

Flat Carbon Europe



ArcelorMittal

# update

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### Cover

Leading from the top

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- p. 1, 4-5: José Luis Méndez – ArcelorMittal Gijón, ArcelorMittal Dunkerque, ArcelorMittal Bremen
- p. 8-9: Mieres Tubos (Condesa)
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### Design & production

Geers Offset nv

### Editor

Dan Smith (MachMedia)

### Editor-in-chief

Dieter Vandenhende

### Editorial responsibility

ArcelorMittal Flat Carbon Europe S.A.  
Vanessa Vanhalst  
19, avenue de la Liberté  
L-2930 Luxembourg  
[www.arcelormittal.com/fce](http://www.arcelormittal.com/fce)





*In each edition of Update, an ArcelorMittal opinion leader speaks out. In this issue, Greg Ludkovsky, Vice President – Global Research and Development (R&D) talks about investing in the future of our products and solutions.*

## Investing in tomorrow

In line with our baseline 'transforming tomorrow', ArcelorMittal is continually researching the development of innovative steel solutions. Through our network of research centres and product development teams, including resident engineers, we are developing new steel solutions which meet customer demands for light, high-quality, environmentally friendly applications which create value. Much of this work is carried out using our co-engineering approach which involves our customers at every stage of the development cycle – from idea to production.

### Powering future mobility solutions

New applications include electrical mobility, where ArcelorMittal has recently launched the iCARE™ range of electrical steels for automotive (see page 6). iCARE™ steels are optimised to help carmakers design electric motors that are light, efficient and which can run for longer on a single charge. ArcelorMittal has also invested over €90 million in our St-Chély d'Apcher production facility in France. The mill already produces high-quality electrical steels, but will become the main production centre for the iCARE™ product range from early 2013.

ArcelorMittal has delivered the S-in motion project which demonstrates to carmakers the advantages of our ultra high strength steels (UHSS) and advanced high strength steels (AHSS). We have also proven that the advantages of S-in motion can be applied to a new generation of electric vehicles.

### Advancements in high strength steels

With a third generation of AHSS steels scheduled to become available in early 2014 and the development of new grades for hot stamping, even lighter and stronger vehicles will be possible. The new AHSS grades will be characterised by their improved formability at high strength.

The use of UHSS is also expanding to include high-thickness grades. Thicker grades are utilised in applications such as yellow goods (for example, construction and earth-moving equipment). ArcelorMittal is working to improve our UHSS grades to achieve strengths of up to 1,100 MPa to meet the demands of these heavy duty applications.

### Steels for specific applications

Packaging, however, relies on ultra-thin steels to meet customer demands for lighter and more environmentally friendly packaging. ArcelorMittal research teams are collaborating to develop higher strength steels with exceptional formability so that the gauge and weight of steel packaging solutions can be considerably reduced.

In the energy sector, ArcelorMittal is developing purpose-designed steels to suit specific energy applications. ArcelorMittal's R&D teams are collaborating with our customers to develop new lightweight solutions for wind turbines which will see their cost and environmental impact decrease significantly (see page 12).

New coatings such as Magnelis® are being exploited in solar energy installations to lengthen their life and reduce maintenance. Magnelis® utilises magnesium, aluminium and zinc to provide optimal surface protection against long-term corrosion. This revolutionary new coating has already been proven to perform significantly better than alternative European products and it is finding wide acceptance in the construction industry.

ArcelorMittal has also developed the Nature range of organic coated steels which are already revolutionising the construction industry. The high-performance coating does not contain hexavalent chromium or heavy metals, minimising its impact on the environment.

This is just an outline of some of the projects that ArcelorMittal has researched over the past few years. All have been developed in response to customer demand for sustainable steel solutions. ArcelorMittal's commitment to the future of our customers and the sustainability of our industry means that we will continue to research and invest in innovative new steel solutions.

### Greg Ludkovsky

# Leading from the top



## The reuse of high pressure flue gas from the top of the blast furnace is reducing ArcelorMittal's carbon footprint – and our energy bill!

**Over the past few years, ArcelorMittal has been perfecting the installation of Top Recovery Turbines (TRTs) to generate energy. TRT technology utilises the high-pressure gases (known as flue gases) which collect at the top of the blast furnace to drive very efficient electricity generators. Installed at just four sites so far, the TRT technology is already reducing ArcelorMittal Flat Carbon Europe's (FCE) energy bills by more than 3% a year. Implementation of TRT is part of ArcelorMittal's ongoing commitment to research and develop improvements to our processes in order to ensure our technological superiority in the use of energy and raw materials, reduce manufacturing costs, improve quality and minimise our environmental impact.**

While the economic benefits of installing TRT are considerable, the environmental advantages are also an important consideration. ArcelorMittal's current production of energy from TRT reduces CO<sub>2</sub>-equivalent emissions by around 176,000 tonnes/year. That equates to removing more than 35,000 cars from the road. TRT is also very sustainable as there are zero emissions from the process of producing electricity using this technology.

### **Generates energy with no emissions**

The TRT turbine generates energy by exploiting a known property of all gases – that they expand as their pressure drops. Dry and wet scrubbing is used to remove fine particulates from the flue gas as it leaves the blast furnace. At this point the pressure is between 1.6 and 2.5 bar. During the scrubbing process the gas cools, and its pressure drops about 0.3 bar. That needs to be reduced to 0.1 bar for the gas pipe

network. The most energy efficient way to do this is to lead the gas through the turbine where it drives a generator to produce electricity.

There is no influence on the operation of the blast furnace and the flue gas is not consumed. As blast furnace gas is very combustible, it is normally utilised in other parts of the plant to generate heat or energy for other processes. With the TRT system installed, the flue gas effectively

## Key electricity generation figures achieved at the test installation site

Flue gas pressure	At top of blast furnace	1.6 bar
	After scrubber (with TRT)	1.3 bar
	After TRT (gas network)	0.1 bar
Turbine power		7.018 MW
Generator efficiency		97.6%
Transferred electrical energy		6.849 MW

ArcelorMittal is actively looking for energy partners to help us increase the amount of electricity we produce from TRT.



TRT technology has been installed in six of FCE's blast furnaces. Another eight have been identified as being suitable for conversion.



A TRT rotor being readied for installation.



Flue gases are cleaned before being led through the TRT to generate electricity. The gas can still be utilised in other parts of the plant to provide heat and energy for other processes.

generates energy twice – once in the turbine and again when it is burnt for its usual purpose. For more detail on how flue gases are utilised in ArcelorMittal's Gent mill, see 'Energizing steelmaking!' in the May 2012 edition of *Update*.

TRT is a proven technology and there is little risk in its installation or operation. If the TRT system fails for any reason, the expanding gas is accommodated in the existing scrubber. This is normal in blast furnaces which do not have a TRT system installed.

### TRT partners sought

Each TRT has the same capacity as three to four land-based wind turbines. To date TRT systems have been installed in six blast furnaces at four of our sites and are generating more than 482 Gigawatt hours (GWh) of electricity each year. ArcelorMittal FCE's energy bill has dropped as a result. TRT also provides ArcelorMittal with security over the sustainability of our

long-term energy supply, and reduces our exposure to rising energy prices.

ArcelorMittal is actively looking for energy partners to help us increase the amount of electricity we produce from TRT. An additional eight blast furnaces in Europe have been identified as being suitable for conversion. Together they have the potential to produce another 475 GWh/year using existing TRT technology.

ArcelorMittal hopes that the TRT technology can be rolled out to its blast furnaces across the world. While Europe is leading in the introduction of TRT, significant efforts are already underway at our plants in Brazil and South Africa. With wider implementation of the TRT technology, ArcelorMittal will be able to sustainably secure even more of our energy supply needs. ■

TRT is very sustainable as there are zero emissions from the process of producing electricity using this technology. The process is 100% green.

# iCARE™: Powering the future of mobility

The iCARE™ portfolio of electrical steels has been created by ArcelorMittal to help carmakers develop innovative mobility solutions for a more sustainable world.

