

# Sustainability of steel-framed buildings

*Description: Summarises the principal sustainability (environmental) criteria for construction and demonstrates the sustainability of steel construction concerning some key environmental issues in Europe*

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# 1. Steel construction sustainability summary

Steel construction means using steel as the building's main framing material. Steel is also common in the building envelope, fasteners, building services, substructures and as concrete reinforcement. Compared to today's average construction practice, modern steel construction offers:

- material efficiency - resulting in less natural resource usage, less transports, less emissions and less energy usage;
- ultra-high recyclability - resulting in less natural resource usage, less waste and less emissions;
- quality and durability – resulting in many sustainability favours;
- dry and lean construction – resulting in less health hazards, less waste, less energy usage, less emissions and a better work environment.

Like other industrial activities steel construction has direct relations to several important sustainability issues, like energy and waste, and further improvements are to be done continuously. Improvements can be worked out all over the construction chain, although the biggest possibilities to affect the results are to be found in the early stages.

**Table 1.1** *Summary of issues of environmental concern and their common relationships to steel construction*

<b>Issue</b>	<b>Steel construction relation</b>	<b>Possible to improve through</b>
Embodied energy	Refining of raw materials to construction products. Recycling saves about 70%	Building system optimization; Recycling; Reuse; Prefabrication
Operational energy	Includes 85-95 % of the life-cycle energy usage in a building; Increased life-cycle thinking	Thermal efficiency; Low-energy equipment; Airflow control; Lean construction
Transports	Truck transports an emission source; Increased trade means more transports	Light structures; Optimised logistics; Local products
Raw materials and water	Construction business uses much material; Virgin materials needed for production	Recycling; Reuse; Material efficient structures
Emissions	CO <sub>2</sub> emissions from raw material refining; Affection on environmental effects	Efficient use of energy and materials; Recycling
Recycling and reuse	Unique recyclability; Societal forces towards increased reuse and recycling	Life-cycle design; Use of recyclable materials; Standardisation
Waste and land-use	Construction business is a waste generator; Light and industrial construction favourable	Recycling; Reuse; Lean construction; Prefabrication
Indoor environment	Unwanted water in structures; Comfort parameters specified in regulations	Dry materials; Airflow control; Judicious design

## 2. Sustainability and construction

*Sustainability* includes environmental, economic and social concerns for achieving a long-lasting development of the society. *Sustainability of Construction* here comprises the major health and environmental aspects related to the life-cycles of all types of buildings. A building life-cycle includes production, use and deconstruction, and the underlying activities and material and energy flows generate inevitable influence on the planet – good and bad.

Most environmental and economic issues can be affected by the choices made by you and your colleagues working within the construction processes. The social concerns are here mainly left to the politicians, planners and architects.

The construction sector is a core economy in many countries which employs about 7% of the Europeans and comprises annual businesses of more than 1000 billion € in Europe, answering to almost 10% of GDP. Construction means welfare, security for individuals and businesses, growth and investments for the future. [4]

The use of the buildings and all construction related activities generate more than 40% of all CO<sub>2</sub> (carbon dioxide) emissions, use about 40% of the produced energy and consume more than 40% of the material resources used in the society. These estimations might differ slightly between European countries. The global governmental intention, except the US, is to reduce the CO<sub>2</sub> emissions by an average 5% over the next 5 years, and some experts claim that the reduction must be 50% over 50 years in order to avoid large-scale climate changes. [11][12]

The usage of energy during the building's service state, called operational energy, is one of the most important sustainability issues for the construction sector. Energy primarily affects the environment due to the production and distribution of electricity and water for heating and cooling. The thermal performance and overall energy efficiency have an effect on the economical and environmental performance of the building, and thereby it's competitiveness. Basic criteria for thermal performance and indoor air quality are set in national Building Regulations.

