



ArcelorMittal

# Our Steel solutions for your Green Building

transforming  
tomorrow







# Steel Solutions for Green Building

As society makes determined moves towards sustainability, construction has a very important role to play within this agenda, not only because of its economic and social contribution, but also because of its impact on the quality of our lives. While the building industry provides 5% to 10% of worldwide employment and generates 5% to 15% of the GDP, the built environment accounts for 40% of energy consumption, 40% of CO<sub>2</sub> emissions, 30% of the consumption of natural resources, 30% of waste generation and 20% of water consumption.

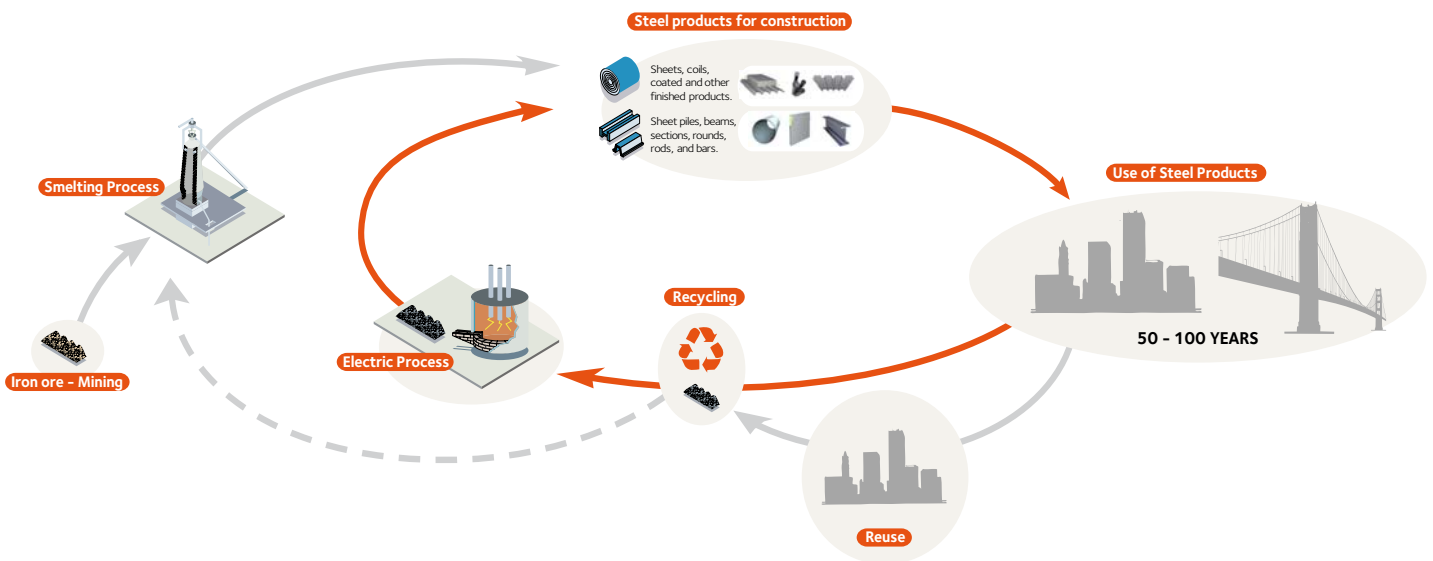
The future global challenge for the construction industry is clearly to meet the world's growing needs while at the same time limiting the impact of its burdens by drastic improvement of its activities.

In construction, steel has developed as a material of choice and offers a wide range of solutions that can make buildings more energy efficient, less costly to operate and more comfortable.

**We in ArcelorMittal believe strongly in steel's values for Green Building and are committed to helping deliver the benefits that our solutions bring to our customers, their buildings and their owners.**

# Steel solutions for lower environmental impact

## The Steel Recycling Loop



1.2 tonnes of steel recycled by ArcelorMittal each second

### 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.

Recycled steel represents 40% of the steel industry ferrous resource in the world. With more than almost 40 million tonnes used in 2007 ArcelorMittal is the world's largest scrap recycler.

### A huge decrease in environmental impact in the manufacturing process

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, CO<sub>2</sub> emissions and energy consumption per tonne have been reduced by 20% over the 20 last years. By year end 2007, 80% of ArcelorMittal production sites had attained ISO 14001 certification, the international standard for environmental management systems.