**ArcelorMittal unveiled the iCARE™ range at the Coil Winding, Insulation and Electrical Manufacturing Exhibition (CWIEME), held in Berlin during June 2012. As part of our strategy for the electric vehicle (EV) sector, ArcelorMittal has also invested over €90 million in our existing St-Chély d'Apcher production facility in France. The investment includes a new continuous annealing line which will enable ArcelorMittal to increase capacity and introduce breakthrough technologies for EVs.**

The new range of iCARE™ electrical steels, together with the improvements at St-Chély d'Apcher, will help carmakers to deliver lower CO<sub>2</sub>-equivalent emissions and reduce the fuel consumption of hybrid vehicles. They will help automotive designers to increase the range of pure electric vehicles and lower the total cost of electrification. iCARE™ steels also promise to deliver increased power density from

electric motors, helping to reduce the size and weight of low-emission vehicles through enhanced energy-efficiency.

'As the leading supplier of steel to the global automotive industry, ArcelorMittal already enjoys enviable heritage and expertise in this space,' commented Greg Ludkovsky, ArcelorMittal's Vice President – Global Research and Development



(R&D). 'The launch of the iCARE™ portfolio reflects not only the global shift towards more energy-efficient vehicle technologies, but also the benefits delivered by our R&D-driven approach to innovation. In 2011 alone, we invested €250 million in researching and developing new steel products, solutions and processes to support a low-carbon world, demonstrating the sustainable advantages available through product innovation.'

iCARE™ is all about helping carmakers create a greener world, by finding innovative and environmentally friendly mobility solutions for the CAR of tomorrow.

## Three distinct iCARE™ grades

The iCARE™ portfolio includes three grades of electrical steel. They are designed to meet specific challenges presented by the shift towards electrical mobility. The grades are:



**iCARE™ Save:** offers very low electrical losses which maximises the use of current coming from the battery, enabling EVs to drive further on a single charge.



**iCARE™ Torque:** ensures the highest levels of mechanical power output from electric motors, generating improved acceleration and a more dynamic driving experience.



**iCARE™ Speed:** is a very high-strength electrical steel which is ideal for the manufacture of high-speed rotors. This type of rotor allows carmakers to reduce the weight of the motor even further.

## Improvements at St-Chély d'Apcher

The new continuous annealing line which is being built at our St-Chély d'Apcher mill will ensure that ArcelorMittal remains a leader in the development and production of non-oriented electrical steels. The line will enable ArcelorMittal to produce top level electrical steel grades with the highest levels of efficiency and which demonstrate increased permeability, reduced loss levels, and improved high frequency behaviour. Our goal is to be able to respond quickly to the demands of emerging and highly technical products and of our existing electrical steel clients.

The new continuous annealing line will replace an existing line and increase

production capacity and quality. It has a modular design which will enable ArcelorMittal to meet future demands for product development and capacity.

ArcelorMittal is already the foremost supplier of steels to the global automotive industry. The new iCARE™ offering and improvements at St-Chély d'Apcher will ensure that we retain this position as our automotive customers start to develop and build the electrical and hybrid mobility solutions of the future.

## Coatings and support available

ArcelorMittal also offers coatings for the iCARE™ range, designed to further enhance and customise the behaviour of each of the iCARE™ steel grades. The coatings provide interlaminar insulation and improve the punchability of the electrical steels. They are suitable for fully processed grades for hybrid and electric traction machines and compressors.

A suite of iCARE™ advanced services offer further technical support for automotive customers. These include:

- **Modelling:** ArcelorMittal provides customers with the help they need to choose the most suitable steels and to design the electrical machine. This assistance utilises both our advanced R&D know-how and the high-tech equipment available in our research centres. These modelling services enable design engineers to reduce the number of prototypes needed before pre-series and series production can begin.
- **Prototyping:** A minimal amount of prototyping is still needed to prove the machine's performance. ArcelorMittal can offer small quantities of sheets for first stage Epstein and tensile testing, and for the next stage of laser cutting. In the industrial validation phase, ArcelorMittal can provide small slit coils for punching and machine assembly development.
- **Material processing:** The production of prototype or series machines can involve production processes that have the potential to degrade the properties of the fully processed steels we have supplied. Advanced R&D support is available to help customers quantify the impact of material handling processes on the magnetic performance of the machine's lamination stack.

## More information?

For more information about the iCARE™ range, please visit [www.arcelormittal.com/automotive/icare](http://www.arcelormittal.com/automotive/icare)

# Keeping Europe on the road

**ArcelorMittal's high strength steels offer lighter, stronger and safer solutions for road safety barriers.**

## The N2-type safety barrier standard

N2-type safety barriers are typically located along highways and at the exits of motorways. Under the new EN 1317 standard, N2-type safety barriers must contain a car with a mass between 900 and 1,500 kg in the event that it runs off the road.

Mieres Tubos also designs their N2-type safety barriers so that a vehicle will decelerate smoothly when in contact with the safety barrier. This prevents the vehicle's occupants from being violently shaken. The safety barrier also acts to help the driver regain control of the steering, reducing the chance that the car will return to the flow of traffic in an uncontrolled manner.

In 2011, a new standard for safety barriers came into force across the European Union. Focus shifted to performance-based standards which enable safety barrier makers to innovate and introduce new designs in order to improve performance and reduce costs. ArcelorMittal Flat Carbon Europe recently partnered with Mieres Tubos (Grupo Condesa) to develop a new N2-type safety barrier (see text box). The project demonstrates how a simple change in material choice can make a big difference to safety, performance and cost.

Mieres Tubos is a Spanish company which develops simple, safe and reliable safety barriers that are easy to install and integrate with other systems. The company approached ArcelorMittal with the goal of developing a new N2-type safety barrier which met its design considerations, and which also offered significant weight and cost reductions.

## Switch to high strength steel

Following consultation with ArcelorMittal's Global R&D researchers and engineers, the co-engineering team decided to replace the existing hot rolled structural steel (grade S235JR) with a new high strength steel (HSS).

Through S-in motion and other projects, ArcelorMittal has already demonstrated that HSS provides significant weight reductions while increasing the safety of vehicles thanks to its high tensile strength.

The higher strength means that less steel is required, leading to lower weight and a reduction in CO<sub>2</sub>-equivalent emissions. In this case the switch to the HSS grade resulted in the new safety barrier being more than 25% lighter. Performance was also improved dramatically and manufacturing costs were lowered.

The high strength of the new grade also made it possible to double the distance between the posts which secure the safety barrier in place. Instead of 50 posts per 100 metres of safety barrier, only 25 posts are needed. Together with the weight saving from the change to HSS, this simple design change has enabled transportation and installation costs to be reduced by at least 25%.

## European safety standards met

The new N2W4A safety barrier successfully passed two crash tests conducted by an



*In the first few months after its launch, more than 25 kilometres of Mieres Tubos (Grupo Condesa) new N2-type safety barrier were installed in Spain.*

external certification body in the first quarter of 2012. The safety barrier now carries the CE marking, meaning that it meets the EN 1317 standard and can be utilised across Europe.

Thanks to the reductions in weight, installation time, and lower raw material and manufacturing costs, the new N2 safety barrier is opening many opportunities for Mieres Tubos. It has also led to environmental benefits as CO<sub>2</sub>-equivalent emissions are reduced during production, transportation and installation. Society also benefits from improved road safety at a lower price. With the implementation of the N2 safety barrier now complete, Mieres Tubos has sought ArcelorMittal's help again to create a new safety barrier with an even higher containment level.



