

STEEL SPECIFICATION

Sustainable, safe steel

Steel is 100% recyclable, indefinitely and without loss of quality



ArcelorMittal



Sustainable, safe steel

'Sustainable, safe steel' encapsulates everything we are trying to achieve at ArcelorMittal.

We want our business to be sustainable in every sense of the word – a business that is both profitable and responsible. We do this by keeping our people safe, and becoming ever more efficient at providing the steel the world needs for construction, transport, manufacturing and all other aspects of everyday life.

Steel in construction is a key component to addressing the challenges of over-population, poverty and climate change.

We are developing new forms of steel that build on its intrinsic flexibility and recyclability to create durable, affordable, and energy-efficient solutions for everything from the tallest skyscrapers to the simplest low-cost homes.

"The main benefit of steel is its light weight and durability. In today's world with its inescapable density, steel is the perfect tool for rehabilitation and extension. Organic coated steel allows for faster and cleaner assembly and thanks to its prefabrication, there are no unexpected surprises in terms of aspect."

Anne Pezzoni, Archi5, France

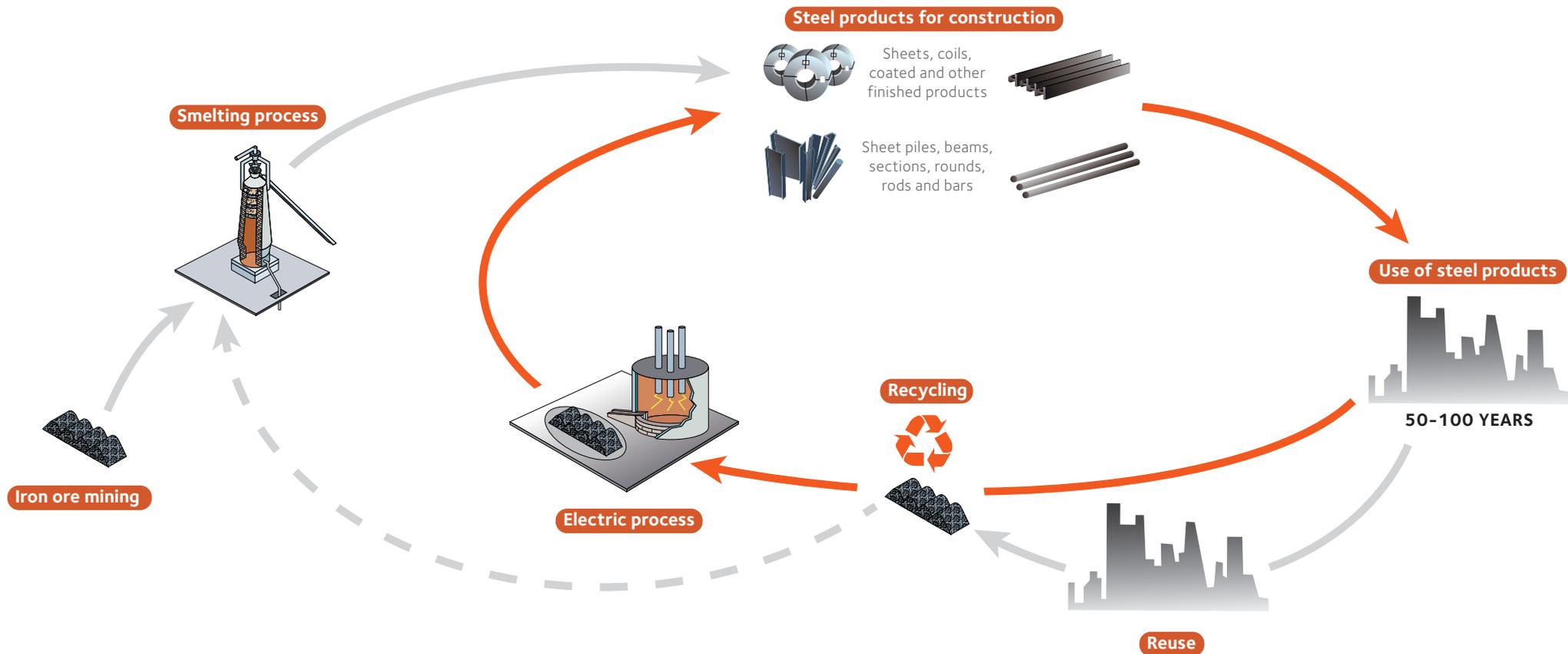
did you know that....