Construction need much material input, both virgin resources and recycled material. Materials primarily affect the environment through the refining processes from raw materials to building components, and also by transports. Virgin natural resources are not infinite, and recycling leads in most cases to improved environmental performance. The construction sector generates huge amounts of waste (>1100 kg per capita annually in EU25), and the demands on improved recycling are increasing. Therefore, in many countries the sustainability focus is on recyclability. [5]

Sustainable construction can in many cases be achieved by “knowing before doing”. By life-time thinking, efficient use of durable and recyclable materials, and by careful construction using the best suitable components as intended sustainability improvements can be reached.

### 3. Sustainability and steel construction

Steel construction enables efficiency, durability and recyclability. These properties give you the opportunity to generate many secondary environmental credits. For example the material efficiency, the relatively low weight, and the high recyclability of steel structures are directly linked to e.g. less use of resources, less use of energy, less waste, less emissions and less transports. The good functional durability means less re-construction and thereby an overall sustainability improvement.

Some summaries of sustainability attributes related to the use of steel in construction are listed in Table 3.1. These attributes are almost the same for all enveloping steel buildings, as residential, office, industrial and public buildings. All properties are not applicable for open structures like bridges and masts owing to the functional differences.

*Table 3.1 Attributes of steel in sustainable construction*

<b>Attribute</b>	<b>Comment on steel construction</b>
Usability	Steel construction is pre-fabricated in efficient factory processes with minimum use of resources, and enables long-span, high-rise and flexible buildings.
Speed	Steel structures are installed rapidly on site which reduces local disruption
Weight	Steel structures are light, and therefore efficient on materials, energy, transports and emissions. The low weight also enables vertical extension and optional location.
Waste	Steel construction is very material efficient, generating low amounts of waste, and most of the waste is recycled
Performance	Steel is a high performance, dimensionally accurate material, produced with modern computerised technology
Logistics	Steel structures are delivered to site 'just in time' for installation, and can be produced locally
Durability	Steel structures have long very design life and the high quality remains
Health	Steel construction is dry construction, low-emitting materials, controlled and safe process and leads to high quality architecture
Recyclability	All steel can be recycled, steel is recycled without quality losses, and all steel has recycled content
Reusability	Steel buildings or components can be dismantled and re-used

The following chapters include the most important attributes allocated to different phases of the life-cycles of steel constructions.

#### 3.1 Sustainable design

Good design is fundamental to sustainable construction. Decisions made at the initial design stage have the greatest effect on the overall sustainability impact of the construction project as well as the life-time of the building. Sustainable design of buildings can be reached by specifying steel.

### **Material efficiency**

Steel's high strength-to-weight ratio is exploited in building structures, giving low overall environmental impacts. The other efficient use aspect contains low waste due to accurate design specifications combined with high-quality and durable steel products.

### **Energy efficiency**

The usage of operational energy is heavily influenced by the design of the building. By specifying high-quality and property stable products, combined with efficient structural solutions enabled by different steel-based systems, the life-cycle energy consumption can be reduced. Using less energy will result in many sustainability credits.

### **Recyclability**

Steel construction enables controlled life-cycle design, including the possibility to "design for recycling". The ease of installing a steel structure also shows the ease of designing for simple dismantling, reuse and recycling of the components. Steel is unique as construction material because it can be fully recycled over and over again into new first-rate steel.

### **Flexibility**

Steel's long-span and high-rise capabilities create flexible spaces that facilitate changes in use during the life of the building. The steel structure's long life and remountability enables repeated design for use optimization, saving money and winning sustainability.

## **3.2 Sustainable construction**

The philosophy of Lean Construction is well applicable to steel construction. The possibilities to reach increased efficiency concerning time, cost, material and resources are already enabled through the material properties and accuracy, and the established industrial construction concepts. Lean construction is one way towards sustainability.

### **Prefabrication**

A big part of steel construction is performed in factory, off the construction site. The prefabrication of frames, structural elements, modular units etc. provides a safer working environment, and facilitates accurate and quality workmanship. Steel construction also simplifies the logistics, increases the speed of the construction process, and minimises the pollution and noise on site. Minimising local disturbance is often a major issue during construction. Steel construction can therefore be both sustainable and cost saving.

