

Global R&D Cooperation Manufuture Conference 2015

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$$\frac{\partial f_{i,j}(\vec{x}, \vec{c})}{\partial x_i} = \sum_{k \neq i} c_{k,j}$$

The right formula
for the steels of the future

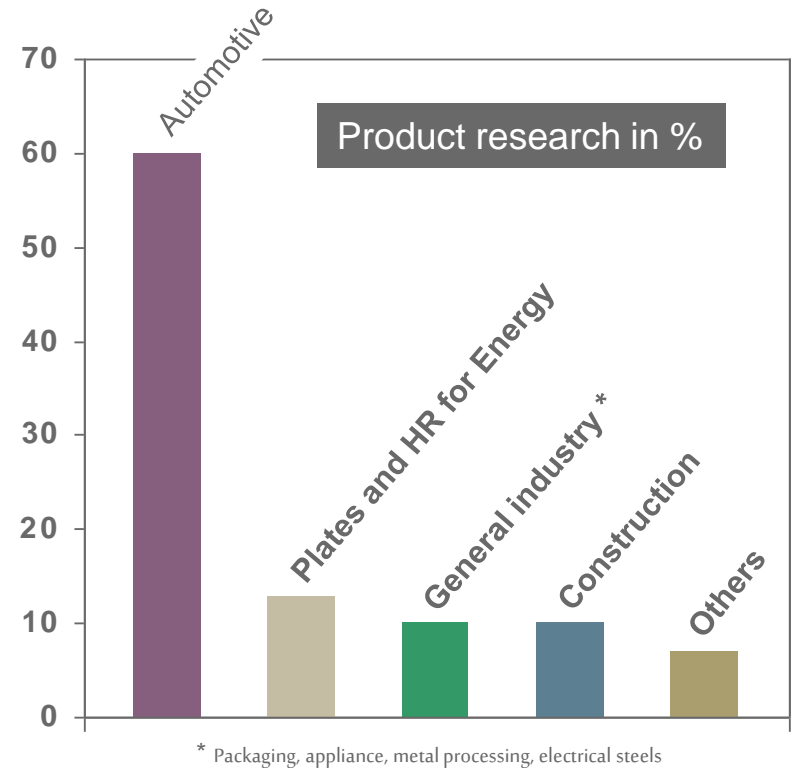
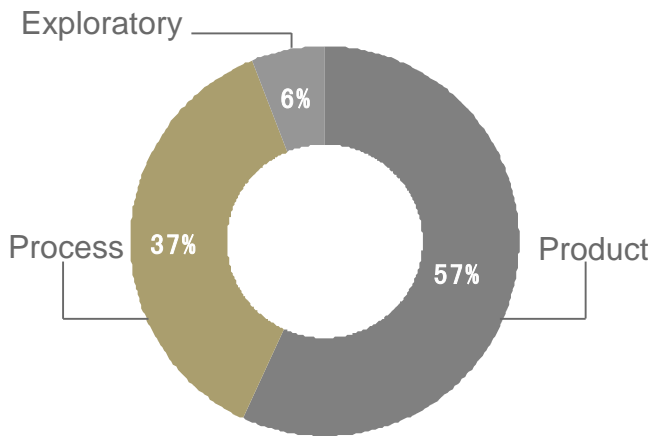
R&D
STEEL

A hand holding a grey marker is shown writing the word 'STEEL' in large, bold, black capital letters on a whiteboard. Above the word, the letters 'R&D' are written in red. The hand is positioned on the right side of the frame, with the marker tip pointing towards the end of the word.



Global R&D Key Facts and Figures

- 1,300 full time researchers
- 2014 spending of \$260m
- Broad, comprehensive portfolio and programmes addressing business needs
- Worldwide network of laboratories: 12 labs in Europe and Americas
- Budget spending by focus area:



R&D effort fully aligned with group strategy: geography, value chain, product differentiation

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Research to be focused on

- A **fast product introduction** based on efficiency, and result driven worldwide
- The **co-development** of processes and products
- Thinking and working **transversally** over the complete value chain from mining to finished products
- **Disruptive** innovations and not only incremental improvements
- Breakthrough innovations based on boldness and calculated risk
- **Strategic** and **business driven**



Global R&D

- ArcelorMittal R&D needs to be **global** to answer **global markets**:
- Automotive
- Construction
- Energy
- Process with plants worldwide



Global R&D deploys highly talented people...

- 1300 researchers:
 - 55 % Engineers, 45 % Technicians
 - 75% male, 25% female
- Diversity and multi-cultural approach
 - Over 25 nationalities... sometimes in the same lab
 - Mixed generations combining highly experienced researchers and young talent
 - Graduates from the best universities and engineering schools worldwide
 - Typically with extensive international experience
- Working together in result-driven project teams





... across 12 research centres and at customer locations on 3 continents...