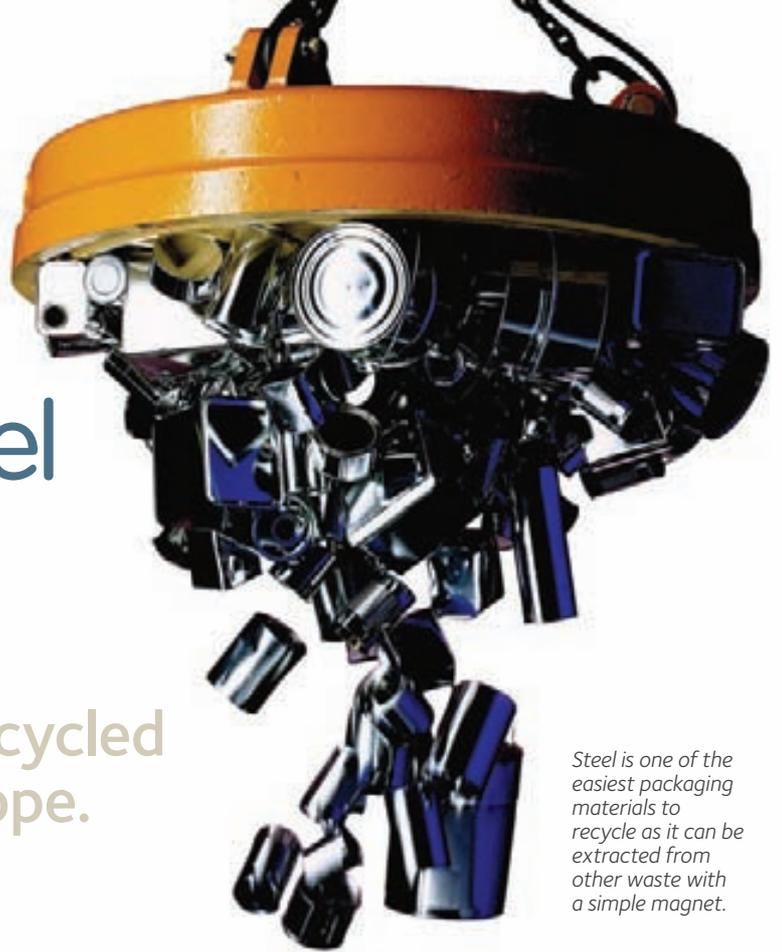
**The switch to the HSS grade resulted in the new safety barrier being more than 25% lighter. Performance was also improved dramatically and manufacturing costs were lowered.**

### **Magnelis® coating offers long-term protection**

Road safety barriers are subject to wear and tear from bumps and atmospheric corrosion. To ensure the safety barrier can last for an expected life of up to 25 years, ArcelorMittal's high strength steels can be either batch or continuously galvanised. Both methods meet the EN 1317 specification and provide protection for the life of the safety barrier.

However, ArcelorMittal customers can now utilise our Magnelis® coating which offers up to ten times the protection of batch galvanisation. Magnelis® utilises 3.5% aluminium and 3% magnesium to create a stable and robust layer of protection across the entire surface of the steel. The edges of the Magnelis® coating will even self-heal if they suffer damage – a property that other coatings cannot match.

# Reducing the carbon footprint with steel packaging



Steel remains the most recycled packaging material in Europe.

*Steel is one of the easiest packaging materials to recycle as it can be extracted from other waste with a simple magnet.*

**Did you know that more than 50 billion steel cans are sold each year in Europe? That's an average of two cans per week for every citizen! Around 71% of those cans are being recycled. As each item of recycled steel packaging saves about one and a half times its weight in CO<sub>2</sub>-equivalent (eq) emissions, steel is also one of the most environmentally friendly packaging materials available. Although steel is the most recycled packaging material in Europe (see figure 1), the industry has set a challenging new recycling target for the medium term. The steel industry is getting stakeholders such as business organisations and policy makers on board in order to achieve this goal.**

## New recycling target set

During the Eurofer Steel Day in June, the Association of European Producers of Steel for Packaging (APEAL) revealed that steel recycling had remained stable at around 71% in 2010, the latest year for which data is available. That rate means that almost 700 million cans are being recycled each week. This reduced CO<sub>2</sub>-eq emissions from steel packaging production by more than four million tonnes in 2010.

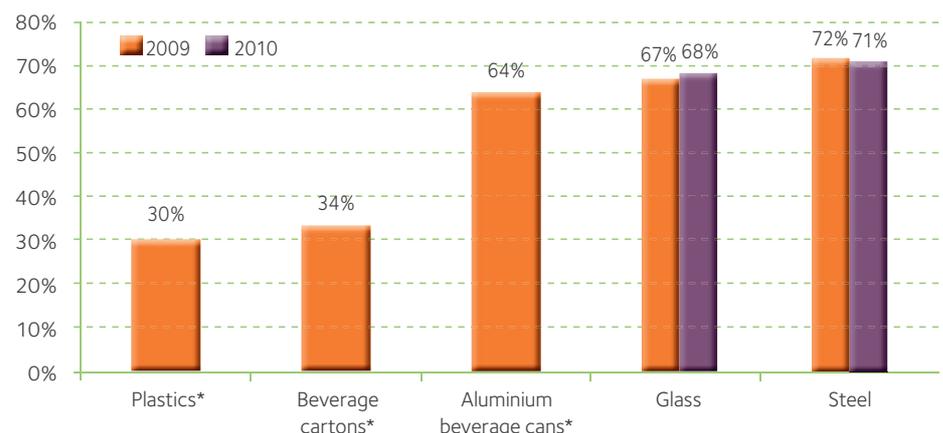
APEAL, of which ArcelorMittal is a member, also announced that the metal packaging industry (through Metal Packaging Europe) had set a recycling target of 80% by 2020. The move is part of the Europe 2020 strategy which aims to develop a low carbon and resource-efficient economy within the European Union (EU). As metal packaging also includes aluminium (which only had a recycling rate of 64% in 2009), it seems certain that the recycling rate for steel will need to be well in excess of 80% by 2020.

As well as its role within APEAL and other industry organisations, ArcelorMittal is an active partner in the European recycling industry. For example, in France ArcelorMittal has scrap steel recovery contracts with some municipalities. The steel scrap is recycled

in ArcelorMittal's French plants. This proactive approach reduces emissions even further as scrap transport and handling is minimised. In Spain, ArcelorMittal is closely involved with national organisations which look at recycling targets and practices.

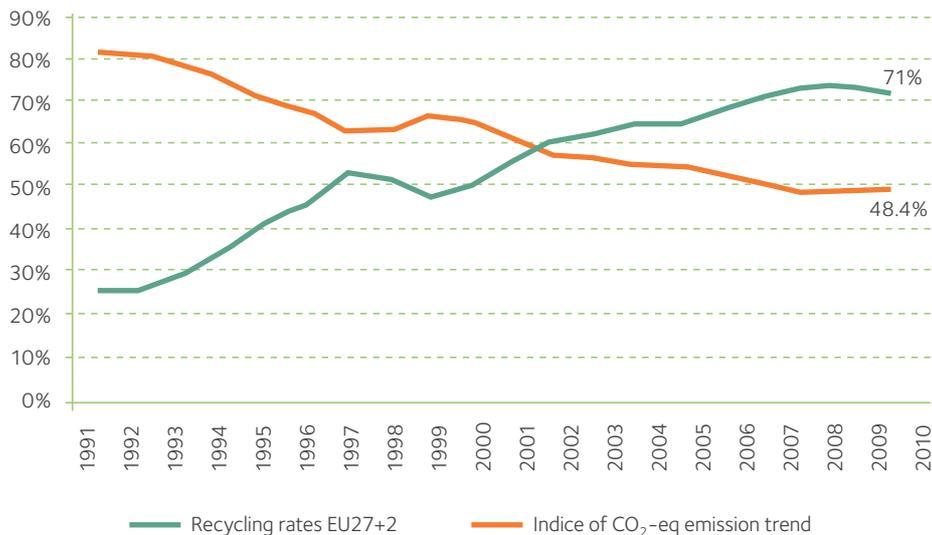
**Figure 1: Recycling rates for major European packaging materials**

(Sources: PlasticsEurope, ACE, FEVE and APEAL)



\* 2010 figures for plastics, beverage cartons and aluminium beverage cans not available

**Figure 2: Improvements in the recycling rate of steel packaging have a significant impact on CO<sub>2</sub>-eq emissions**



**7 key benefits of steel for packaging**

The Eurofer Steel Day also saw the promotion of [www.steelforpackaging.org](http://www.steelforpackaging.org), a new website dedicated to steel packaging. Also available as an app, it enables producers, can makers, fillers and retailers to easily access the latest data for steel packaging’s seven key benefits: Recycling, Performance, Use, Manufacturing, Efficiency, Versatility and Safety.

It includes the new life cycle inventory (LCI) figures for steel packaging released by APEAL based on data from 2008. The new study covers 95% of European producers of tinplate, the thin steel used to create most steel packaging. Compared to data released for 2006, the life cycle impact of steel packaging on the environment has shown an improvement in most areas. For example, the global warming potential has dropped by 9% in three years time (see

table). That is particularly significant given the short lifespan of packaging compared to other products.