... With an external temperature of 35 °C, the surface temperature of the steel can be as much as 11 °C cooler using a typical brown or green roof construction.

Left Project: Marcel Sembat High School, Sotteville-lès-Rouen, France Architects: © archi5 with B. Huidobro Photography: © Thomas Jorion

While the building industry generates 5% to 15% of worldwide GDP, the built environment accounts for 40% of energy consumption and 40% of CO₂ emissions. Steel is playing an ever-greater role in providing buildings that are more energy-efficient and ArcelorMittal is focused on producing lower carbon products, for lower carbon buildings that are less costly to operate and more comfortable to use.



Steel: the most recycled material in the world

Steel is 100% and indefinitely recyclable, without any quality loss. When recovered, it is 100% recycled.

Its recycling rate (i.e. the percentage of materials being taken out of service, recovered and reused) is high but varies from product to product.

In construction, it reaches particularly high levels: 98% for beams, 65-70% for reinforcement bars. 100% for flat steel sheets and panels.

Recycled steel represents 40% of the steel industry ferrous resource in the world. ArcelorMittal is one of the biggest recyclers of steel in the world. In 2013, we recycled 31 million tonnes of scrap steel at our plants.

Decreasing environmental impact in steel manufacture

A lot of progress has been made by ArcelorMittal over time. Waste generation, water use and air emissions are continually decreasing, as are energy consumption and greenhouse gas emissions. In Europe, CO₂ emissions and energy consumption per tonne have been reduced by 20% over the 20 last years.

By year end 2013, 98% of ArcelorMittal production sites had attained ISO 14001 certification, the international standard for environmental management systems.

Off-site prefabrication efficiencies

Use of prefabricated elements provides a large range of benefits that contribute to reduce the risks during the construction phase.

Using off-site steel construction systems reduces environmental impacts and neighbourhood nuisance on the construction site.

Water use, waste generation, dust emission, traffic and noise are considerably lower than in traditional construction.

Work site management is largely facilitated. All these advantages are especially appreciable in congested urban areas.

Thermally efficient buildings

A high proportion of energy use is devoted to heat control, by artificially heating or cooling the building: good steel-based design or use of appropriate steel products can achieve a major reduction in this energy consumption.

- The combination of a steel structure with effective external insulation drastically reduces a building's losses.
- Double-skin systems and/or sandwich panels provide a thermally efficient envelope, matching latest energy standards.
- No thermal bridges due to external insulating systems.

- Airtightness of steel cladding or roofing systems eliminates air leakage that contributes to energy waste.
- Intelligent use of the thermal mass effect of steel products or components enables energy savings.
- The large range of colours or finishes of organic, metallic or even reflective coatings is suited to all existing climate models.

did you know that....



... More steel is recycled worldwide annually than all other materials put together. More than 500 million tonnes of scrap is melted each year.

did you know that....



... Steel frames can reduce embodied energy in buildings - up to 30% energy saving in a two-storey house when compared with masonry structure.

did you know that....



... Across the whole steel sector, CO₂ emissions per tonne of crude steel output are now 50% lower than 40 years ago. Some plants are now near the technical limit of what can be achieved with existing technology.



© Hellen Sergeyeva, Shutterstock.com



Project: University of Lethbridge Edmonton, Alberta, Canada Architects: © Cohos Evamy Partners Photography: © Robert Jim Courtesy of Steel Design Publication, Spring 2009



Photography: © Thermoplus Constructions



Photography: © Courtesy of Profil du Futur



Photography: © Pryzmat/Shutterstock.com

Steel for sustainable buildings

According to a recent report produced by the World Business Council for Sustainable Development (WBCSD), buildings are responsible for at least 40% of energy use in most countries, with the absolute figure rising fast as construction booms especially in China and India. Importantly the report highlights opportunities to promote sustainable building know-how and technologies including Zero Energy Building (ZEB).