(*) Strategic partner
 - Forbach: CPM
 - Liège: CRM

Canada, USA

Spain, France, Germany, Italy

China, South Korea, Japan

On-site product-portfolio deployment: Product Development Engineers, Automotive Residents, Process Development & Deployment Specialists





... to meet our customers' needs

- **Automotive:** compromise between weight reduction, comfort, safety & durability
- **Packaging** cost effectiveness, easy processing, weight reduction, innovative look, food compatibility, green products
- **Appliances:** cost reduction, antibacterial, aesthetics, environmental friendly...
- **Construction:** energy-efficiency, environmental issues, safe buildings, durability, fast erection, health & comfort, aesthetics,...
- **Metal Processing:** weight and cost saving, corrosion resistance, safety, reduced total cost of ownership, high temperature resistance
- **Electrical Engineering:** higher efficiency and power density machines through low loss, high permeability, high strength electrical steels
- **Energy pipes:** heavy gauge, high strength, corrosion resistance, improved welding
- **Process:** quality improvement, competitiveness, robustness, sustainability,...





R&D operating model to answer global presence

- A matrix-based operating model governed by 2 main principles:
 - Alignment with the market structure
 - Alignment with ArcelorMittal's business units
- Organisation built on 2 axes:
 - Portfolio management (orientations & structure)
 - Research Center Management (means & execution)



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The 3 main research areas

- Process
- Products
- Applications & Steel Solutions

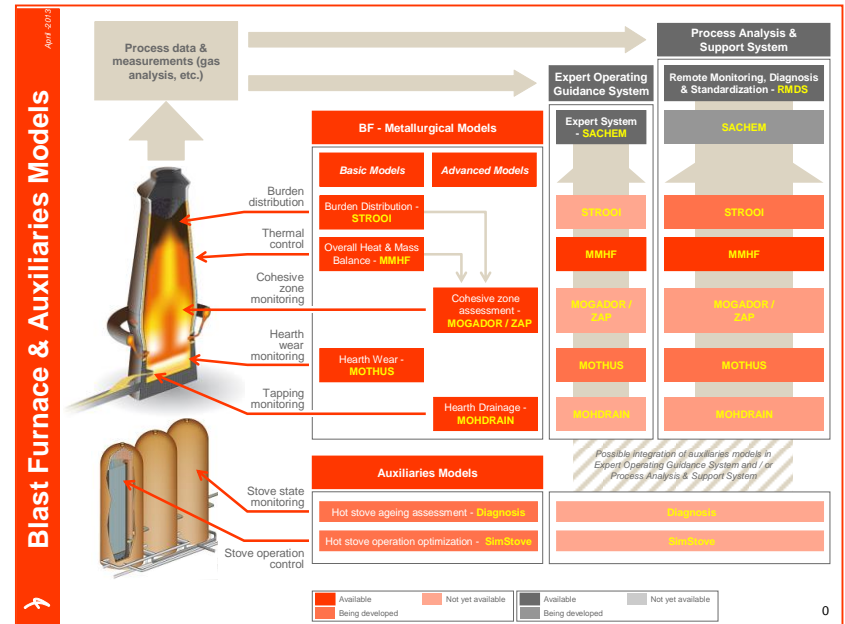




Example of Global Process project

Remote Monitoring Diagnostic and Standardization (RMDS)

- Real-time remote monitoring of blast-furnace parameters
- Integrated with key models and Expert Guidance systems
- Facilitates early detection of process problems
- Enables global process experts to collaborate in real time
- Identifies the most appropriate action at the right time
- Facilitates sharing of best practices
- Supports development of a universal knowledge-base



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Example of Automotive Product project

Innovative steel solutions for automotive weight reduction

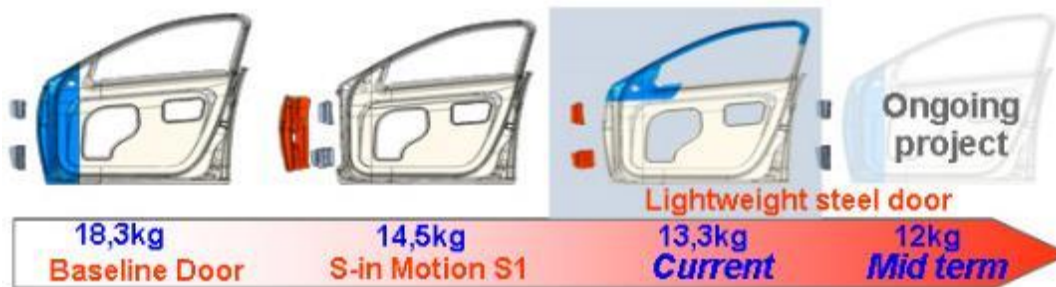
Weight reduction with attractive cost and without impacting vehicle performance

