM

Dash panel



- Front view -

- Rear view -

Parts successfully hot stamped at ArcelorMittal facilities: no forming issues and part properties reached

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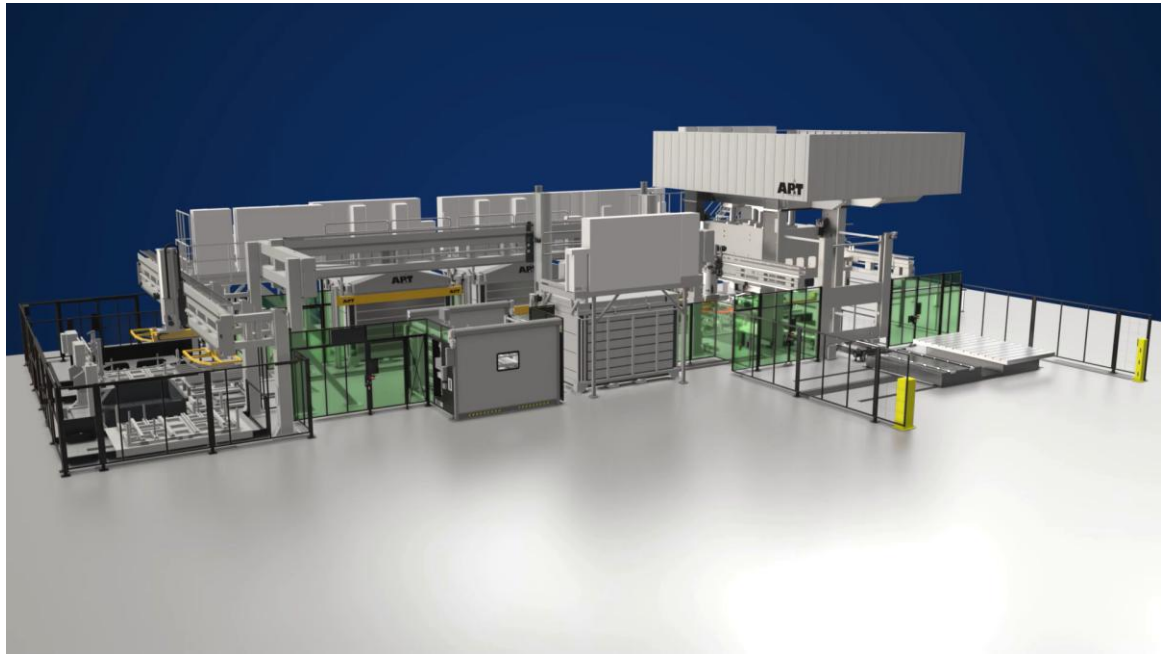
Partner Enabled Solutions – AP&T

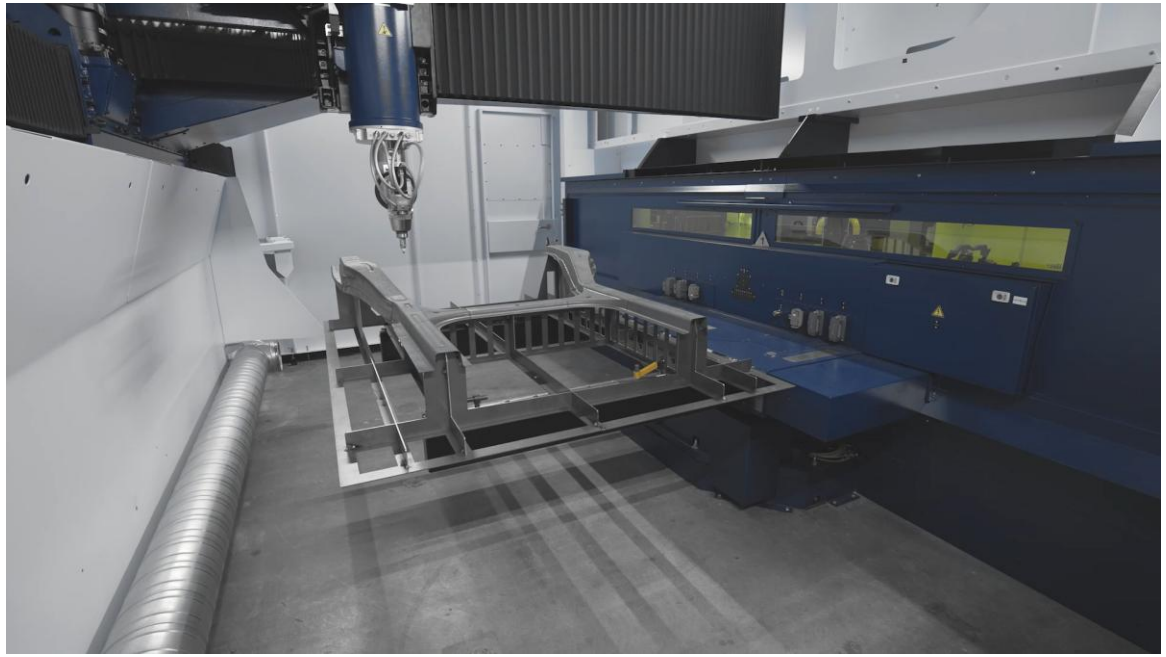


"We have certainly taken on the challenges related to the production of large parts. Our press-hardening technology is a perfect match for ArcelorMittal's MPI body components, since it offers low total cost of ownership, low climate impact, and a very small equipment footprint."

Dr Christian Koroschetz,
Head of Products & Marketing at AP&T.Dr Christian Koroschetz, Head of Products & Marketing at AP&T

Source: Hot stamping MPI parts with AP&T

Partner Enabled Solutions – Trumpf



"With TRUMPF's laser cutting solutions, we're pushing the boundaries of what's possible in automotive manufacturing, and enabling MPI parts to simplify production and design."