While ArcelorMittal continues to invest in new technology, we already propose many types and grades of steel that are ideally suited for making buildings more energy-efficient, including steel for sustainable roof systems which prolongs envelope life, reducing roof surface temperature in hot and sunny climates and saves energy by balancing a building's temperature.

"It's interesting to think of steel as a material that can be easily deconstructed and reused for another building, in another place."

Sergio Baragaño, [baragaño], Spain



Project: Docks in Aviles Port (Neighbours of Oscar Niemeyer), Spain Architects: © [baragaño] architects Photography: © Mariela Apollonio, Fotógrafa de arquitectura



Project: Residential house under construction Photography: Courtesy of Profil du Futur

Steel is easy to construct and deconstruct ...

Construction with steel is adaptable and sustainable, used in all type of buildings, from non-residential to residential.

Fabrication of steel components can be carried out off-site, at large scales by highly skilled and experienced manufacturers.

The high degree of prefabrication potential can increase quality, efficiency and the safety levels of the remaining work to be done in-situ while reducing the costs.



Project: ArcelorMittal Orbit, Olympic Park in Stratford, London Architects: © Anish Kapoor and Cecil Balmond Photography: © Stephen Hird Tubes provided by: Grupo Condesa

Steel is versatile ...

Steel makes it much easier to adapt buildings to new and innovative uses.

A steel building characterised by the absence of load-bearing walls is intrinsically more versatile and flexible than other types of structure. Steel is already widely used for the construction of horizontal extensions and thanks to its light weight, is fast becoming the only viable solution for vertical extensions.

Steel provides sustainability throughout the life cycle of a building



Courtesy of Profil du Futur

Steel can help conserve resources ...

Thanks to steel's inherent mechanical properties (particularly its high strength-to-weight ratio) steel construction requires less material than traditional building technologies, helping to reduce a building's environmental impact and conserve natural resources.

Steel in fully Life Cycle Assessed building solutions ...

When evaluating the sustainability of a building it is essential to take into account every phase of a building's life, from the actual extraction of raw material to production, transportation to the construction site and construction operation itself through to the operational use of the building, demolition or dismantling, waste disposal and recycling.

At ArcelorMittal we are closely involved in all stages of the life cycle of steel and are therefore ideally placed to provide full Life Cycle Assessment (LCA) for any building, however large or complicated the project may be. Except for low or zero energy buildings, the most critical assessment phase occurs during actual occupancy. Once again ArcelorMittal is able to provide energy-efficient solutions for building design.

ArcelorMittal is able to help provide solutions:

- Locating thermal weaknesses
- Monitoring the building's energy consumption
- Measuring the building's air tightness

When proposing more sustainable scenarios (typically those with lower energy consumption and CO₂ emissions), every aspect of the building's design, location and use is taken into consideration. Where necessary, we'll provide alternative solutions, which may include combining steel with other materials.

Steel as a material

- 40% of resources come from recycling: raw material and energy savings
- Manufacturing process with controlled environmental impact (-20% in CO₂ emissions and energy consumption over 20 years, low waste generation)
- Steel is environmentally inert
- Material durability
- High recycling rate

Steel in construction

- Prefabrication/off-site manufacture: quality controlled, construction site optimisation (reduced lead times, transportation and neighbourhood nuisance), enhanced safety, ease of deconstruction
- 'Dry' system: reduction of water consumption and environmental impact at the construction site.
- 50% construction time reduction



End of life of steel

- Easy dismantling
- Re-usability
- Recyclability: 100% and indefinitely recyclable without quality loss, high recycling rate