- S-in motion: A catalogue of 60 steel solutions:
 - Up to 20% weight savings, reducing the Green House Gas emissions (-6.2g CO₂/Km) during the use phase of the vehicle
 - 31 customer events (car makers & Tier 1)
- Lightweight steel door: Toward steel grades and process optimisation for lighter door solutions



ROLL OUT TO CUSTOMERS

- Increased collaboration with OEMs on co-engineering
- Contribution to significant growth of AHSS
- Increase of our patented solutions (e.g. Usibor® and Laser Welded Blanks)





Example – Magnelis®

A new metallic steel coating

- A metallic Zinc coating with 3.5% Aluminium, 3% Magnesium that offers ultimate corrosion resistance in aggressive environments (e.g. chloride & highly alkaline).
- Unique about Magnelis®:
 - improved cut-edge protection;
 - reduction of zinc coating mass
- Benefits:
 - Superior corrosion resistance in chloride & ammonia atmospheres
 - Self-healing on cut edges
 - Alternative to batch - galvanised steel
 - Cost savings

Markets:

Construction, public works, civil engineering, agricultural & farming, solar applications...





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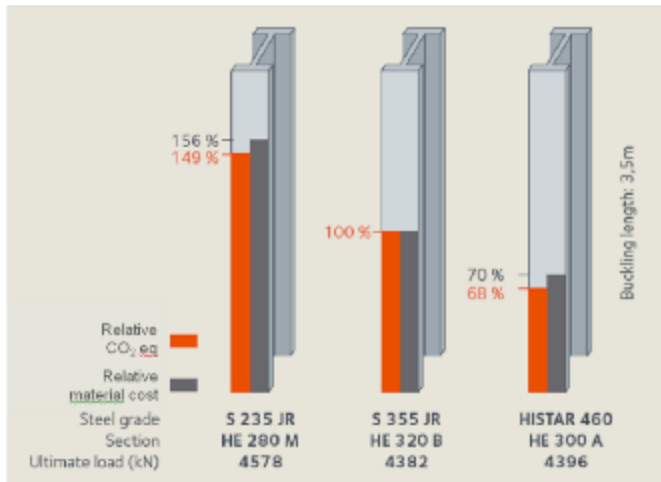
Example – HISTAR®

Most environmentally-friendly structural steel product

Jumbo HISTAR® beams improve the global performance in construction: cost and weight savings, reduction of CO₂ emissions

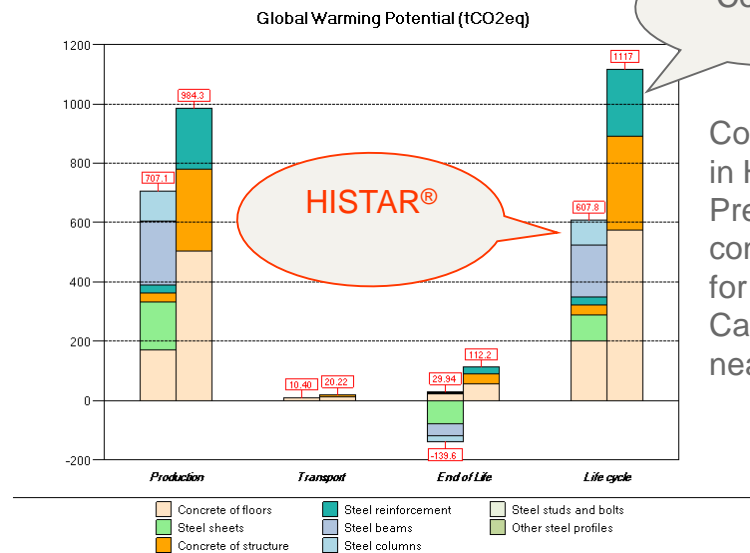


Steel vs Steel



Large improvement of Carbon footprint using HISTAR® column

HISTAR® vs Concrete



Concrete

Composite structure in HISTAR® vs Prefabricated concrete structure for office building. Carbon footprint nearly divided by 2

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Partnerships



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Open innovation

Because there are neither improvements nor breakthrough innovations without external exchanges and close cooperation, ArcelorMittal has set up an extensive network of partners:

- Customers
- Suppliers
- Universities
- Industries (steel, glass & other materials, engineering...)
- Communities
(scientific societies, regional bodies...)





3D printing with steel welding wires



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MX3D, Bridge project in Amsterdam



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Partnerships with customers

- A large proportion of our research into products and solutions is conducted within the framework of partnerships with customers
- More than 150 researchers are permanently involved in joint development groups with our customers:
 - 60% in automotive
 - 40% in packaging, construction, and general industry.