Andreas Müllegger, TRUMPF

Source: Driving Steel: Laser cutting big MPI parts with TRUMPF

Superior Sustainability

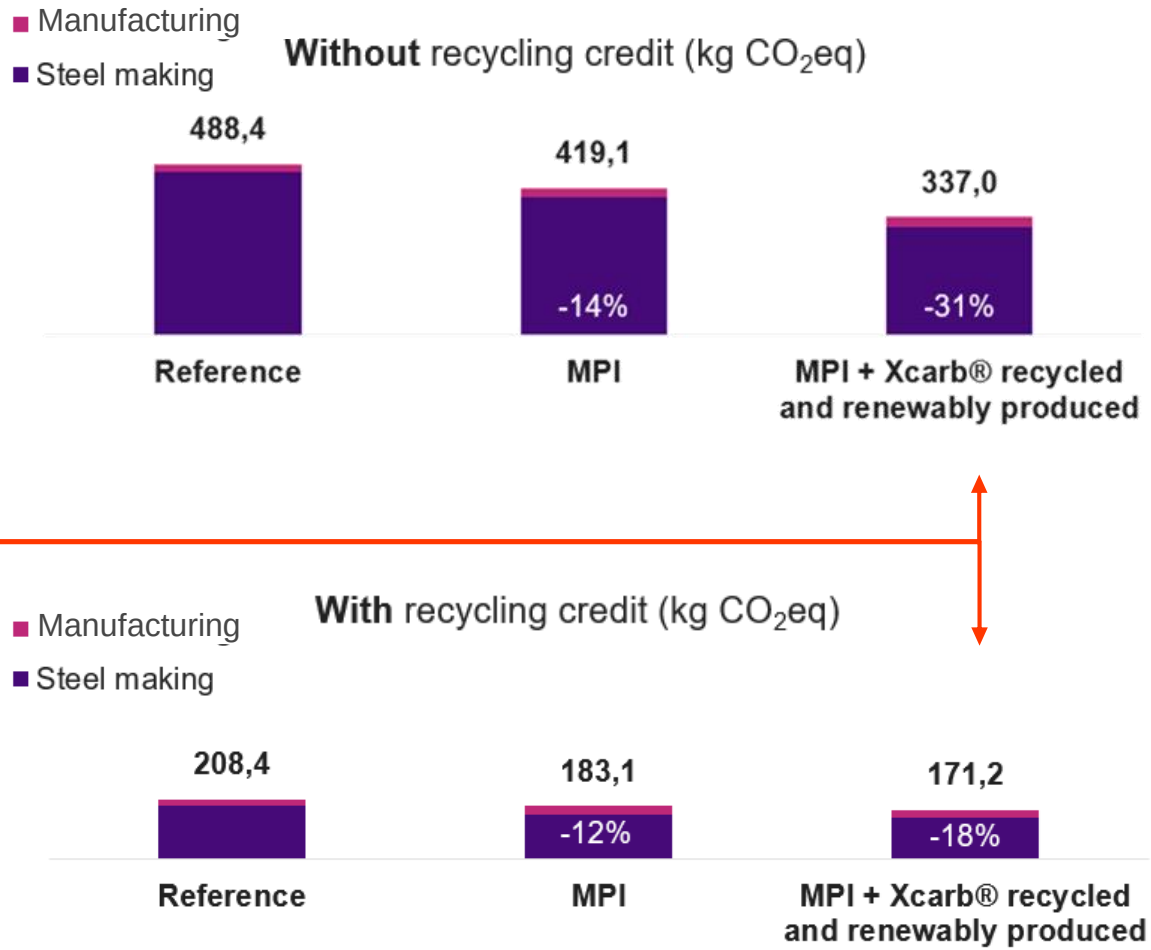
- Usibor® 1500 is available in XCarb™ recycled and renewably produced
- XCarb™ recycled and renewably produced Usibor® provides the highest decarbonation potential

XCarb™ recycled and renewably produced label is reserved for products made

- ➢ via the Electric Arc Furnace route
- ➢ powered by 100% renewable electricity and
- ➢ using a guaranteed 70% minimum scrap content