### A high degree of prefabrication for fast, reliable and predictable construction

The advantages of the dry steel construction system

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

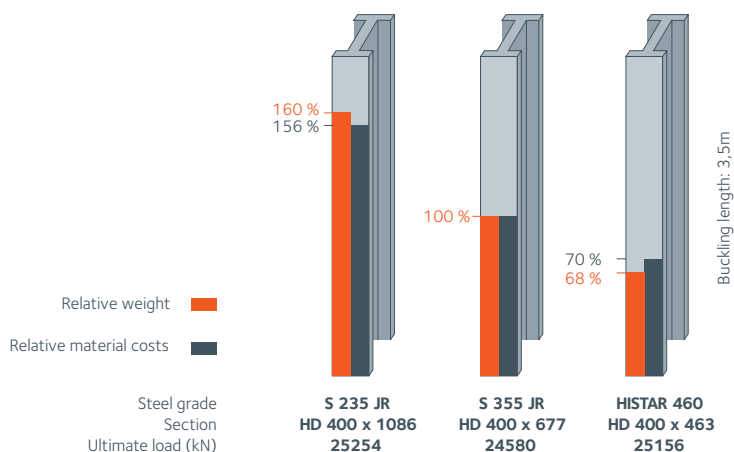


Velodrome, Berlin – Architect: Dominique Perrault

## Steel's high strength to weight ratio for conservation of natural resources

Thanks to steel's high strength to weight ratio, steel construction requires less material than traditional construction technologies and contributes to reducing a building's environmental impact.

Resultant conservation of natural resources could be from 30% up to 70%. It is possible to achieve further savings by using high strength steels in place of merchant steels.



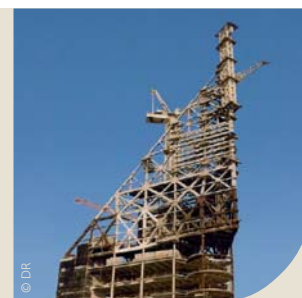
### HISTAR® performance compared with other steel grades – Use in heavy columns

## High strength steels

ArcelorMittal new high-strength steels (HSS) developed for the construction market are contributing to a major reduction in greenhouse gases by making it possible to use lighter structures.

Substituting HISTAR® for merchant steel achieves weight reductions of 32% in steel columns and 19% in beams.

The 50,000 tons of HISTAR® produced in 2007 by ArcelorMittal represents a saving of 14,000 tonnes of CO<sub>2</sub>, which roughly equates to the annual emissions of 4,000 vehicles.



One example of extensive use of HISTAR® steels: The Emirates Tower in Dubai.

Up to 30% reduction of CO<sub>2</sub> emissions during construction.

# Steel solutions for energy - efficient buildings

In order to address global warming issues as well as economic considerations, the management of rising energy consumption is an operational imperative: steel solutions can help achieve this and even have a key role to play in the move towards zero energy buildings.

## More than 80% of the energy consumed during the use phase

In a building, the operational energy consumption (due to heating, air conditioning, but also lighting etc...) largely outweighs its embodied energy (the energy used to build it). By proposing technical solutions to reduce the energy consumed during the whole life of a building, ArcelorMittal is contributing positively to the reduction of its environmental impact.

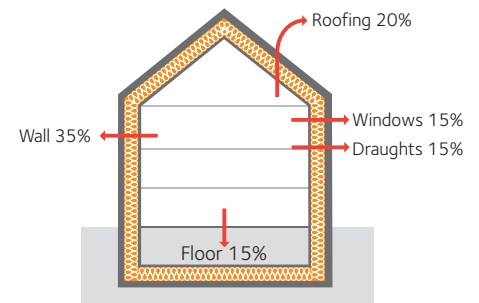
## Thermally efficient buildings

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.

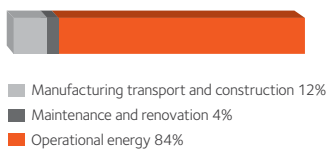
- The combination of steel structure with effective external insulation drastically reduces a building's losses.
- Double skin systems and/or sandwich panels provide a thermally efficient envelope, matching latest energy standards.
- No thermal bridges due to approved design.
- Airtightness of steel cladding or roofing systems eliminate 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 radiative coatings is suited to all existing climate models.