Academic Partners

4 categories :

- **Long Term Partners** and **Partner Centres**: Top Scientific Research groups in our core competences on very specialized topics, or beside our competences to complement our internal resources.
 - Key words: Long time relationship, mutual confidence, stability, worldwide excellence
- **Partner Universities** and **International Scientific networks**: Top Universities and Institutions in targeted countries for recruitment or with specific scientific and technical competences on key specialties for networking

Objectives	Cooperation in R&D Projects	Recruitment
Long Term Partners		
Partner Centres		
Partner Universities		
Long Term Partners		



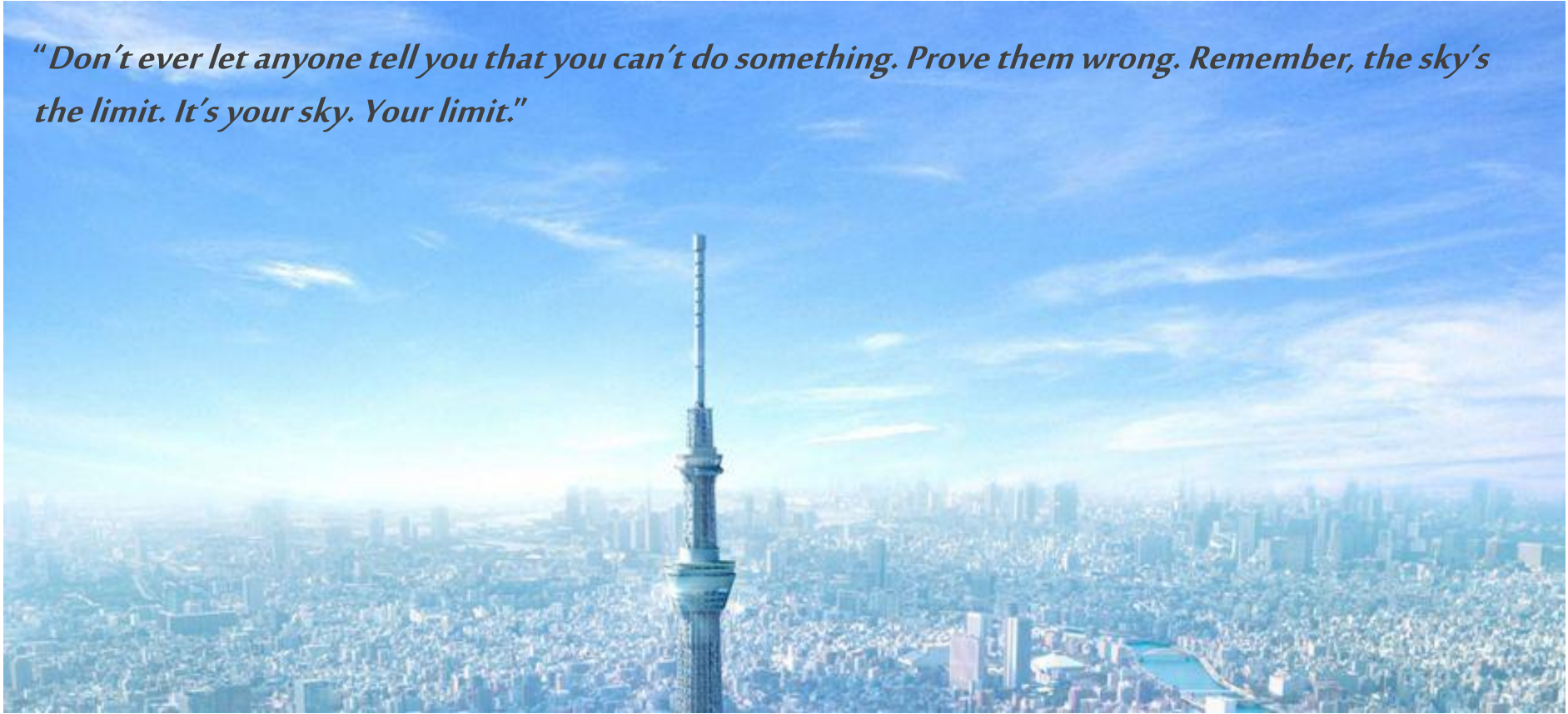
Lessons to be learned

- To answer Global market, the only way is to have a Global organization
- Multi culturality and differentiation in the way of working is a key challenge but also a key opportunity to stimulate creativity
- Partnerships are key to succeed, it is impossible today, for a company to have 100% of the necessary knowledge.



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"Don't ever let anyone tell you that you can't do something. Prove them wrong. Remember, the sky's the limit. It's your sky. Your limit."



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