ArcelorMittal North America – Flat Products offer from Dofasco

XCarb™ Recycled and renewably produced



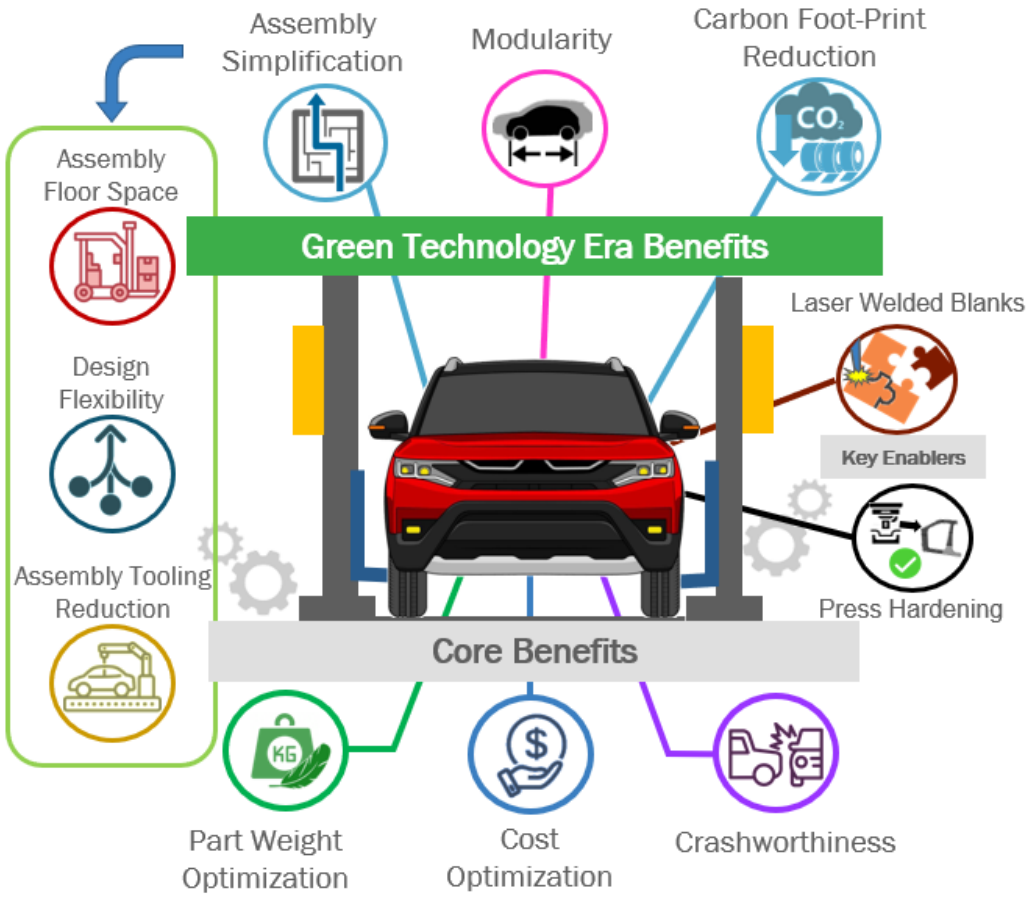
Driving phase not included

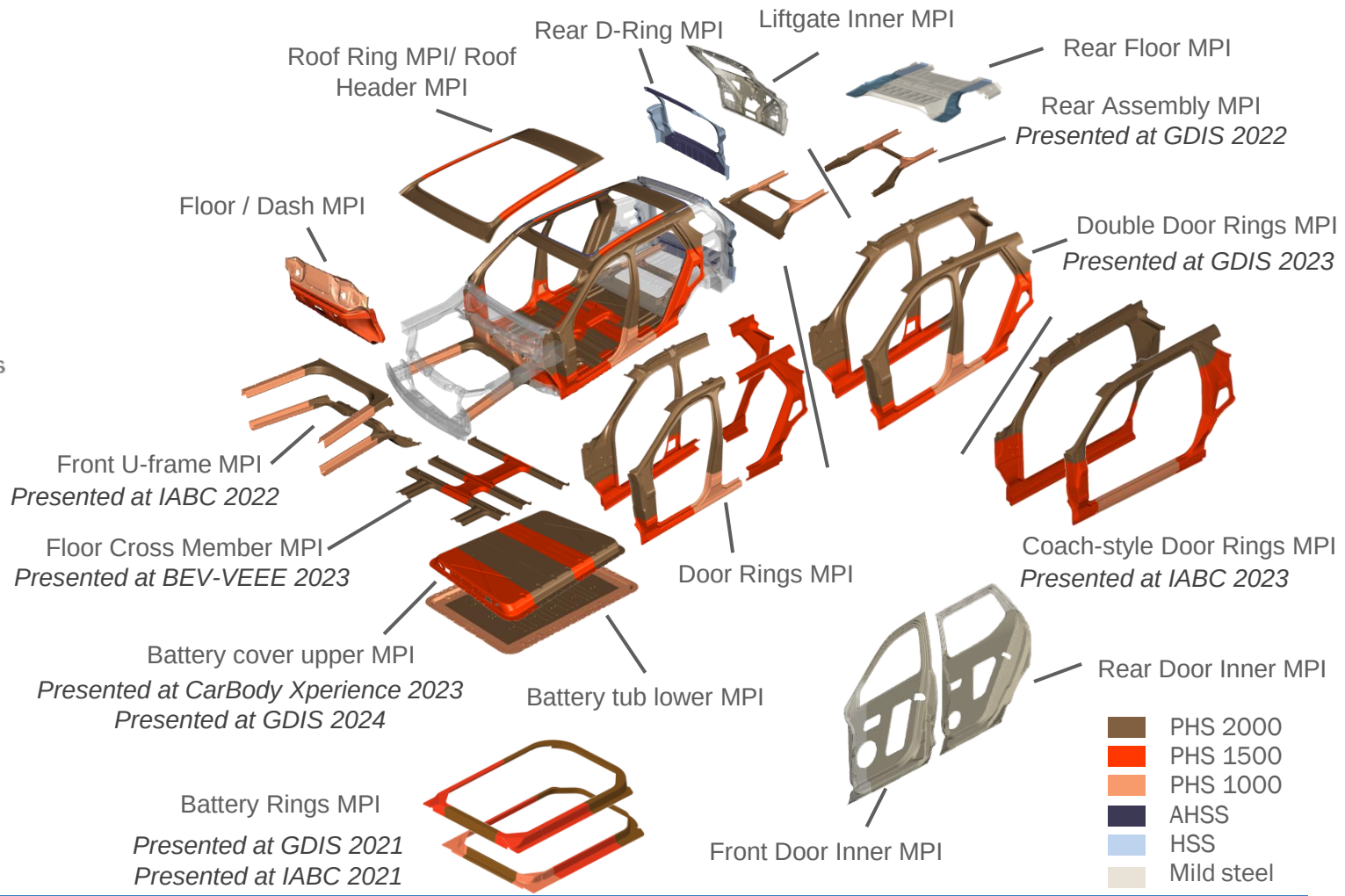
XCarb™ products combined with ArcelorMittal Multi Part Integration® to go further in terms of sustainability

ArcelorMittal

ArcelorMittal Multi Part Integration™ Concepts

GDIS





MPI concepts envision to meet the key challenge of part consolidation & crash safety

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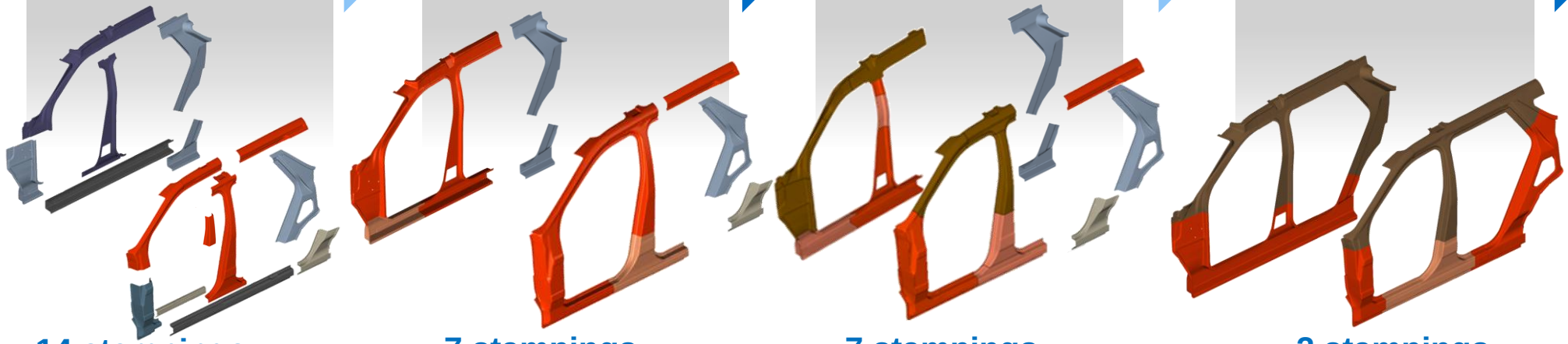
Door Ring Evolution & Door Rings in Production

GDIS

Conventional Design → **Door Ring Inner & Outer** → **Usibor®2000 in Door Rings** → **Double Door Rings Sys.**



14 stampings | 7 stampings | 7 stampings | 2 stampings

Cold stamped | PHS

Door ring design variation & complexity → **+30 more by 2030**

2014 | 2016 | 2019 | 2021 | 2022 | 2023 | 2025

Door ring Execution

OEMs have implemented multiple Door Rings across multi-powertrains & vehicle sizes