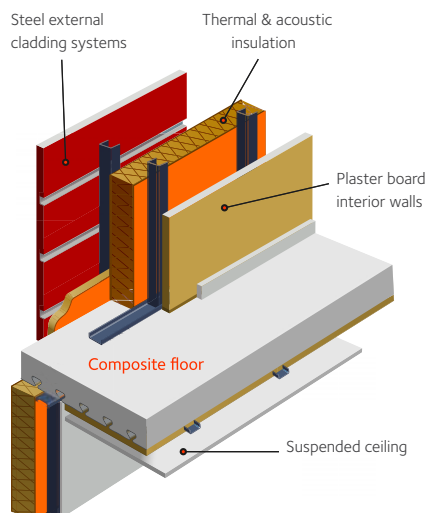
Energy losses in a building



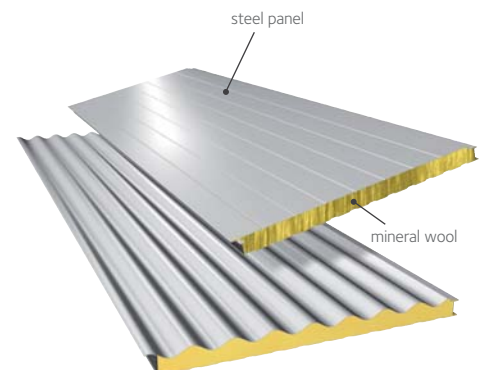
## Life Cycle Energy Use in a Building (source EEB)



## Thermally steel efficient system



## High insulation panels (mineral wool)







© DR

Arsolar® Photovoltaic System

## Sunscreen and green roof systems

Efficient use of steel sunbreakers protects from the sun and helps to reduce solar heat entering a building. It allows substantial energy savings by limiting or even eliminating the requirement for air conditioning.

Green roof provides also various benefits, such as longer roof membrane life, acoustic insulation, but it almost increases energy efficiency. In the summer green roof planting shades the building from solar radiation and reduces if not

**Helice:** from ArcelorMittal Sunstyl range of solutions for summer comfort



© DR

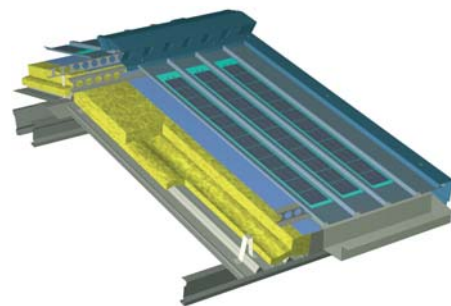
eliminates any heat gain. In the winter the additional insulation helps to decrease the amount of energy required to heat the building.

## Renewable energy generation systems

Besides providing thermally efficient solutions, ArcelorMittal has developed a complete range of products capable of producing energy, such as solar absorbers for hot water production, or photovoltaic cell systems for electricity generation.

### Arsolar® Photovoltaic System

30 - 35 m<sup>2</sup> of roofing produce 4,000 kWh per year



**GlobalRoof Hacierco:** the green roof solution



© Stéphanie Chalmeau



# Steel solutions for high building values

Steel's inherent mechanical properties (particularly its high strength-to-weight ratio) enable the creation of lightweight load-bearing structures, thus gaining additional usable and efficient space, and bringing higher economic and social value to the building.



## Increasing and optimising spaces

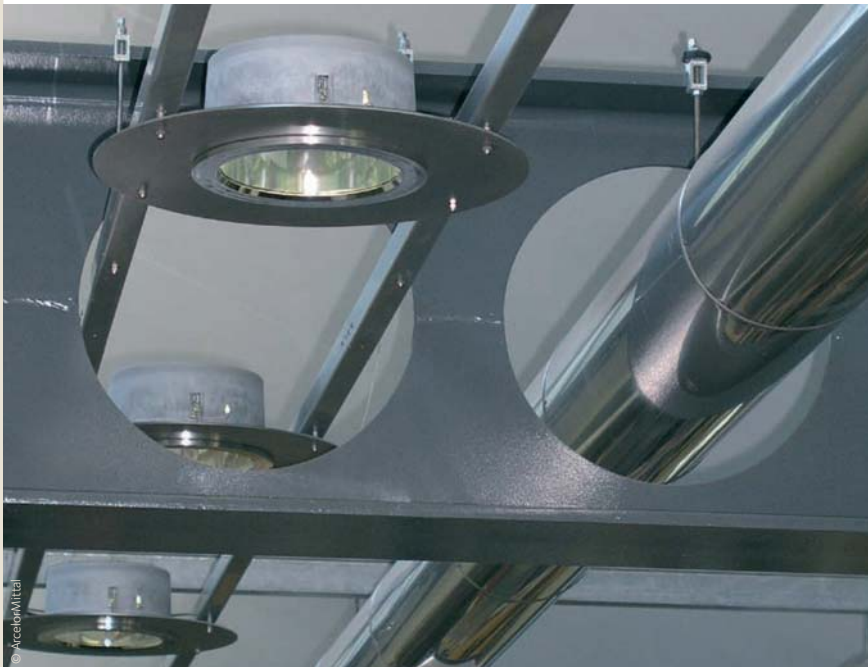
### Long spans and column-free areas

The use of long span sections for the building's structure creates large, open and flexible spaces. Using steel columns instead of concrete ones could deliver around 40 square metres of additional floor area on 1000 square metre office floor plates. Thin floor systems allow appreciable gains in vertical space.