APEAL’s goal is to increase the frequency of LCI updates to provide relevant data for industry partners. The next update, containing data for 2010/2011 should be available in 2013.

The new LCI data and recycling numbers prove that steel remains one of the greenest packaging materials available. Through ongoing monitoring of its performance, the industry will be able to continue to offer steel packaging solutions which meet the needs of consumers, can makers and fillers, while continuously improving the impact of steel packaging on the environment.

**Comparison of main life cycle inventory (LCI) indicators 2008 data (APEAL) versus 2006 data (worldsteel)**

Indicator	2008 versus 2006
Primary (renewable and non-renewable) energy demand	-3%
Global warming potential	-9%
Acidification potential	-6%
Eutrophication potential (EP) – a measure of the potential effect of artificial or natural substances on ecosystems	-11%

Steel does not lose any of its properties, regardless of the number of recycling loops it goes through. Recycling scrap to produce new steel also lowers its environmental impact by more than half compared to using virgin materials.

**EU Parliament recognises steel as a permanent material**

Materials are generally categorised as either renewable or non-renewable resources in existing legislation on packaging, recycling and material use. Renewable resources belong to the natural environment and can be replaced by natural processes. Non-renewable resources are those that are consumed at a faster rate than they can be replaced by nature or that are only available in limited quantities.

Steel, like a few other materials, does not fit into either category as its raw materials are abundant and it cannot be destroyed. Steel does not lose any of its properties, regardless of the number of recycling loops it goes through. Recycling scrap to produce new steel also lowers its environmental impact by more than half compared to using virgin materials (see figure 2).

To recognise these unique properties, the metal packaging industry invited the EU to create a new category for permanent materials such as steel. Although the first meetings were only held at the end of January, the European Parliament has already asked the European Commission to recognise this new category in future policies relating to resource efficiency. Metal Packaging Europe is working with the European Commission to establish further areas for collaboration.

**More information?**

For more information about ArcelorMittal’s steel packaging solutions, please visit [www.arcelormittal.com/packaging](http://www.arcelormittal.com/packaging) and [www.apeal.org](http://www.apeal.org)

# Winds of change

ArcelorMittal and Siemens cooperate to supply the next generation of wind farms.

In recent years there has been a steady growth in the number of wind-power generation projects around the globe. ArcelorMittal is very active in the sector as a leading supplier of heavy plate for traditional welded towers and electrical steels for the turbines. Siemens is a major player in the implementation of wind farms with more than 11,000 turbines installed worldwide. Although Siemens and ArcelorMittal already have a long history of cooperation, Siemens was looking for a long-term steel partner who could match their global footprint and provide them with the expertise and technical experience the company needed for success in the wind power segment.

ArcelorMittal and Siemens are now working closely together to build the next generation of wind-power plants.

For Siemens, one of the prime considerations was the ability of their steel supplier to guarantee stable lead times. With wind towers using up to 180 tonnes of heavy plate and up to 175 individual turbines in a wind farm, the logistics of ensuring just-in-time deliveries of steel are critical for success. The heavy plate is used to construct both the tower and, in offshore installations, the jackets that keep the turbine stable on the sea floor.

#### Global customer team

To meet the Siemens challenge, ArcelorMittal established a global customer team including technical experts, representatives from the mills, and marketing and sales personnel. This team worked closely together to respond quickly to the customer's requirements – imperative in such a complicated supply chain. The team also undertook research and development activities in order to maximise cost savings for the client.

ArcelorMittal is already a well-regarded supplier of heavy plate from a number of our mills around the world. One of the largest is ArcelorMittal Gijón in Spain, ideally situated to meet Siemens European needs.

In November 2010, Siemens placed a trial order for heavy plate to build 21 wind towers at the Hill of Towie Wind Farm in Scotland. Thanks to the work of the ArcelorMittal customer team and the Gijón mill, the first plates were shipped in January 2011.

With the success of the first order, Siemens placed an additional order for hot rolled coils of high strength steel to build a new generation of 'shell' towers. Unlike other wind towers, shell towers can be higher than normal and are held together using bolts rather than welding.



#### Production and processing

To answer the growing demand from Siemens in Northern Europe, an entirely new supply chain was developed and implemented. All supplying units (including external suppliers) were extensively audited by Siemens before they could be integrated into the supply chain.

ArcelorMittal also took on the challenge of both producing and processing the heavy plate. Processing is handled by ArcelorMittal's partners who are located close to our Gijón mill. Together we have built a competitive offer for Siemens which is unbeatable in terms of quality. The added value ArcelorMittal and our partners are able to offer also creates significant cost savings for Siemens.

As a result of this cooperation, Siemens and ArcelorMittal agreed on a long-term contract for the supply of heavy plate for Siemens' wind turbine needs at the end of 2011. The agreement was possible thanks to ArcelorMittal's proven ability to understand and meet the customer's needs, our global footprint, and speed of delivery. ArcelorMittal and Siemens are now working closely together to build the next generation of wind-power plants. ■

#### About Siemens

Siemens is the largest European-based engineering and electronics company with interests across the world. The company is active in a number of sectors including mobility, industry, construction, and renewable power generation.

In the field of renewable energy, Siemens Wind Power is a leading supplier of wind power solutions for onshore, offshore and coastal sites. With over 30 years of experience and more than 11,000 wind turbines installed around the world, Siemens offers integrated solutions and services that meet the demands of wind markets around the globe.

#### Big is beautiful

Large-scale wind power plants are becoming increasingly common around Europe. Siemens is currently implementing the London Array offshore project. Siemens will supply 175 of its SWT-3.6 wind turbines to the London Array, which is jointly owned by DONG Energy, E.ON and Masdar. Upon completion, the London Array will be the largest offshore wind farm in the world with a capacity of 630 megawatts (MW). There is also an option to further expand the wind farm up to 1,000 MW in the future.

# Lightening the footprint of commercial vehicles



## ArcelorMittal develops a cost-effective lightweight modular steel platform for fuel-powered and electric light commercial vehicles.

**Load capacity has traditionally been the first concern for designers of light commercial vehicles (LCVs). Today's criteria include cost, environmental performance, and the fact that LCVs (also known as vans) are now used to transport both goods and people. If the LCV is to be electrically powered or used to transport passengers, a vehicle with higher safety standards is required. Addressing these needs at the lowest possible cost requires modular solutions which can be serially produced to meet demand.**

From 2017, makers of N1-type LCVs (see text box) will face financial penalties in the European Union if the emissions of their vehicles exceed 175 grams/kilometre. While this limit will be phased-in from 2014, the 2020 target is just 147 g/km. These targets are pushing van manufacturers to look at a range of solutions from weight reduction to a complete shift towards electric power.

With these considerations in mind, ArcelorMittal's Automotive Global R&D team set out to create a new underbody platform for both fuel- and electric-powered LCVs. The goal was to develop a single underbody module which can reduce

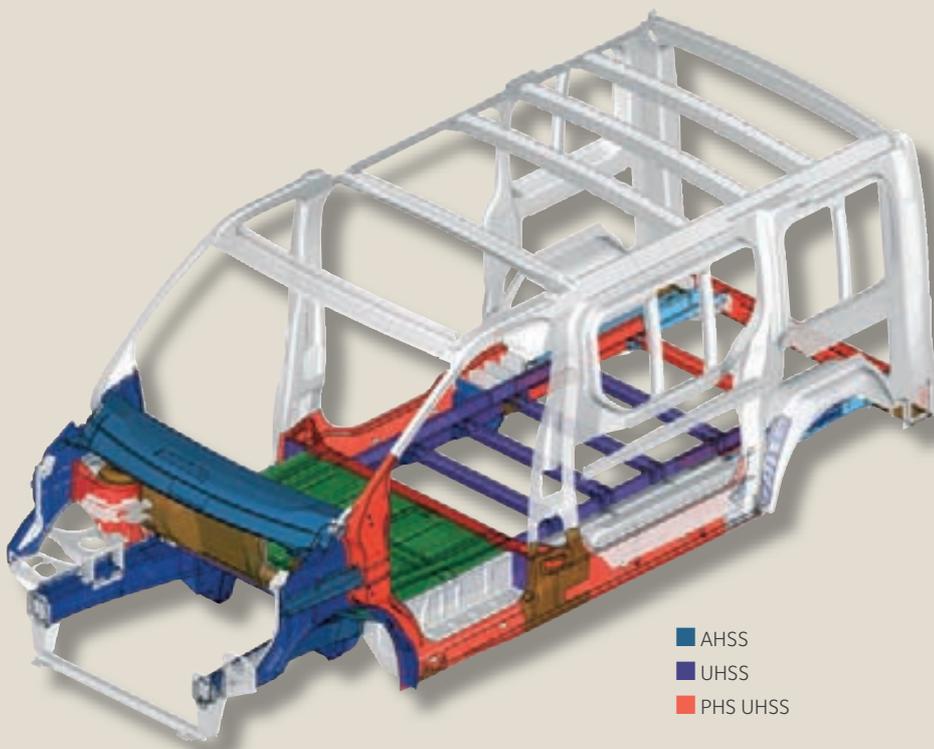
the weight and total cost of ownership of both variants. The underbody was chosen as the first module for optimisation as it is typically similar across different models. Manufacturers often utilise the same underbody for 10 to 12 years, simply modifying the upper structure to create new passenger models or cargo versions with different volumes.