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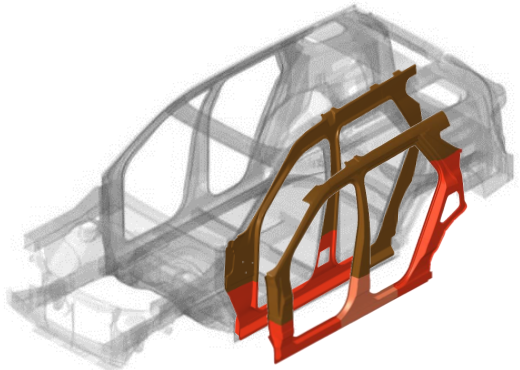
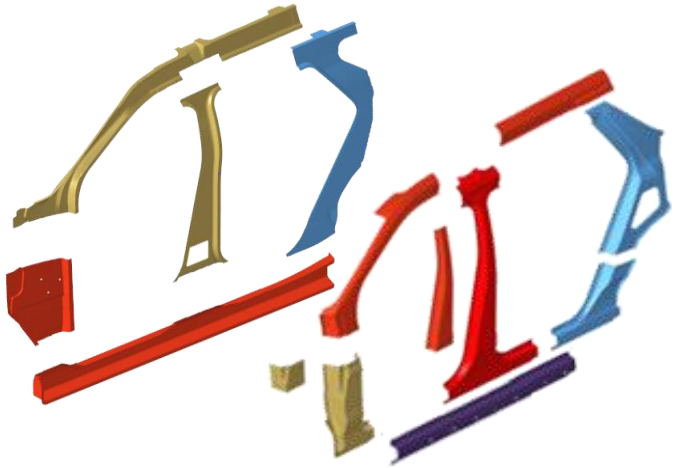
Double Door Ring MPI

GDIS

Baseline



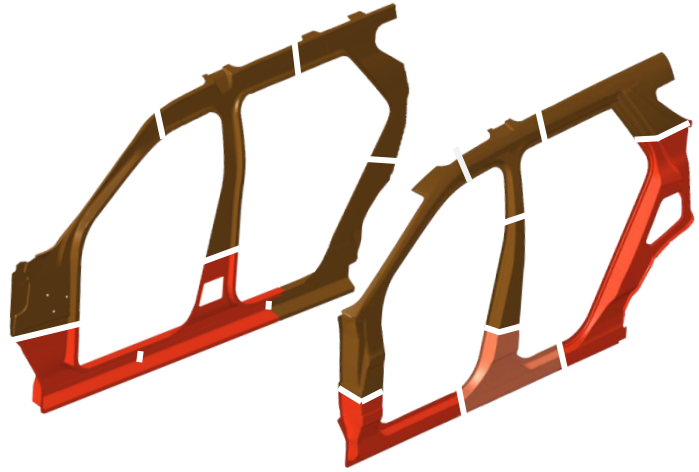
AMTB NBEV model

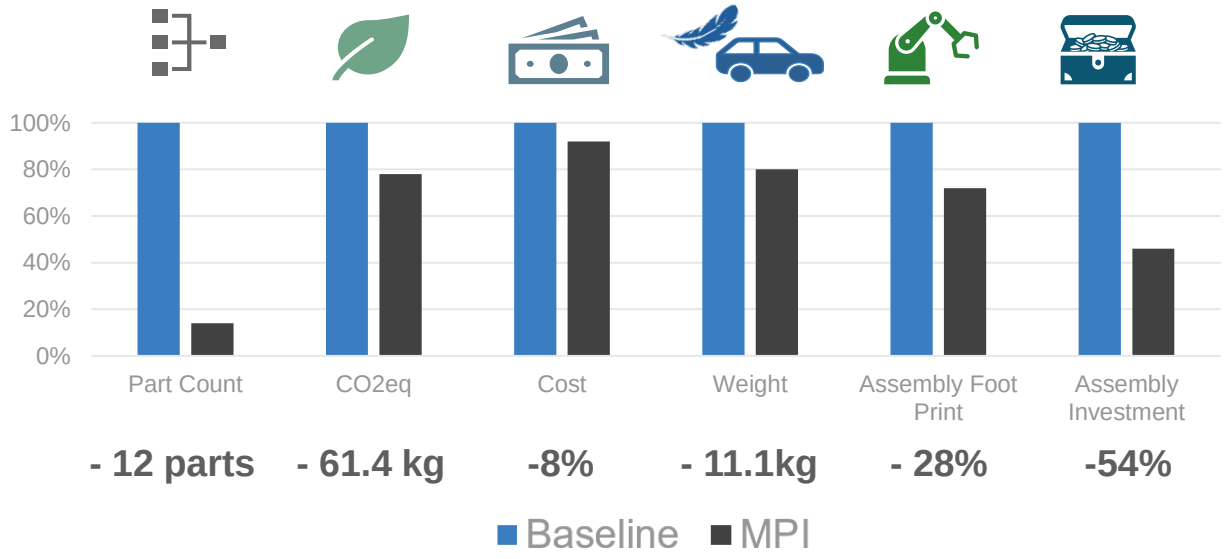


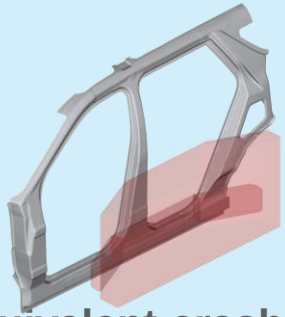
PHS 2000
PHS 1500
PHS 1000

AHSS 980
AHSS 600
HSS 350

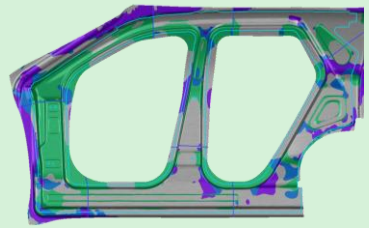
AMTB MPI Proposal







Equivalent crash performance



Forming Feasible

68,008 Acres of Forest*

10,088 Households*

12 wind turbines*

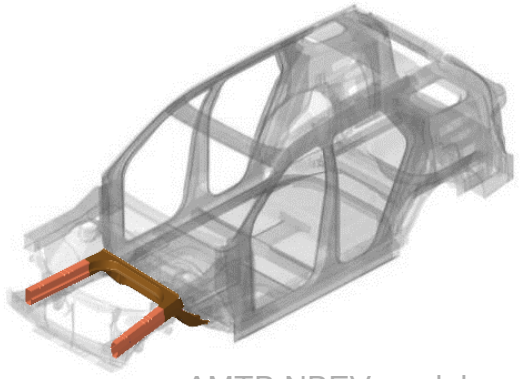
* Greenhouse Gas Equivalencies Calculator | US EPA

