

STEEL'S CONTRIBUTION TO A LOW CARBON FUTURE AND CLIMATE RESILIENT SOCIETIES

worldsteel position paper



Partnerships between governments and the steel industry are fundamental to a sustainable future.

Steel is everywhere in our lives and central to making modern society sustainable.

Steel provides the solutions to infrastructure and construction needs around the world. It is the material to build climate resilient cities and coastal protection. Steel protective design minimises the impacts of natural disasters.

Today global population growth combined with improvements in standards of living are exerting pressure on the world's ecosystems. Increased emissions of CO₂, use of scarce resources and growing challenges to the disposal of waste are the results. Steel is at the heart of delivering solutions to so many of these challenges.

Steel is infinitely recyclable and its byproducts and waste energies are valuable resources. The steel industry is integral to the global circular economy and thus the successful delivery and maintenance of a sustainable future.

The steel industry has made significant reductions in greenhouse gas emissions in the past decades by improving energy efficiency and deploying new technologies and practices resulting in benefits to the environment and economies. Reducing greenhouse gas emissions is a global challenge that requires a global solution. The steel industry believes it is very important to be actively engaged as we continue to strive to move towards a low carbon society.

Governments, the steel industry and other stakeholders will all need to collaborate in order to overcome the technological and economic challenges involved to ensure progress.

› **FIRST, governments need to recognise and embrace the importance of a strong and healthy industrial base in a sustainable economy. The role of the steel industry needs to be considered within the context of a progressive industrial policy and governments need to engage with the steel industry when developing a carbon policy that would impact the industry.**

Steel is a major driver of economic success - providing critical products, employment, revenue and investment in modern economies. Lack of unity and cohesion between government departments without a clear future-focussed steel industry strategy leads to short term, ill-considered and damaging regulation that limits industrial development.

› **SECOND, steel is a CO₂ and energy intensive, but highly competitive industry that also enables major CO₂ mitigation in other sectors. However, there is a risk that inequities introduced by carbon pricing mechanisms could jeopardise fair competition.**

The OECD Council states that "Attempts to price carbon implicitly or explicitly will have distributional consequences that

may be contentious. It requires the determination and creativity of governments to find the right level of arbitrage between the economic efficiency and the political and social sustainability of climate policies." Since as much as 31% of steel is traded internationally, policies must promote a level playing field to ensure that steel companies in one region are not put at a disadvantage with steelmakers from other regions or in relation to competing materials. Furthermore, if these mechanisms are to be successful with regard to both production process improvements and consumer behaviour, they must not result in relocation of steel production. A global level playing field and consistent application of comprehensive market based approaches are necessary conditions to ensure a fair treatment of the related financial and trade implications throughout the value chain.

› **THIRD, a life cycle approach is an important tool for future environmental policy.**

Governments should take into account the full life cycle of products when creating new regulations. Only by doing this, can the actual impact of each stage of a product's life be calculated and be efficiently addressed. Today too often regulations focus only on the production phase or the use phase of a product ignoring the full life cycle, leading to inappropriate material selection.

Taking the life cycle into account will help to create reliable and predictable frameworks for cost effective energy and environmental policies.

› **FOURTH, governments should promote and encourage a circular economy approach leading to: innovative design, a reduction in the amount of materials used, encouragement of reuse and recycling of all materials and minimised waste.**