### **Waste**

Minimising waste is a priority for the construction industry. In steel construction Computer Aided Design (CAD) systems are efficiently integrated with the manufacture, producing high-quality steel products to correct and stable dimensions, generating almost no wastage on site. Any steel waste is recovered and recycled into new steel.

### **Building physics**

The accuracy of the construction work can have significant influence on the indoor environmental performance and on the usage of operational energy. Steel-based envelopes and systems enable insulation, functional services and controlled airflows for good thermal performance. The dry and inorganic materials in steel construction disable possible moisture

problematics during delivery, erection and completion, making the construction work easier and more cost efficient.

### **3.3 Sustainable use**

Designing buildings for long life and a minimum of operational burdens are key aspects of sustainable construction. Extending the life of buildings by using steel-based systems maximises value from the financial and material resource investment. Frequent re-construction is not only an economical disaster, but also environmentally adverse.

#### **Durability**

Constructional steel can last much longer than the building it is part of. Thereby, steel products often can be reused as new products. Steel system durability and strength brings safety and long lasting functionality for the occupants, which is an important part of sustainable use of constructions.

#### **Maintenance**

Maintenance of buildings is vital to achieve longevity. Multi-storey steel framing needs no maintenance, and exposed steel construction products might require regular maintenance, often for aesthetic reasons. A wide range of advanced and sustainable coatings is available for steel. When used in accordance with recommended maintenance programmes these coatings offer long-term protection, resulting in reduced environmental impact.

#### **Energy**

The energy associated with the occupation of buildings, the operational energy, is the key issue of life-cycle environmental performance. The framework itself has insignificant influence on the operational energy, but the thermal efficiency of the building envelope in combination with adapted building services is important. Steel-based envelopes can provide well-insulated and airtight solutions, possible to combine with optional energy-saving efforts. As the operational costs related to energy are significant, there is also money to save.

#### **Flexibility**

In times of rapid change, sustainable buildings have to be able to accommodate task changes concerning e.g. changes of use, services, electricity and IT systems. The useful life of steel buildings can be extended through adaptation of internal space, structural extension and upgrading of the climate envelope. In these ways the life cycle costs and environmental impacts are reduced as more value is obtained from the same source.

### **3.4 Sustainable end-of-life**

When it is impossible, or undesirable, to extend the life of buildings through adaptation or refurbishment, and therefore deconstruction becomes unavoidable, it is important that end-of-life impacts are minimised. Principally this involves minimising pollution and waste, and ensuring that materials are recovered, reused and recycled.

#### **Demountability**

Steel buildings and steel construction products are highly demountable. The large number of temporary structures that are steel-based can illustrate the potential. Prefabricated frames, elements and modules can easily be removed and collected. Provided careful design for

deconstruction and careful end-of-life treatment, the steel building stock can be regarded as a vast warehouse of building parts for future use.

### **Recyclability**

Steel is unique as construction material because it is fully recyclable, and the steel materials can be recycled over and over again without quality loss. The recovery rate for many steel construction products is today 94-97%, which is a very strong sustainability argument for steel construction. [7][17]

### **Reusability**

Reuse offers an even greater environmental advantage than recycling. The second-hand market is still small, but there is significant scope for increasing reuse of constructional steel. Probably, a certain degree of standardisation is necessary. Reused steel products are framing components, cladding components, pedestrian bridges, sheet piling, wall elements and temporary structures. Any other construction material cannot enable this.



## 4. Specification of key issues

The disturbing influences on the exterior environment can be divided into embracing environmental effects, that all are regarded significant for ecological balances, for human life-quality and on the long term for human survival. The six main environmental effects under surveillance are:

- Global warming,
- Acidification,
- Eutrophication,
- Ozone layer depletion,
- Toxicity, and
- Resource depletion.