### Angelina™ beam



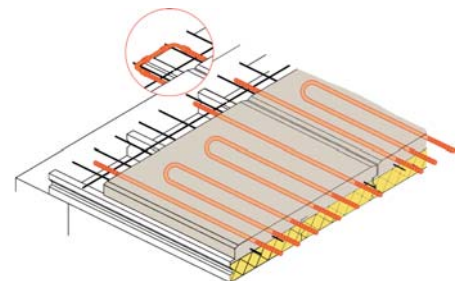
Sleek, open, transparent and flexible, the Angelina™ beam offers a new architectural dimension within an environmentally friendly approach.



### Integration of technical components

The shape and design of steel components makes it possible to integrate a building's technical services into ceilings, flooring or partitioning. It enables reduction of the storey height and consequent savings in weight and material, or increasing the lettable area by adding extra floors.

### Integrated heating floor







Kranspoor: re-utilisation of a old concrete crane for a new innovative steel framed office building - MIPIM green building Award

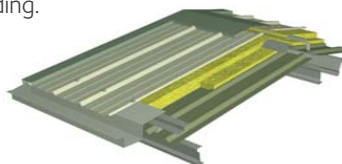
Sustainability means also the ability to accommodate to change requirements and to take up the challenge of time. A steel building characterized by its bearing walls is intrinsically more evolutive and flexible than other structures.

### Fast and easy renovation

By providing prefabricated, lightweight and fast to erect components, steel construction is well placed to facilitate rehabilitation and to update building to evolving construction standards. Over cladding and over roofing are particularly efficient solutions to give a second life to a building by improving thermal performance as well as envelope esthetics.

### Hairenov

An innovative renovation process which allows complete renovation of a roof without interfering with the activity taking place in the building.



Enlarging the National Art Museum Reina Sofia, by addition of a complementary steel building to the classic style original museum



### Flexible internal spaces

A column and beams structure creates more efficient and usable spaces, which can be reconfigured to suit to users requirements over the time. It makes it easy to redesign volumes by using relocable steel partitions.

### Extension

Often associated to envelope retrofitting, building extensions provides new habitable spaces and new facilities. Steel construction enables horizontal extension (balcony, terrace) and it's fast becoming the only viable solution for vertical extension, thanks to the lightness of steel.

Dusseldorf: surelevation of an historical brick building



# Efficient steel solutions at each stage of a building's life

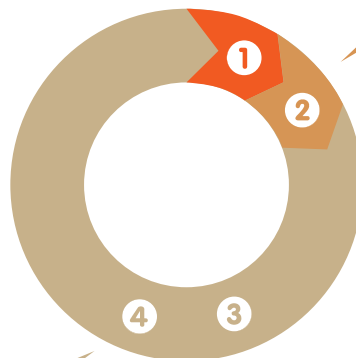
When evaluating the sustainability of a building, the life cycle approach is required, taking into account all phases of a building's life, including materials production, transportation to the construction site, the construction operation itself, operational use of the building, demolition or deconstruction, and end of life.

## 1 Steel Material

- 40% of resources come from recycling: raw material and energy savings
- Manufacturing process with controlled environmental impact (-20% in CO<sub>2</sub> emissions and energy consumption over 20 years, low waste generation)
- Steel is environmentally inert
- Material durability
- High recycling rate

## 2 Construction Phase

- Prefabrication/offsite manufacture: quality controlled, construction site optimisation (reduced lead times, transportation and neighbourhood nuisance), enhanced safety, ease of deconstruction
- "Dry" system: reduced environmental impact of the construction site



## 4 End of Life

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

## 3 Design and Service Life

- 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
- 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

**Environmental advantages  
of steel construction**

- Building Materials
- Construction Sites
- Building Life and Deconstruction





ArcelorMittal  
Building and Construction Support  
Head Office

24-26 Boulevard d'Avranches  
L-1160 Luxembourg  
Tel: + 352 4792 2233  
Fax: + 352 4792 2502

ArcelorMittal  
Building and Construction Support  
Sustainable Construction

5, rue Luigi Cherubini  
F-93212 La Plaine St Denis  
Tel: +33 (0)1 71 92 16 90  
Fax: +33 (0)1 71 92 24 97

[www.arcelormittal.com](http://www.arcelormittal.com)  
[www.constructalia.com](http://www.constructalia.com)



**Mixed Sources**

Product group from well-managed  
forests, and other controlled sources  
[www.fsc.org](http://www.fsc.org) Cert no. EUR-COC-051203  
© 1996 Forest Stewardship Council