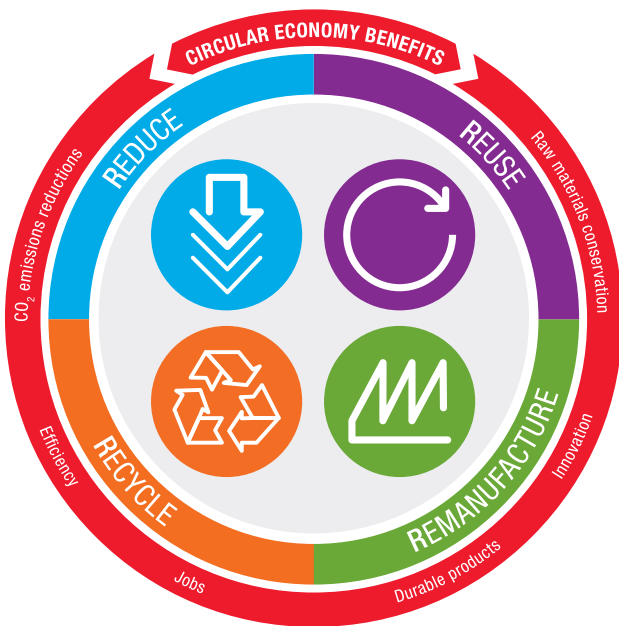
Governments around the world at national and regional levels need to prioritise the collection and recycling of end-of-life steel products. This should also be extended to all products. Policy should not encourage use of materials that cannot be comprehensively recycled and thus end up in landfill.

› **LASTLY, progress in breakthrough technology development in steelmaking and implementation must be maintained or accelerated requiring the financial burden to be shared by both government and the private sector.**

The inherent risk of failure associated with the long term research, development and implementation of new technologies requires a partnership between the steel industry and national and regional governments. Considering the need for breakthrough technologies including reuse of CO₂ and the potential benefits to society, policy should support funding for environmentally focussed research and development. Any future climate agreement should include provisions on technology transfer, climate risk management mechanisms and international funding

Steel in the circular economy

The circular economy refers to a move from linear business models, in which products are manufactured from raw materials, used and then discarded, to circular business models where products or parts are repaired, re-used, returned and recycled. This concept is fundamental to the triple bottom line concept of sustainability, which focuses on the interplay between environmental, social and economic factors. This should all be based on a life cycle approach. In a well-structured circular economy, steel has significant advantages over competing materials. Four keywords define these advantages: reduce, reuse, remanufacture and recycle. These are all benefits of steel.



However, continuing to fulfil a positive role in our sustainable future comes with some major challenges:

• Recycling

The use of steel scrap reduces carbon emissions from the steel life cycle. Steel is a unique material in its capacity to be continually recycled without loss of properties or performance. This, in combination with a long history of significant efforts to increase recycling rates, has resulted in steel leading the recycling statistics, for example in cars and cans. But recycling is limited by the availability of scrap due to the long life of steel products for example buildings and bridges. Reducing the amount of pre-consumer scrap generated when steel products are transformed into final consumer goods (up to 50% of the scrap generated today) would also have a large impact. Policies can provide further support for recycling by placing emphasis on recyclability and design for dismantling.

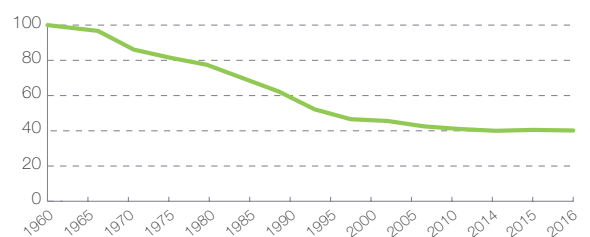
• Use of by-products

The production of steel results in the generation of by-products that can reduce CO₂ emissions by substituting resources in other industries. For example, blast furnace slag is used by the cement industry allowing it to reduce its CO₂ emissions significantly. Steelmaking slags are also used as civil works aggregates thereby saving natural resources and reducing environmental impact. worldsteel believes that by-products should receive preferential treatment as they contribute to the conservation of resources. Application standards would ensure that all potential materials for a particular application compete on the same terms.

• Energy efficiency

In the last 50 years, the steel industry has reduced its energy consumption per tonne of steel produced by 60%. Waste energies are also captured and used effectively. However, due to this dramatic improvement in energy efficiency, it is estimated that there is limited room for further improvement on the basis of existing technology. A recent worldsteel study shows that the average energy intensity for steel production is 20 GJ/t crude steel with a potential for improvement of 15-20%. It is interesting to note that the plants with low energy intensity do not necessarily have the most advanced equipment but their performance tend to be the result of optimal operating knowledge and software systems.