ArcelorMittal

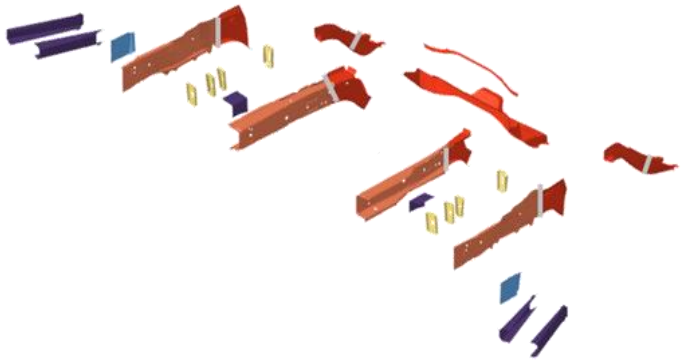
Front U-Frame MPI

GDIS

Baseline



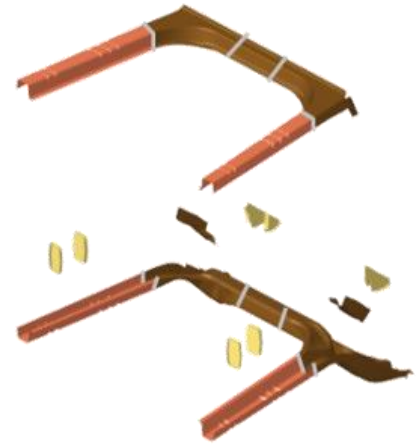
AMTB NBEV model

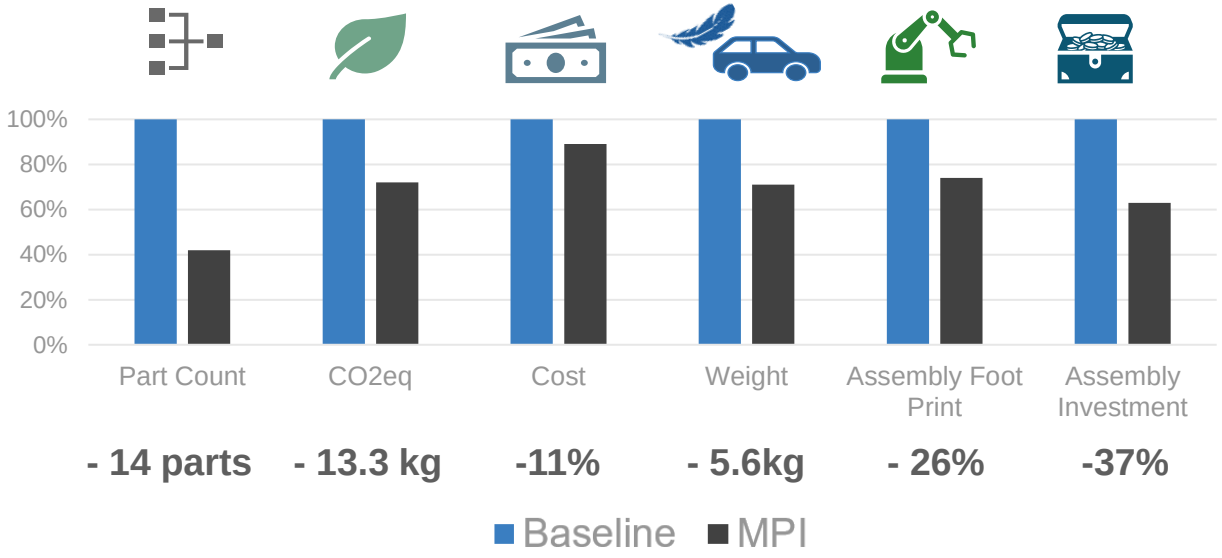


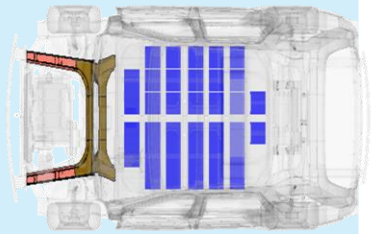
PHS 2000
PHS 1500
PHS 1000

AHSS 980
AHSS 600
HSS 350

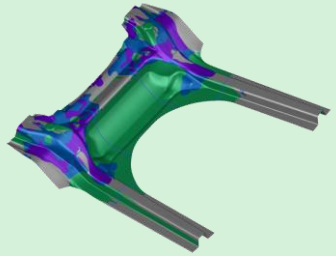
AMTB MPI Proposal







Equivalent crash performance



Forming Feasible

9,000 Acres of Forest*

1,500 Households*

2 wind turbines*

[* Greenhouse Gas Equivalencies Calculator | US EPA]

ArcelorMittal

Rear H-Frame MPI

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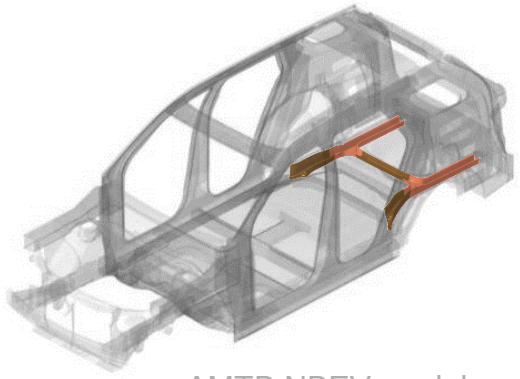
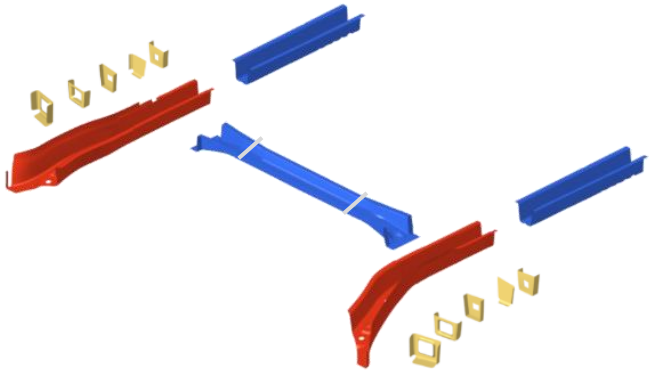
Baseline