### Increased use of high strength steels

A recent-model baseline LCV was selected for the fuel-powered engine study. The reference underbody mainly comprises high strength low alloy (HSLA) steels and had a total mass of 193 kg.

Utilising ultra high strength steels (UHSS) and advanced high strength steels (AHSS) such as Usibor® and Ductibor®, ArcelorMittal's engineers have been able to reduce the total weight of the underbody to 155 kg, a reduction of 38 kg or 19.8% compared to the baseline model. UHSS and AHSS now represent more than 85% of the underbody module.

**AHSS and UHSS can cost-effectively reduce the weight of light commercial vehicles and improve safety.**



Over 85% of the redesigned LCV underbody is comprised of AHSS and UHSS, including PHS (press-hardened steel, Usibor®).

## What are light commercial vehicles (LCVs)?

In the EU, LCVs are classed as either M1 or N1 and account for around 12% of the EU market for light-duty vehicles. M1 vans are used to transport passengers and have a maximum of eight seats, not including the driver. N1-type LCVs are designed for the carriage of goods and have an unladen weight less than 3,500 kg.

N1 models fall into one of three main sizes. The smallest can carry around 800 kg of cargo and have a load space of about 3 m<sup>3</sup>. In the middle, models typically have a capacity of 1,200 kg in a 7 m<sup>3</sup> load area. The largest LCVs can carry 2 tonnes of cargo and typically have a volume of 17 m<sup>3</sup>.

### Lower cost and weight, equal safety

ArcelorMittal engineers paid particular attention evaluating the performance of the redesigned underbody in several crash scenarios. Analysis of frontal, rear and lateral crash data for the fuel-powered model has shown it has the equivalent

safety performance as the baseline, despite the significant weight reduction.

Although more costly and stronger UHSS and AHSS have been used in the design, overall material costs of the optimised solution are lower. This is because much less material is required to achieve the

required performance. Industrial validation is expected to show that further savings can be achieved during manufacturing thanks to process improvements and the use of laser welded blanks (LWBs).

The study has proven that UHSS and AHSS have the potential to lighten LCVs and reduce costs. By utilising them in other parts of LCVs, such as the upper structure, even greater savings should be possible while improving safety.

### Electric LCVs

As electric technology matures, more light commercial vehicle (LCV) manufacturers are expected to launch electric-powered vans. Most manufacturers utilise the same underbody for both their electric- and fuel-powered models.

As part of this study, Automotive Global R&D has developed a battery-powered LCV solution. While work on this variant is ongoing, ArcelorMittal's engineers anticipate a weight reduction of the underbody by around 19%.

The baseline electric vehicle has a payload of 900 kg and a range of 130 km. By reducing the weight of the underbody, vehicle manufacturers can either increase the payload or improve the vehicle's range.

Significant attention has been paid to the design in order to prevent vehicle parts from penetrating the battery in the event of a crash. The frontal crash management strategy has focussed on the reinforcement of the front side members and the use of laser welded blanks (LWBs) to manage crash energy. As the battery comes close to the edges of the underbody, lateral crash management has been a major consideration. Side sill reinforcement has been added using a lightweight AHSS. UHSS and AHSS have also been used to create a crash box and cross member to absorb energy in the event of an accident.

Although more costly and stronger UHSS and AHSS have been used in the design, overall material costs of the optimised solution are lower.

### More information?

For more information about the LCV study, please get in touch with your regular ArcelorMittal contact person.

# Enamelling goes green

Appliance makers can now reduce their carbon footprint, reduce costs and increase throughput thanks to ArcelorMittal's new Ready-to-Enamel steel.

**Enamelled steel has many applications both in domestic and industrial appliances. The enamelling process protects the underlying steel from corrosion and provides a beautiful, easy to clean surface which can resist food acids, heat and everyday damage. Enamelling also prevents the growth of bacteria, making it a popular finish in domestic and industrial applications such as cookware, oven linings, cooking hobs, bench tops and washers. ArcelorMittal's new Ready-to-Enamel steel now enables appliance makers to develop more environmentally friendly enamelling processes.**

The unique organic binder on the Ready-to-Enamel cold rolled steel accelerates the bonding reaction, enabling a 20 to 30°C drop in firing temperature and reducing firing time by between 15 and 25%. Productivity is increased while less energy is consumed. Lower temperatures also mean less deformation of the enamelled parts during firing, improving yield. Ready-to-Enamel has much better formability than other enamelling steels and does not require re-oiling.

Ready-to-Enamel also simplifies the enamelling process as no degreasing is required. By removing this step the amount of water, energy and consumables required decreases significantly. The steel's dry coating also means cleaner workshops, creating additional savings.

The organic binder used on Ready-to-Enamel contains nano particles of non-oxide ceramics which play the same role as carbon in other enamelling steels. The nano particles bind with the oxides in the enamel and increase adherence. Bonding elements such as cobalt and nickel are avoided to ensure Ready-to-Enamel complies with Europe's REACH regulations on the Registration, Evaluation, Authorisation and Restriction of Chemicals.

## LCA shows significant savings

ArcelorMittal estimates that the cost of an enamelled part can be reduced by between 9 and 12% using the ground-coat enamelling process (see illustration). For 2C/1F (two-coat/one-fire) enamelling,

costs are reduced by between 6 and 9% depending on the part to be enamelled.

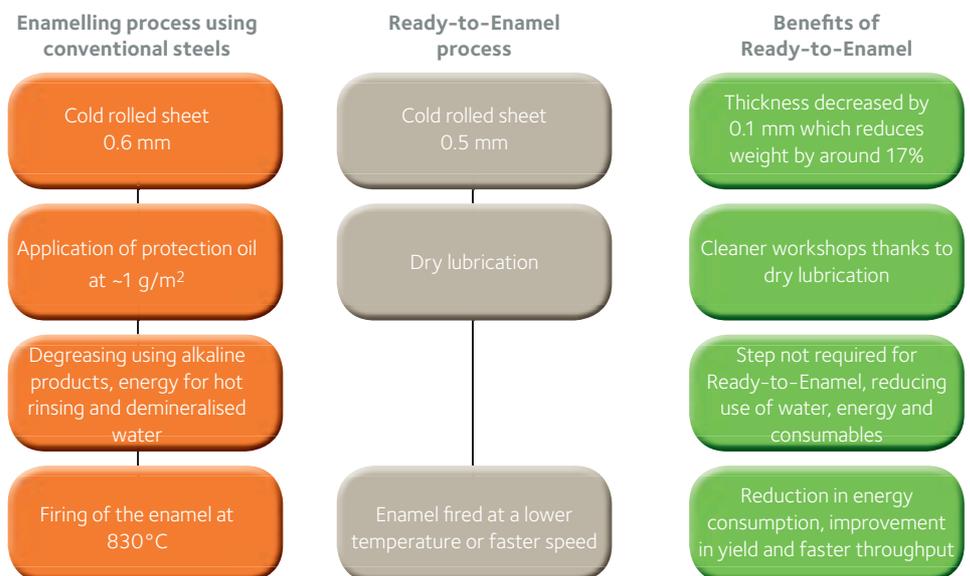
A life cycle analysis (LCA) of Ready-to-Enamel was carried out using the World Steel Association's methodology. The gate-to-gate evaluation focussed on three stages of the enamelling process: steel production, pretreatment and enamel firing.