Many different kinds of industrial, human and natural activities contribute to these effects, positively or negatively, which means that we are all able to affect the environmental future today. The major steel construction - and most industry - issues of environmental concern, can be grouped as:

- Energy use in production (embodied energy)
- Energy use in service (operational energy)
- Transportation
- Use of raw materials and water
- Emission of harmful substances
- Recycling and reuse
- Waste treatment and land use
- Indoor environment

The differences in main focus can be significant between countries, and also for various types of buildings. The following chapters show some relationships between the issues above and the building's life-cycle. The focus is here on residential and commercial steel buildings, but the information might be applicable to other steel structures.

### 4.1 Embodied energy

The production of 1 kg of finished steel product for constructional usage demands about 9 kWh of energy in average, including all processes and energy types (EU-average from ore). Compared to a 50-year life cycle of a multi-storey steel building, the production of all embedded steel components contribute to less than 2% of the total energy usage. [2][6]

As only about 10% of the steel building is steel (much more for certain structures), the origin of the building's embodied energy is mainly the cement production, the lime refining for gypsum boards, iron reduction by coke and electric arc processes for scrap melting. [2]

While making new steel, about 70% of the constructional steel's embodied energy can be saved. Up to half of the embodied energy in combustible products will be reused for heating and other purposes. [6]

*Further improvement opportunities through:*

- ✓ Prefabrication, high strength steel and light-gauge steel structures for material efficiency

- ✓ Extended use of recyclable components
- ✓ Extended reuse of steel products

## 4.2 Operational energy

The operational phase normally includes 85-95% of the life-cycle energy usage of a multi-storey building. The framework itself has insignificant influence on the operational energy, but the thermal efficiency of the climate shelter in combination with adapted building services is important. Small insulation improvements can have big influence on the total energy usage. [1][9]

Steel systems in exterior walls can be very efficient if used correctly. Light-gauge steel framing combined with thermal insulation, wind stopper, moisture shield and optional surfaces can under normal circumstances perform a thermal transmittance  $U$  down below  $0,15 \text{ W/m}^2\cdot\text{K}$  (corresponding to thermal resistance  $R > 7 \text{ m}^2\cdot\text{K/W}$ ). Modern technology shows that metal framing is no worse concerning thermal performance. Building Regulations set the heat loss limitations for different types of buildings. [10]

The national differences are of course significant depending on the climatic conditions, and the operational energy is directly related to the type of activity within the building. Thermal storage can give limited credit to the energy use in heavy structures if there are significant heat loads and temperature variations. Furthermore, energy is also used for cooling, especially in office buildings. In industrial buildings heating is often at a low level as processes might produce heat and indoor temperature requirements are insignificant.

*Further improvement opportunities through:*

- ✓ Thermal efficiency of exterior walls and roofing
- ✓ Optimised ventilation system and controlled air flows
- ✓ Low-energy equipment
- ✓ Prefabrication and Lean construction.

## 4.3 Transports

Combustion of fossil fuels is the activity having most influence on the above mentioned environmental effects. All heavy transports, except for electrified trains supported by electricity from 'carbon free' power plants, emit  $\text{CO}_2$ ,  $\text{NO}_x$ ,  $\text{SO}_x$ , HC and other pollutants, and use finite fossil resources. Construction materials transports are today dominated by trucks, and the increasing international trade causes more and longer transports.

Steel structures are light and material efficient, and in most cases fabricated off-site. Therefore there is less weight to transport, a minimum of waste to move to recycling or deposit, and the instant erection and low degree of in-situ production makes the logistics very efficient. The accurate design and shape stability of steel profiles also result in a minimum of constructional waste. But a high degree of prefabrication can also result in more volume to transport to site, and specialised fabricators are not always located nearby. [15][8]

*Further improvement opportunities through:*

- ✓ Material efficiency and light structures
- ✓ Railway transports

- ✓ Increased use of alternative fuels
- ✓ Use of local construction products

## 4.4 Raw materials and water

All new construction need material, much material. When the recycled material does not fulfil the market demands in amounts or quality, virgin materials from nature are needed. The virgin materials input to steel construction is mainly metal ores, limestone, oil, coal, natural gas and some other minerals. The recycled materials input is mainly steel, other metals, plaster, glass and water. Steel construction is unique because of it's high degree of recycled content and recyclability, and therefore the need for limited virgin resources is relatively small.