The design and service life of steel

- Weight reduction of structure, reduced consumption of materials and conservation of natural resources (from 30% to 70%), possible use of sites with low loadbearing capacity - soil or foundations
- Thermally efficient steel solutions: reduction of energy consumption in service
- Simple incorporation of renewable energy generation systems: very low consumption, or even positive energy buildings
- Long spans: creation of versatile spaces, capable of change over time and adaptation to users requirements; comfort and well-being
- Prefabricated systems and components: ease of maintenance, extensions/modifications possible, flexibility
- Excellent acoustic insulation of steel solutions
- Longevity and robustness of steel components

1. Project: ArcelorMittal Technology Development Centre in Avilés, Spain Architect: © [baragaño] architects Photography: © Mariela Apollonio, Fotógrafa de arquitectura
2. Photography: © Candace Hartley / Shutterstock.com
3. Project: Parking Metro des Argoulets, Toulouse, France Architect: © Azema Architectes, Toulouse Photography: © Pierre Azema.
4. © Matee Nuserm / Shutterstock

Steel for safe buildings

Steel not only provides exceptionally sustainable solutions for construction, but extremely safe ones too.

Steel combines remarkable strength-to-weight ratios with physical flexibility – it does not crush or crumble, it flexes. So when severe loading occurs (say in an earthquake) steel is better able to absorb the loads without losing its structural integrity, than many other building materials.

This strength and flexibility give steel good performance characteristics in relation to fire too. Steel can retain its structural (and loadbearing) integrity at high temperatures and can be used to create building elements with superb fire performing properties that can help occupant safety and minimise structural damage.



Project: Stoas Vilentum Hogeschool, Wageningen, Netherlands System supplier: ZND Nedicom in cooperation with Jack Muller B.V Architects: © BDG Architecten Ingenieurs Zwolle
Photography: © Dirk Verwoerd



Photography: © Fotostory/Shutterstock

Steel resists earthquakes better than any other material

Earthquakes are unpredictable in terms of magnitude, frequency, duration, and location. Steel is the material of choice for designing buildings that cope with these events because it is inherently ductile and flexible – flexing under extreme loads rather than crushing or crumbling.

Many of the beam-to-column connections in a steel building are designed principally to support gravity loads. Yet they also have a considerable capacity to resist lateral loads caused by wind and earthquakes.

Taken as a whole, these connections provide superior reserve strength and defence, increasing a building's resistance against earthquakes and potential for repair. For residential buildings, light-gauge steel profiles allow the design of lighter structures than with concrete, and therefore are less susceptible to lateral seismic forces. Light Steel Framing has been used extensively in seismic risk regions such as Turkey, New Zealand and California.

Steel resists fire

Steel as a material, is intrinsically incombustible and will not usually allow the spread of flames. Combined with other materials steel can be used to create constructions such as fire-resistant panels, partitions, doors and facades, that have excellent fire performance.



Project: Steel ceiling suspension systems by Saint-Gobain API Photography: © Michael van Oosten



Project: Ambulance station in Oss, Netherlands Architect: © Hooper Architects
Photography: © Nick Kuijpers - De Koperloods



Photography: © Jeroen Op de Beeck

Coil coating, a sustainable process

Organic coated steel offers exceptional economic and technological advantages and is certainly the product best placed to respond to present and future environmental regulations.

The extreme durability and versatility of organic coated steel has led to its wide use in the building industry: from wall facades and roofing, to different innovative forms of suspended ceilings and lighting applications.

At ArcelorMittal, we combine our advanced coil coating technology with a selection of high-quality paint systems, guaranteeing their aesthetic appearance and long-term durability. Whatever the project or intended use for the steel, coil coating remains the most efficient and ecological process to apply long-wearing paint finishes on metallic surfaces.

Production

Organic coated steel is produced on industrial lines that are designed to meet the most stringent environmental regulations concerning surface treatments, solvent emissions and the absence of harmful substances in the composition of the paint. Our steels already comply with standards such as ISO 14000/1 in this regard.

Recycling

At the end of its life cycle, organic coated steel is 100% recyclable, just like all other steel products.