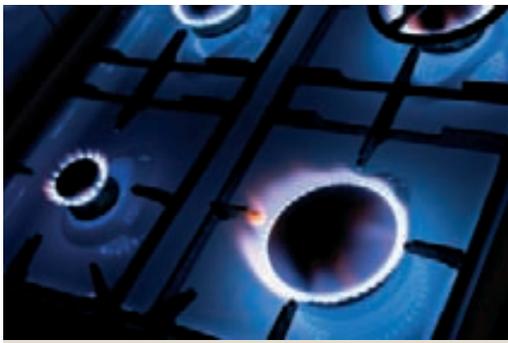
The LCA showed that Ready-to-Enamel could reduce CO<sub>2</sub>-equivalent (eq) emissions by 8% and primary energy by 9%. If an enameller uses 3,500 tonnes of Ready-to-Enamel steel per year with the ground-coat enamelling process, he could

The life cycle analysis showed that Ready-to-Enamel could reduce CO<sub>2</sub>-equivalent emissions by 8% and primary energy by 9%.

save 546 tonnes of CO<sub>2</sub>-eq emissions and 8,000 gigajoules of primary energy. The reduction in CO<sub>2</sub>-eq emissions equates to 4 billion kilometres of travel in a mid-range car or the amount of carbon stored by a 78 hectare forest in a year (source French Environment and Energy Management Agency – ADEME).

## Ready-to-Enamel simplifies the enamelling process while reducing costs, emissions and the weight of enamelled products





## Ready-to-Enamel works with main enamelling processes

Ready-to-Enamel can be used with both the ground-coat and 2C/1F enamelling processes. Both wet and dry application are possible with ground enamelling.

In the two-coat, one-firing process (2C/1F), the ground and powder cover coats are applied on top of each other and then fired. It is also possible to use both wet and dry (powder) coatings. The following 2C/1F systems are in use today:

- **2C/1F – dry/dry**

A powder ground coat and a powder cover coat are applied to the steel. Both coatings can be immediately fired as no drying is required.

- **2C/1F – wet/dry**

A thin wet ground coat is applied and then dried. The cover coat enamel is applied and the steel is fired.

- **2C/1F – wet/wet**

The ground and cover coats are applied wet, one after the other. Once both coats are applied they must be completely dried before firing.

Ready-to-Enamel can be used with wet and dry enamelling application processes. A surfactant must be added to the enamel slip in the wet ground-coat enamelling process. For the 2C/1F process, wet/dry and dry/dry systems can be used.

ArcelorMittal is also working with enamel suppliers to optimise their formulas. While tests have shown that existing coatings work with Ready-to-Enamel, development of new enamels should lead to reductions in the cost of ground-coat enamels.



The reduction in primary energy is equivalent to 190 tonnes, or almost 1,400 barrels of oil. That's enough to meet the energy consumption needs of 37 typical French families for a year (source ADEME).

Following extensive testing with our clients, Ready-to-Enamel is available now and ready to ship. ArcelorMittal can provide full technical and co-engineering support for appliance makers and enamellers who want to introduce Ready-to-Enamel. We can also trial your existing coatings with Ready-to-Enamel in ArcelorMittal's test facilities. Contact us now to find out how we can help you turn your enamelling processes green!

## Thinner Ready-to-Enamel sheets lighten the weight of enamelled cladding in architectural applications.

## Lighter weight makes enamelled cladding possible

The weight reduction offered by the use of Ready-to-Enamel steel also makes it attractive for architectural applications including building cladding. Previously, laminated cladding required large panels with a thickness of 1.5 mm. With Ready-to-Enamel the thickness of the panel can be reduced which lightens the weight of cladding significantly. Ready-to-Enamel coils are available in sizes up to 1,800 mm and in thicknesses ranging from 0.5 to 3 mm.

### More information?

For more information about Ready-to-Enamel, please visit: [www.arcelormittal.com/industry](http://www.arcelormittal.com/industry)



Granite® HFX Cool uses standing seam technology to create a weather-tight and stable connection.

# Protected by Nature

ArcelorMittal's **Nature Granite®** organic coated roofing steels bring style and modernity to contemporary architecture.

**Steel roofing solutions are growing in popularity as architects, designers and homeowners seek out stylish modern alternatives to traditional materials. But steel roofs aren't just popular because they are attractive. They are also extremely lightweight, cost-effective, quick and easy to install, and can increase the value of your building thanks to their durability and low maintenance.**

ArcelorMittal's organic coated steels for roofing are extremely flexible and can also be used as exterior wall panels. **Nature's** entire Granite® range uses organic coatings which are as safe for nature as they are for the people who will occupy the building.

## Suitable for roofs or cladding

The specific roofing solutions available in the **Nature** range – Granite® Deep Mat and Granite® HFX Cool – can be utilised for new buildings or renovation projects.

To complete the roof, two organic coated guttering solutions are available within the **Nature** range – Granite® Rain HDS and Granite® Rain HDX. Both feature a unique double-sided paint system which has been specifically designed for rainwater systems. Available in seven colours, the Granite® Rain gutters and accessories offer guarantees of up to 15 years against perforation and peeling.

## Standing seam or wrinkled finishes

The most noticeable feature of Granite® HFX Cool is its pronounced parallel ridge lines which rise up from the smooth surface of the steel. Known as standing seams, the ridges form the weather-tight links

between the Granite® HFX Cool panels (see box). Granite® HFX Cool is finished with a 55-micron coating of ArcelorMittal's own High Formability eXtended (HFX) paint system. HFX is extremely flexible and can be processed at temperatures as low as -10°C.



Standing seam roof on the Swedish coast – Lindab Buildings

Product	Usage	Guarantee*
Granite® Deep Mat	Roofing and cladding	10 to 15 years
Granite® HFX Cool	Roofing and cladding	20 years
Aluzinc® HFX	Roofing and cladding	25 years
Granite® Rain HDS	Guttering	10 years
Granite® Rain HDX	Guttering	15 years

\* Indicates maximum guarantee depending on local conditions and coating thickness.

In contrast to the standing seams of Granite® HFX Cool, Nature's Granite® Deep Mat has a slightly wrinkled surface structure. While it looks smooth from a distance, the wrinkles help to ensure that dust and dirt are washed away each time it rains. Granite® Deep Mat has a standard paint thickness of 35 or 40 microns. This provides good formability and a high level of corrosion resistance in any climate.

When processed into panels or tiles, both Granite® HFX Cool and Granite® Deep Mat can utilise hidden fastenings to maintain the visual integrity of the roof. With their easy formability, the steels can be used to create additional accessories as required.

### Resilient and light for a long maintenance-free life

ArcelorMittal's Granite® steel roofing solutions are amongst the most resilient roofing materials on the market today. Nature's Granite® range can withstand hail, snow, wind, fire and extremes of temperature and still remain beautiful – year after year.

Granite® roofs are extremely economical in terms of their initial cost, installation and long-term low maintenance. They are also significantly lighter than existing 'light' roofing materials. That can significantly

reduce the amount of supporting structure required in new buildings, leading to additional savings.

The lightness of Granite® also improves the sustainability of your construction project. Due to the inherent strength of the steel, thinner sheets can be used. This reduces the amount of steel required and cuts emissions from production, manufacturing and transportation. At the end of the roof's useful life, the steel can be 100% recycled while the organic coating will not harm the environment. Granite® steel roofs are also available with reflective paints to reduce the carbon footprint of the building and improve its performance with respect to some sustainable building labels.

With their wide range of colour options, nature-friendly organic coatings and stylish appearance, ArcelorMittal's Granite® roofing solutions provide the final layer of protection modern buildings need. Why not contact us today to find out how Granite® can protect your investment!

## Granite® HFX Cool and Aluzinc® HFX bring traditional design up to date!

Standing seams have been used for hundreds of years to seal metal roofs. Typically found in cold climates, the standing seams keep the vulnerable connections above the snow level, ensuring they remain dry. Standing seams also provide additional visual interest – whether they are oriented vertically, horizontally or at an angle.

Nature's Granite® HFX Cool is available in nine colours which have a low level of gloss. For roofing applications where a higher level of shine is required, ArcelorMittal has introduced Aluzinc® HFX.