Producing 1 kg steel from ore demands about 2,5-3,0 kg of material input. The excess is used as by-products, as energy or being emitted. In some economies only about 60 g out of the input of 2,5 kg are sent to deposit as non-usable waste, which prove another type of good material efficiency. [6][11]

The water consumption related to steel structures is mainly related to the cooling procedures in steel production plants. Some 60 litres of water can be used as indirect and direct cooling media for producing one kg of steel product. The indirect systems are closed, so this water will not be polluted. Most of the direct cooling water is being recycled and cleaned within closed systems, which makes the fresh water need very small. Net water consumption for scrap-based plants are about 1 l/kg and for ore-based plants about 11 l/kg. [6]

*Further improvement opportunities through:*

- ✓ Recycling and reuse
- ✓ Material efficiency and light structures
- ✓ Use of alternative fuels

## 4.5 Emissions

The emissions to air and water from important materials manufacturing industries are significant, and mainly originate from the upstream processes and transports including combustion of organic matter. Examples are processes for material production, heating, and conversion to usable energy, and also road and sea transports. Main airborne emissions are CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub> and dust. These are some of the most important influences on the environmental effects mentioned. Over the life-cycle of a steel structure CO<sub>2</sub> stands for about 98% of the airborne emissions by amount. [11][17]

Compared to other building systems with same function and size, the total emissions related to steel construction is relatively small. Comprehensive studies have shown that the building related emissions can differ a lot between different systems for the same function, depending on material efficiency and weight, the location, durability, user's special demands etc. Most of the sustainability optimisation can therefore already be done in the design stage. Material efficiency and recyclability are important building properties. Specifying steel also means that the built in elements not will be released as emissions in the future, as the steel and some other important steel construction related materials are fully material recyclable and will not be combusted or deteriorated at a deposit. [3][9]

*Further improvement opportunities through:*

- ✓ Decreased use of energy
- ✓ Decreased use of virgin resources
- ✓ Recyclability
- ✓ Alternative (eco-efficient) fuels.

## **4.6 Recycling and reuse**

A product can be recycled into the same material, another material or as energy. Reuse means using the demounted product again with or without any refurbishment. Steel is unique as construction material because it can be fully recycled over and over again without quality losses. Other construction materials often used in combination with steel with a high degree of material recyclability are plaster, other metals and mineral wool. The recycled content of any steel product for construction is in practice between 12% and close to 100%. [6]

The recovery rate for built-in steel products in construction is today about 94-97%, which is a very strong sustainability argument for steel construction. The total recovery rate including steel in civil engineering has been approximated to 85%, and increasing. There is some 2-3 billion tonnes of steel in buildings out there waiting to be recycled in the future. And these structures are durable. [7][8][17]

Reuse offers even greater environmental advantages than recycling. Reuse is not yet that common, as some standardisation might be necessary. About 14% of the steel construction products at end-of-life are today being reused on certain markets. Reused products are e.g. steel frames, cladding components, pedestrian bridges, sheet piling, wall elements and temporary structures. [7][17]

*Further improvement opportunities through:*

- ✓ Prefabrication and carefully prepared design
- ✓ Guidelines for reuse of structures and products
- ✓ Increased use of recyclable materials
- ✓ Minimised use of complex composites.

## **4.7 Waste and land-use**

The waste issue is directly related to the issues of recycling and raw materials above. The huge amounts of constructional waste is a big problem in some regions where controlled disposal areas are small or non-existing. In severely exploited areas, and in close-urban areas with difficult topography or other unpleasant nature conditions, green land is very attractive for man as well as for nature.