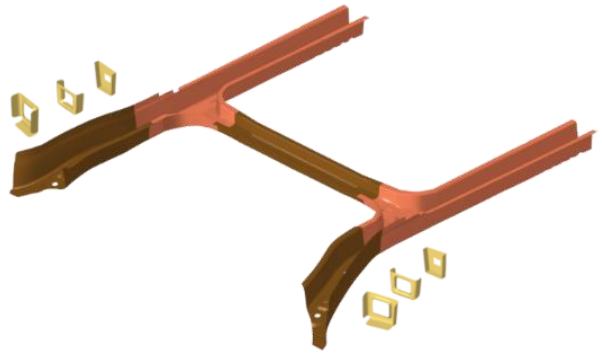
AMTB NBEV model

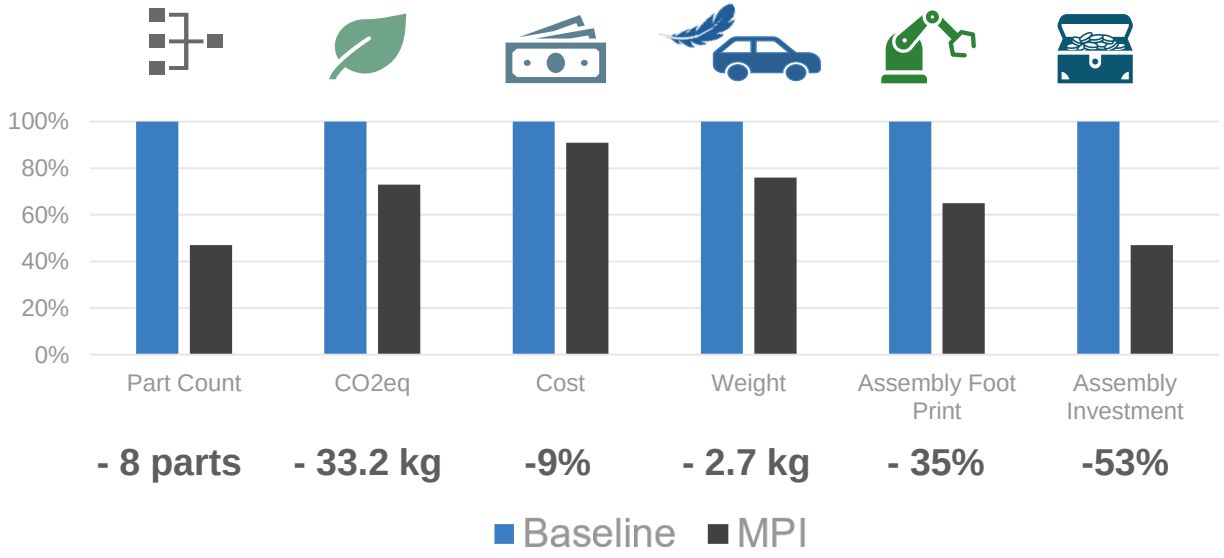


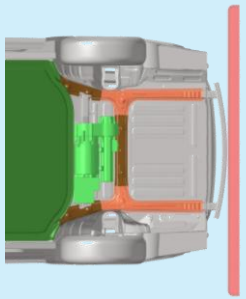
PHS 2000
PHS 1500
PHS 1000

AHSS 980
AHSS 600
HSS 350

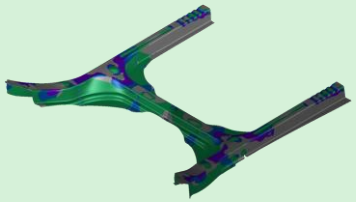
AMTB MPI Proposal







Equivalent crash performance



Forming Feasible

20,500 Acres of Forest*

3,000 Households*

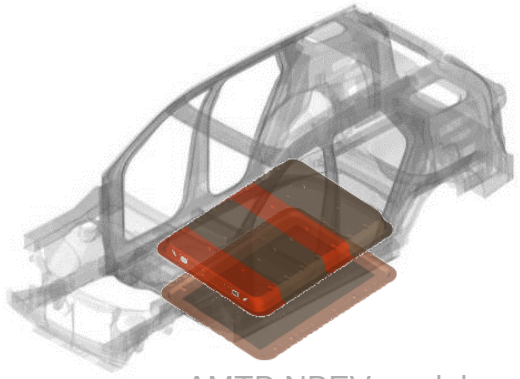
4 wind turbines*

* Greenhouse Gas Equivalencies Calculator | US EPA

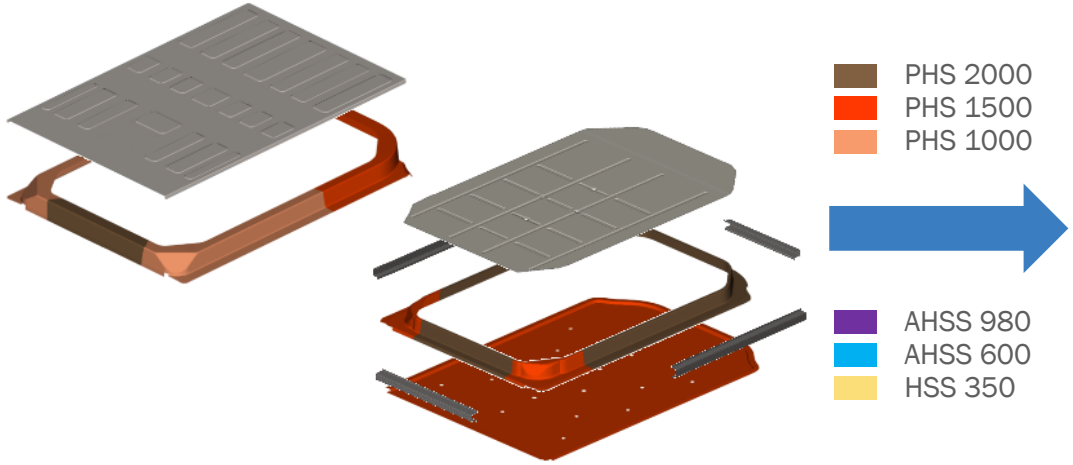
ArcelorMittal

Battery Enclosure

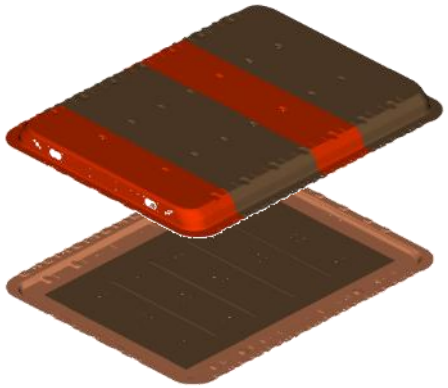
Baseline

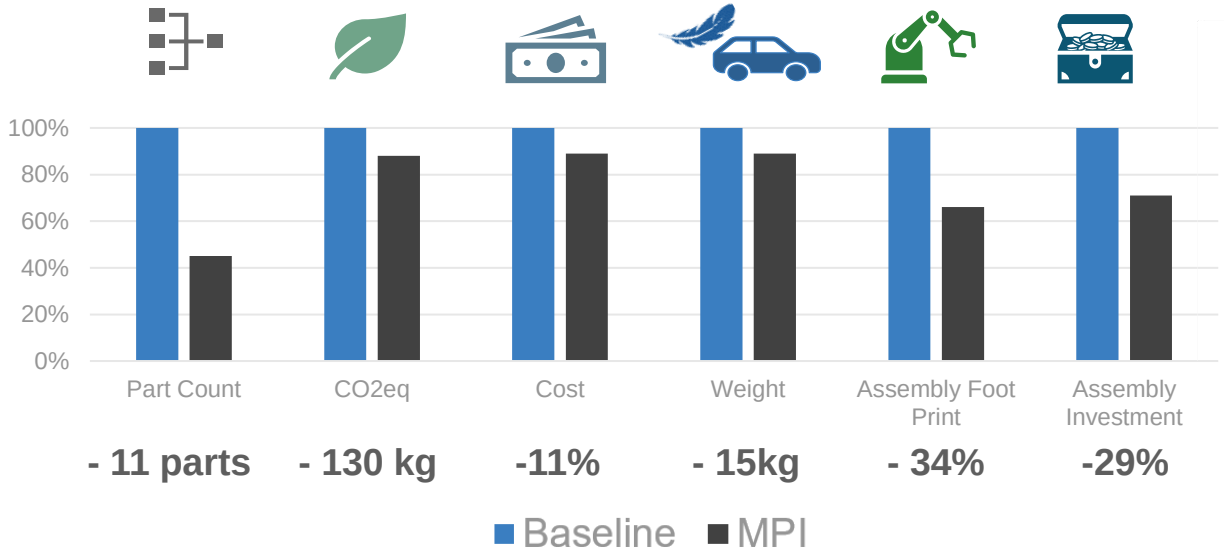


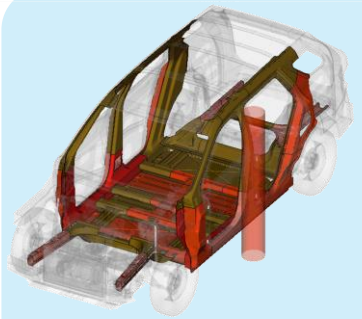
AMTB NBEV model



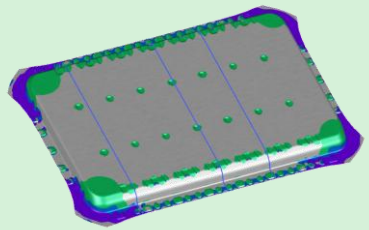
AMTB MPI Proposal







Equivalent crash performance



Forming Feasible

30,500 Acres of Forest*

4,500 Households*

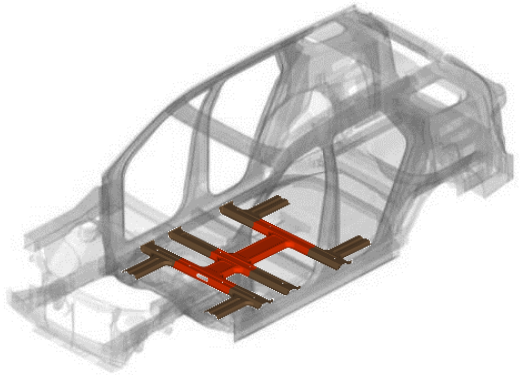
6 wind turbines*