The ductility and look of Aluzinc® HFX can be compared to that of pure zinc sheets. This makes it a perfect solution in both restoration projects and cutting-edge building design. The shiny Aluzinc® appearance remains stable and durable for an extended period. In fact, it can be guaranteed for up to 25 years.

Both HFX grades benefit from ArcelorMittal's High Formability eXtended paint system which makes them extremely flexible and formable. The steels can be profiled, bent or drawn without affecting strength or inducing cracking.



The fine texture of Granite® Deep Mat ensures that dust and dirt are washed away each time it rains.



The Granite® Rain HDS and Granite® Rain HDX guttering solutions in the Nature range feature a unique double-sided paint system.

### More information?

You can find further information about the full Nature range of organic coated steels on the ArcelorMittal Flat Carbon Europe website for Industry applications: [www.arcelormittal.com/industry/nature](http://www.arcelormittal.com/industry/nature)

# Tailored information on a brand-new FCE website

**ArcelorMittal Flat Carbon Europe (FCE) has launched a totally new website covering the main segments of our business: Industry, Automotive and Packaging. The launch follows the unveiling of ArcelorMittal's new corporate website earlier this year. The new websites are designed to optimise our communication with customers, investors, potential employees, NGOs and the media.**

The corporate website – [www.arcelormittal.com](http://www.arcelormittal.com) – makes extensive use of social media and videos which feature ArcelorMittal's highly experienced personnel talking about their passion – steel! The design, user experience and content of ArcelorMittal's website have been benchmarked against those of other leading Fortune 100 corporations. The site also showcases the important role ArcelorMittal plays in the world economy and the communities in which we operate.

While the [www.arcelormittal.com/fce](http://www.arcelormittal.com/fce) website contains information about our industrial presence and corporate responsibility, dedicated websites are also available for our Industry ([www.arcelormittal.com/industry](http://www.arcelormittal.com/industry)), Automotive ([www.arcelormittal.com/automotive](http://www.arcelormittal.com/automotive)) and Packaging ([www.arcelormittal.com/packaging](http://www.arcelormittal.com/packaging))

These websites include innovative features such as:

- Multiple drop-down menus for quicker navigation through each website
- Access to an interactive map showing ArcelorMittal's global presence in more than 440 locations
- Pages that automatically adapt their content and layout to the screen size of your PC, laptop, notepad or smartphone
- Social media links to the ArcelorMittal YouTube channel ([www.youtube.com/ArcelorMittal](http://www.youtube.com/ArcelorMittal)) and Twitter feed (@ArcelorMittal)

'Via our new websites, you get direct access to facts, figures, images, projects and case studies designed to inspire our customers,' explains Vanessa Vanhalst, Head of Communications at ArcelorMittal

Flat Carbon Europe. 'Our challenge was to present our content as part of an attractive and user-friendly visitor experience. Through these websites, we want to share our passion for sustainable steel solutions with you.'



Follow us on Twitter:  
[www.twitter.com/arcelormittal](http://www.twitter.com/arcelormittal)

## Overview: ArcelorMittal on the worldwide web [www.arcelormittal.com](http://www.arcelormittal.com)

'This fantastic new website really brings our Group and its brand to life for stakeholders,' says Nicola Davidson, Vice President of Corporate Communications at ArcelorMittal. 'Having a strong online presence is crucial for all leading companies in this day and age regardless of sector or focus.'



## [www.arcelormittal.com/fce](http://www.arcelormittal.com/fce)

The FCE website offers general information about the FCE mills and our corporate responsibility initiatives. Those initiatives make a significant difference to the communities in which we live, the health of all of us, the environment and transparency. The site also acts as an entry to the dedicated FCE websites mentioned below.



## [www.arcelormittal.com/industry](http://www.arcelormittal.com/industry)

The Industry website provides information and inspiration on a wide range of industrial applications for steel. The site covers Industry segments such as building, energy (including renewables, oil and gas), appliances, agricultural and construction equipment, transport (including shipbuilding, railways and trailers) and road safety (for example, safety barriers).

## [www.arcelormittal.com/automotive](http://www.arcelormittal.com/automotive)

The Automotive website covers all relevant information about ArcelorMittal's Automotive business unit, a partnership-oriented organisation which supports its customers to expand and grow their businesses. ArcelorMittal is the only steel solutions provider for both fuel- and electric-powered vehicles which has a truly worldwide presence.



## [www.arcelormittal.com/packaging](http://www.arcelormittal.com/packaging)

The Packaging website contains all the information you need about the most recycled packaging material in the world – steel. Used in food, beverage, aerosol and other cans, lightweight and ultra-thin steels are the most efficient and durable packaging material on the planet.

# Light, safe, strong and local

**ArcelorMittal provides tailored blank support from design to production, wherever carmakers are located.**

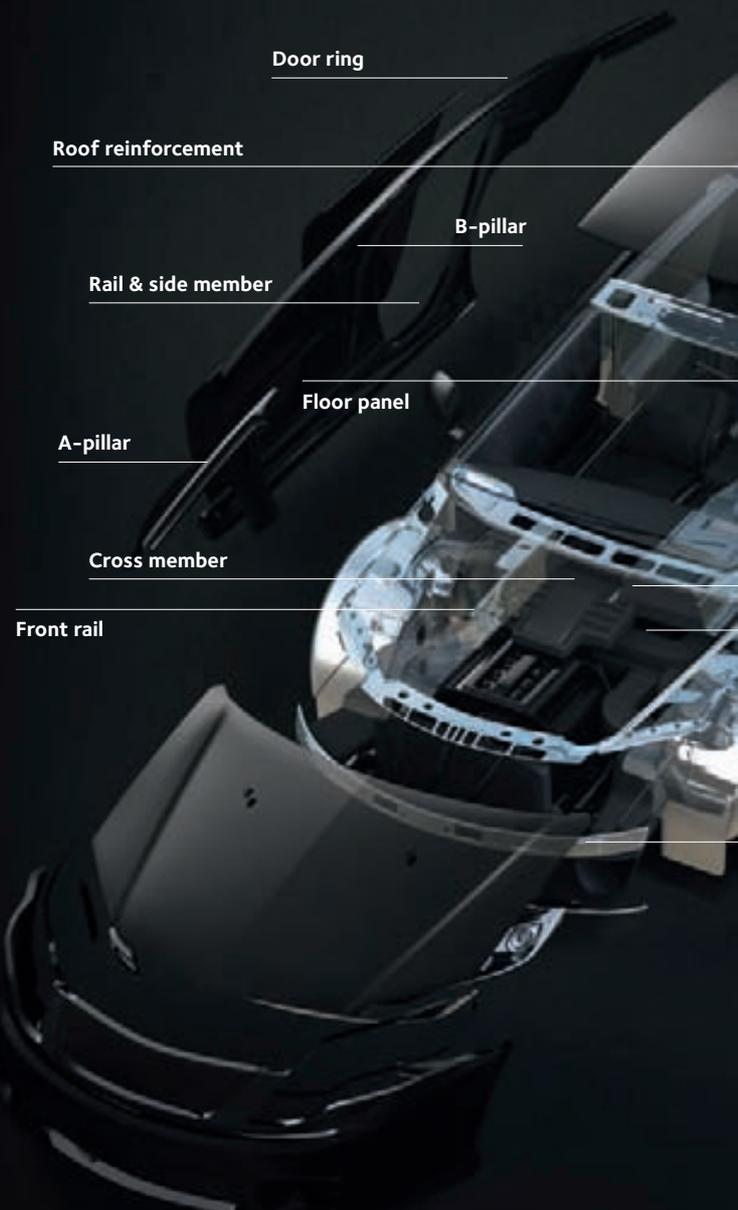
**Carmakers are constantly seeking ways to improve the safety of their vehicles and lighten them in order to reduce fuel consumption. One of the most effective ways to achieve both goals is by using tailored blanks for specific car parts. As well as improving the strength and safety of vehicles, tailored blanks reduce both the economic and environmental costs of mobility.**

Because of its intrinsic strength to weight ratio and 100% recyclability, ArcelorMittal's ultra high strength steels (UHSS) offer manufacturers an excellent opportunity to meet environmental performance targets for vehicles, without compromising strength or safety. Tailored blanks – also called laser welded blanks (LWBs) – enable carmakers to reduce vehicle weight and address specific design and safety issues by putting the right steel at the right place.