The opportunities for achieving sustainable steel construction regarding waste and land-use are many:

- The high degrees of recyclability and reusability means less waste generation
- Off-site production enables small construction sites
- Lean construction and prefabrication enables reuse, material efficiency and less waste

- Light structures, short construction time and material strength enables possible vertical extension of existing buildings, use of developed land and construction on bad soil or in tectonic areas

Most of the construction waste consists of soil from the construction site. Any steel waste from construction is being recycled, and mineral waste from steel production is used in many other applications, such as road construction. Other major waste generating processes are mining and other raw materials extraction. Mining sites for iron ore are commonly situated under ground, supervised by authorities and refilled with generated mineral waste. [11]

*Further improvement opportunities through:*

- ✓ Recycling adaptation
- ✓ Reuse
- ✓ Increased prefabrication and lean construction.

## **4.8 Indoor environment**

You are spending more than 90% of your life indoors, and your children even more. The building physics is therefore very important for your health and well-being. The relationships between indoor environment and human health are very complex. Main issues are moisture, thermal comfort, sound and air quality, and the size of each issue vary between different countries.

The Sick Building Syndrome (SBS) is a modern “disease” caused by misplaced water in organic building components. Steel is not hygroscopic, nor organic, which minimizes the risks of SBS, direct airborne emissions and structural deterioration. The common off-site prefabrication of steel buildings keeps the dry materials also dry assembled. Steel systems for walls and floorings also fulfil high Building Regulation levels on thermal comfort and sound insulation. [9][10]

*Further improvement opportunities through:*

- ✓ Increased use of dry and non-hygroscopic materials
- ✓ Prefabrication and well planned design
- ✓ Weather protected production
- ✓ Better airflow control.

## Literature

- [1] *Achieving Sustainable Construction*, Corus Construction Centre, UK (2003)
- [2] Adilstam, T., *Livscykelanalys av bostadshus i Lättbyggnad* {Life-cycle assessment of light-gauge steel housing}, The Swedish Institute of Steel Construction, Sweden (2005) <in Swedish>
- [3] Björklund, T. et al, *LCA of Building Frame Structures*, Chalmers University of Technology, Sweden (1996)
- [4] *Construction in Europe: Key Figures*, European Construction Industry Federation, Belgium (2005)
- [5] <http://epp.eurostat.cec.eu.int>, Eurostat, Belgium (2006)
- [6] *Life Cycle Inventory Study for Steel Products 1999/2000*, International Iron and Steel Institute, Belgium (2002)
- [7] *Sustainable Steel Construction. Building a Better Future*, The Steel Construction Sector Sustainability Committee, UK (2003)
- [8] *Personal communication*: International Iron and Steel Institute, Belgium (2006)
- [9] *Stålbyggnad* {Steel construction}, The Swedish Institute of Steel Construction, Sweden (2004) <in Swedish>
- [10] Svensson-T., C., *Handbok för ytterväggar* {Guide for exterior walls}, The Swedish Institute of Steel Construction, Sweden (2004) <in Swedish>
- [11] *Stålet och miljön* {The steel and the environment}, The Swedish Steel Producers Association, Sweden (2001) <in Swedish>
- [12] *Technology and Policy for Sustainable Development*, Centre for Environment and Sustainability, Sweden (2002)
- [13] *Competitiveness of the construction industry. An agenda for sustainable construction in Europe*, The European Commission, Belgium (2001)
- [14] <http://europa.eu.int/comm/environment>, European Commission – Environment, Belgium (2006)
- [15] *Steel in residential buildings for adaptable and sustainable construction*, European Commission, Belgium (2005)
- [16] Birat, J-P., *The Greening of Steel: the Blast Furnace in the Garden*, International Iron and Steel Institute, Belgium (2005)
- [17] *Life cycle assessment (LCA) for steel construction*, European Commission, Belgium (2002)

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