* Greenhouse Gas Equivalencies Calculator | US EPA

Floor Reinforcement MPI

GDIS

Baseline

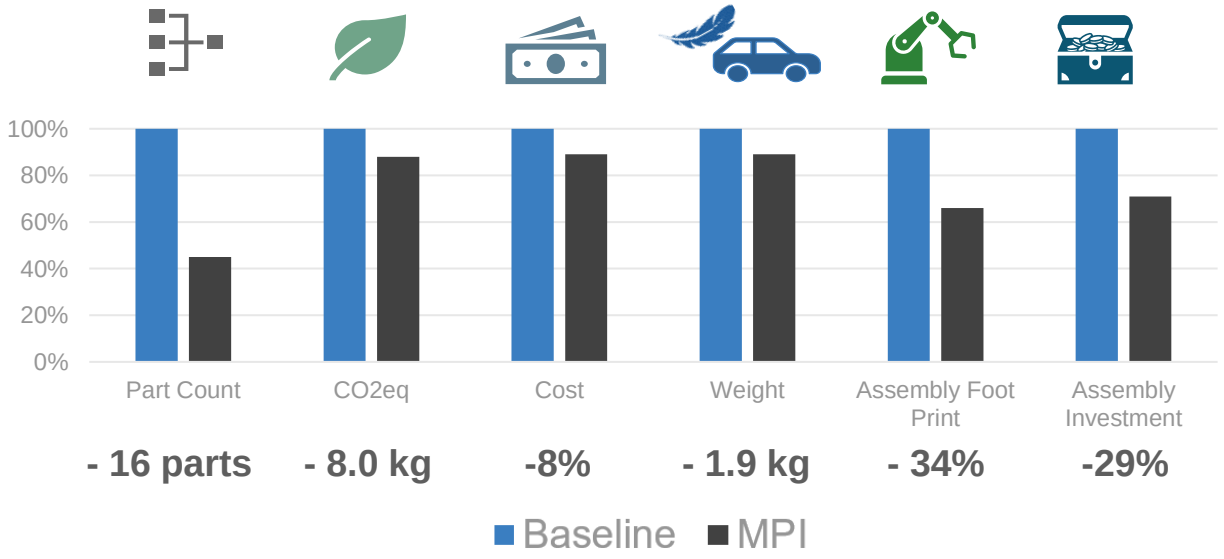


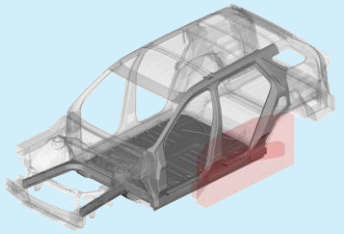
AMTB NBEV model

PHS 2000
PHS 1500
PHS 1000

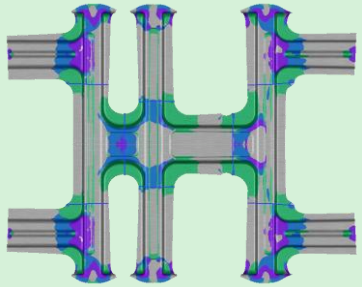
AHSS 980
AHSS 600
HSS 350

AMTB MPI Proposal





Equivalent crash performance



Forming Feasible

1,900 Acres of Forest*

280 Households*

0.3 wind turbines*

* Greenhouse Gas Equivalencies Calculator | US EPA

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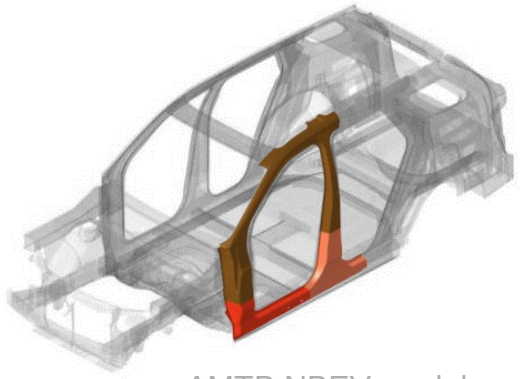
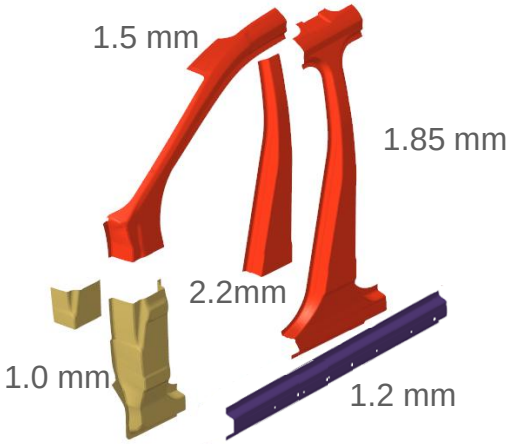
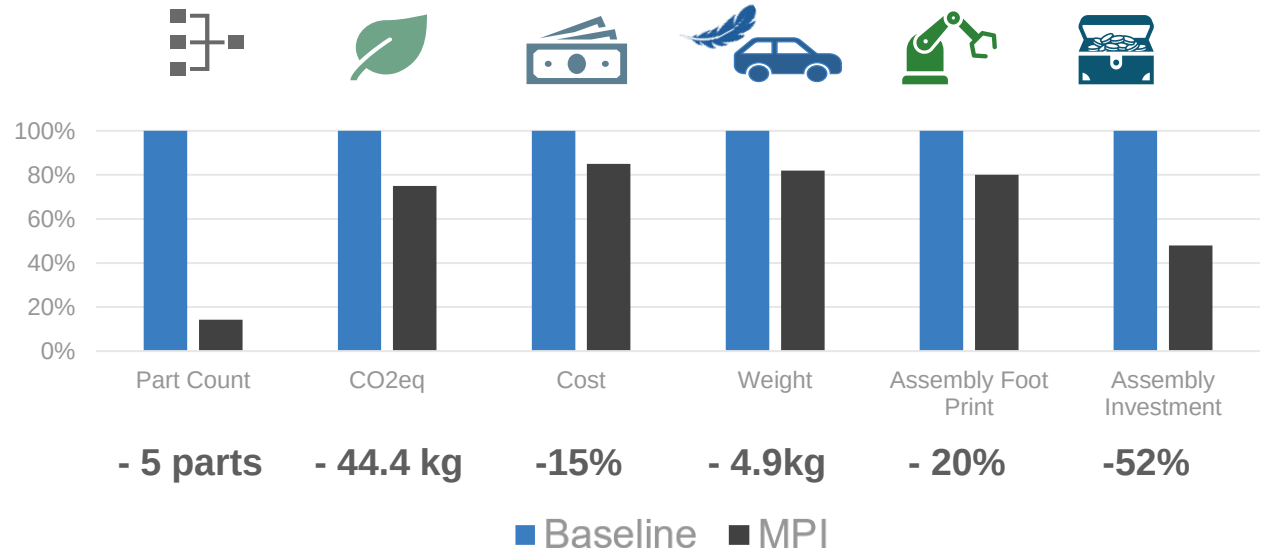
Door Ring MPI

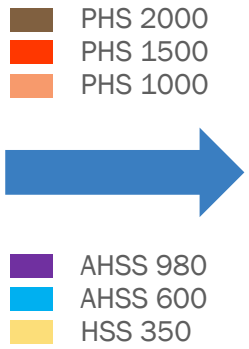
Baseline



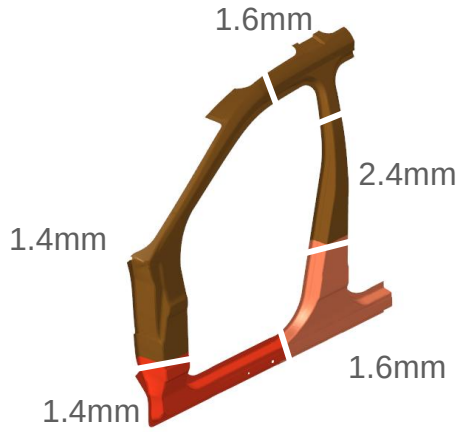
AMTB NBEV model

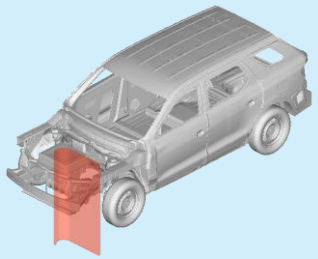




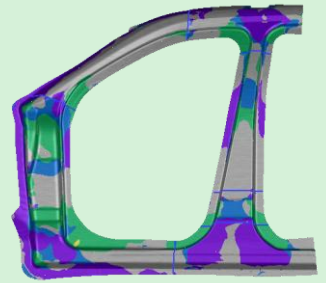


AMTB MPI Proposal





Equivalent crash performance



Forming Feasible

21,700 Acres of Forest*

3,550 Households*

5 wind turbines*

* Greenhouse Gas Equivalencies Calculator | US EPA

ArcelorMittal

In Summary

ArcelorMittal Multi Part Integration® design concepts uses mature and proven technologies for part integration leading to **savings in the assembly shop**

Laser Welded Blanks are a good lever to **reduce the gross weight** consumption

The combination of lightweighting, gross weight reduction and decarbonization through **Usibor® 1500 Xcarb™** position ArcelorMittal Multi Part Integration® **as a CO_2eq effective solution**

ArcelorMittal seeks **engagement and collaboration** with OEMs, tier suppliers and technology companies to enhance, mature and bring to production designs that address the evolving needs of the OEMs

For more information

Ram Iyer
ram.iyer@arcelormittal.com

Gagan Tandon
gagan.tandon@arcelormittal.com

Visit our booths at GDIS!

Automotive.arcelormittal.com