## Design and production support

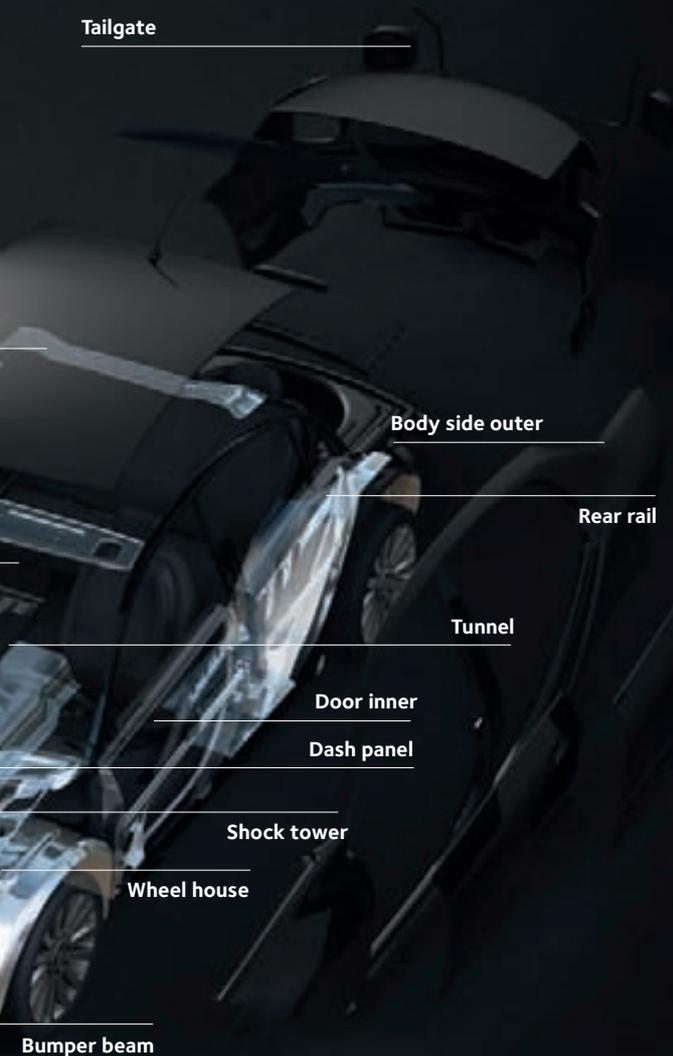
ArcelorMittal's Tailored Blanks division offers assistance at all stages of the vehicle creation lifecycle – from initial design to volume production. Our support includes the identification, selection and optimisation of the right steels for each part of the LWB.

ArcelorMittal's global network of Automotive R&D centres is equipped with the latest simulation software, enabling us to digitally mimic the tailored blank's behaviour in a range of scenarios. Using these tools, we can quickly modify the design or material selection without the need to produce physical parts, reducing development time and costs significantly. Various behaviours can be simulated including crash performance, rigidity, formability and long-term performance. Once the design of a tailored blank has been digitally proven, ArcelorMittal's Tailored Blanks development teams can assist with the manufacture of prototype parts. The performance of the parts can also be assessed in our test-beds or on production vehicles.



## Tailored for modern vehicles

These are the most common uses of our Tailored Blank products in cars. The list is expanding every day.



Tailored blanks enable carmakers to reduce vehicle weight and address specific design and safety issues by putting the right steel at the right place.

## Reducing production and material costs

While material cost is an important consideration in the design of a new part, ArcelorMittal actively works with carmakers to optimise the total cost of vehicle ownership. Our experience enables us to simulate the process changes needed to incorporate the new part into the overall vehicle assembly and evaluate the associated costs of these changes. Using this approach, carmakers can lighten their vehicles while protecting profit margins. Our laser welded blanks enable carmakers to cut unnecessary costs by reducing the number of stamping processes and tools required.

## Global experience, local production

With 20 tailored blank production sites around the world, ArcelorMittal's global footprint enables us to provide the same consistent quality of LWB solutions, wherever our clients are located. Carmakers have one point of contact with ArcelorMittal but, thanks to our worldwide network of tailored blank production sites, various points of delivery. Our newest facility in Senica (Slovakia) is further evidence of our commitment to support the global car industry.

Our dedicated Automotive Global R&D centres are constantly researching and developing new steels, coatings and cost-effective tailored blank solutions to meet almost any requirement. Revolutionary new laser welding technology and advanced steels such as Usibor® and Ductibor® are increasing the range of cost-effective tailored blank applications available. We are also able to optimise solutions for local requirements or regulations, without jeopardising cost or quality.

ArcelorMittal recently started construction of a new building to accommodate our existing laser welded blank production line in Senica. An additional welding line and a new blanking line will also be installed in the new building. Volume will be tripled when the new facility comes on-stream in early 2013. Senica currently supplies five carmakers with around a million laser welded blanks each year.

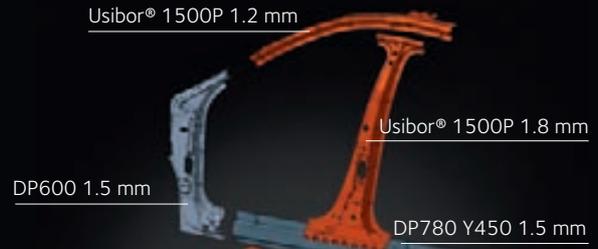
## Taking steel and technology to the limit: LWB hot stamped door ring

ArcelorMittal Tailored Blanks has developed a new hot stamped door ring concept which combines the benefits of laser welding technology with the high performance of hot stamped steel. The new door ring is stamped as one part instead of the four parts which are usually required. Forming the part requires just one stamping tool and one stamping operation. No post-assembly tasks are required. Reducing the number of parts and operations required also reduces the manufacturing cost of the door ring significantly.

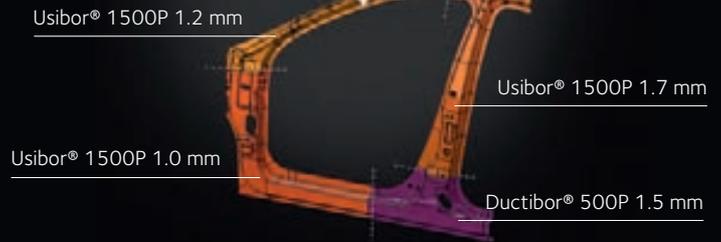
By using Usibor® 1500P and Ductibor® 500P, the weight of the optimised door ring was reduced to just 12.7 kg, a 19.8% weight saving compared to a baseline C-segment vehicle. Front, side and pole impact tests were performed on the door ring using Euro NCAP standards. In all cases the optimised door ring met the required standard and, in the case of the side and pole tests, outperformed the existing baseline solution.

The new door ring concept has already been adopted by a major car manufacturer and will go into serial production in a new vehicle. The vehicle is scheduled to be launched in North America during 2013.

### Baseline



### LWB door ring solution



### Tailored Blanks around the world

ArcelorMittal Tailored Blanks supplies automotive companies worldwide with a manufacturing technology that improves vehicle component performance.

### Europe

Birmingham UK  
Bremen GERMANY  
Neuwied GERMANY  
Gent BELGIUM  
Liège BELGIUM

Lorraine FRANCE  
Senica SLOVAKIA  
Zaragoza SPAIN  
• Merelbeke BELGIUM  
(head office)

### North America

Concord, Ontario, CANADA  
Pioneer, Ohio, USA  
Murfreesboro, Tennessee, USA  
Delaco Tonananda, New York, USA  
Delaco Dearborn, Michigan, USA  
Silao, MEXICO  
San Luis Potosí, MEXICO

### Brazil

Project under construction

### Asia Pacific

#### China

Shanghai Baosteel & Arcelor Tailor Metal (JV)

#### India

Arcelor Neel Tailored Blank Chennai (JV)  
Arcelor Neel Tailored Blank Pune (JV)

#### Australia

Adelaide

### More information?

For more information about ArcelorMittal's Tailored Blanks solutions, please visit [www.arcelormittal.com/tailoredblanks](http://www.arcelormittal.com/tailoredblanks)