The Nature Collection

For the past 15 years, ArcelorMittal has been developing and testing a new range of organic coated steels which fulfil steel's promise as a strong and durable building material. To be known as **Nature**, the new collection of steels for the building industry offers exceptional technical advantages and is well-

placed to respond to present and future environmental regulations. **Inspired by Nature**, the range does not contain hexavalent chromium or heavy metals (such as lead or hexavalent chromium complex).

free of chromates

Inspired by Nature

and heavy metals

Why ArcelorMittal organic coated steel is more sustainable

- Free of hexavalent chromium compounds (SVHC)
- Free of lead and other heavy metals
- Guaranteed up to 30 years
- Fully tested by our R&D experts to extreme corrosion and weathering conditions, both in the laboratory and outdoors
- Innovative aesthetics for a more harmonious integration in the environment
- Reflective coatings allow more comfortable living conditions, reducing indoor temperatures by a few degrees in hot and sunny environments

✓ REACH COMPLIANT

ArcelorMittal's new **Nature** collection of organic coated steels already complies with current and future European Union REACH regulations on the Registration, Evaluation, Authorisation and Restriction of Chemical Substances. REACH aims to improve the protection of human health and the environment through better and earlier identification of the intrinsic properties of chemical substances.

ArcelorMittal gives automatic guarantees on its **Nature** collection of organic coated steels of up to 30 years, depending on the environmental conditions at the construction site.

Helping comply with sustainable building best practice

Our **Nature** collection is especially designed for environmentally responsible construction and can help designers comply with sustainability legislation and guidance such as BREEAM in the UK, LEED in the USA, HQE in France and many others.

did you know that....

...**Nature** has undergone an extensive testing programme over several years. The steels have been exposed to different sources of corrosion and weathering conditions at locations around the world. The results were excellent, especially with regard to corrosion resistance (including edge corrosion), paint peeling and film integrity.



Sustainable, safe steel

Building sustainably with steel



Meetse-a-Bophelo School won the award for architecture in 2011 from Pretoria Institute for Architecture.

Meetse-a-Bophelo School, South Africa

The challenge for this primary school in Mamelodi was to utilise alternative steel technologies within the cost parameters of a conventional construction (bricks and mortar) and to develop a prototype cost-efficient school building method that could later be produced in kit form for further new projects.

The school buildings are not only aesthetically pleasing but also incorporate unique design solutions like the integration of electricity and data cables, and the creation of natural ventilation, improving the well-being of the students while reducing energy bills.

The remarkable build time of 13 months, was half the time allowed by the Department of Education in Pretoria and could even be reduced to 8 months on a greenfield site. This speed, helped by the use of lightweight renewable material makes Steel the material of choice for sustainable business.

Project: Meetse-a-Bophelo primary school, Mamelodi, South Africa Architects: Geldenhuis & Jooste Architects, Photography: © ArcelorMittal

Cost-effective, seismically safe structures



Casa Buna, Romania

In this part of Romania, buildings must be able to withstand earthquakes measuring 7 to 8 on the Richter scale. Furthermore, the continental climate, characterised by abundant snowfall in winter causes large loading surges which must be taken into account when calculating the proportions of the framework.

Built entirely with lightweight steel frame construction, this project was financed by the ArcelorMittal Foundation in collaboration with the NGO Habitat for Humanity.

The steel structure based on thin sections, combined with other materials like plaster and wood, is perfectly suited to the construction of houses such as Casa Buna, which must not only be of high quality, but suit the climatic and seismic conditions, and still be very affordable.

Project: Casa Buna, Moinesti, Moinesti, Romania Architect: SAM IMPEX S.R.L. Photography: © ArcelorMittal

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steel.envelope@arcelormittal.com

Cover large image: Project: Canadian Aviation Museum Expansion Ottawa, Ontario, Canada Architects: © Consortium Le Group Arcop / Provencher Roy & Associes Photographer: © Marc Cramer Courtesy of Steel Design Publication, Fall 2012

Smaller images, from left: 1 Photography: © Rihardzz, Shutterstock.com

2 Project: Office building IVIO, Belgium Architect: © BURO II & ARCHI+1 Photography: © Kris Vandamme

3 Project: Issy Les Moulineaux treatment plant SYCTOM, France Architect: © Dubosc & Associés Photography: © Martin Argyroglo

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