Indexed global energy consumption/tonne of crude steel production



Source: worldsteel

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The greenhouse gas of most relevance to the world steel industry is carbon dioxide (CO₂). On average, 1.9 tonnes of CO₂ are emitted for every tonne of steel produced. According to the International Energy Agency, the iron and steel industry accounts for approximately 6.7% of total world CO₂ emissions.

• Use of finished steel

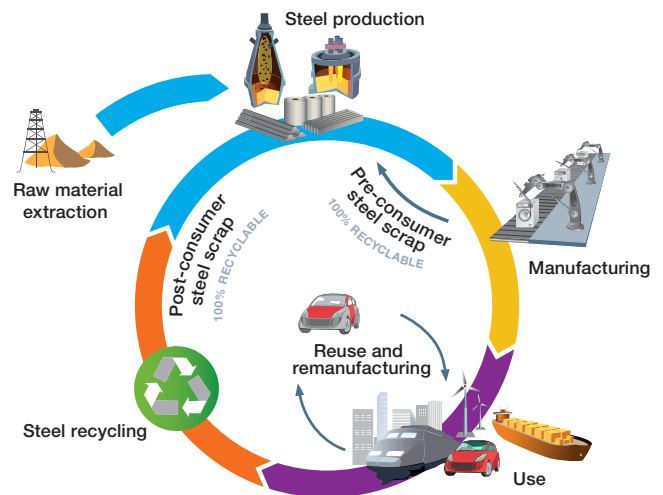
In many applications, steel has a very long service life and as a result the contribution of modern steels in improving the energy efficiency of buildings, plants, machinery and transportation is very important. Avoided CO₂ emissions from the use of high grade applications are on average 6 times higher than the CO₂ emissions from the production of these advanced steels. For example, high strength steels reduce the weight of trucks allowing them to carry more goods for the same amount of CO₂ emissions per km and improved electrical steels produce much more efficient transformers and motors thereby significantly reduce the total energy needed throughout their lives. Steel also enables recycling of other materials through vital recycling equipment thereby fulfilling an important role in the circular economy. A key contribution from the steel industry is to work closely with its customers in optimising the design and use of steel.

• Life cycle approach

In order to continue these efforts and to identify all the opportunities to reduce the carbon emissions from steel's life cycle, it is essential to take a full life cycle approach. This not only considers the emissions associated with the manufacture of steel products, but also the reduction in energy consumption from the use of new-generation steels in lighter and stronger products. Furthermore, the inherent recyclability of steel must be duly accounted for in material decision making. The recycling of steel also reduces the burden of disposal in landfill facilities and prevents the accumulation of otherwise abandoned steel products.

Unlike with energy production, the carbon emissions profile of materials is very variable and extended over a long lifetime. Steel, which has low manufacturing emissions when compared to low density materials such as aluminium and carbon fibre, also provides benefits for generations to come since it can be recycled over and over again without loss of properties and with a considerable carbon benefit.

Governmental support of Life Cycle Assessment initiatives is essential. Policies aiming to reduce carbon intensity of material use should provide a correct signal to consumers and designers on the overall impact of their choices in a comparable way and for all materials.



Global steel industry activities

The global steel industry is working together on a number of dedicated initiatives.

• Breakthrough technology development

Keeping total global CO₂ emissions at the current level or better depends on the development and introduction of radical new steelmaking technologies with a lower carbon footprint, including reuse of CO₂. This approach may prove successful and will help to lower the emissions for the steel industry; for example:

In Europe, Hlsarna has been shown to be successful at pilot plant scale. Hlsarna is funded via a combination of public bodies and European steelmaking consortium partners.

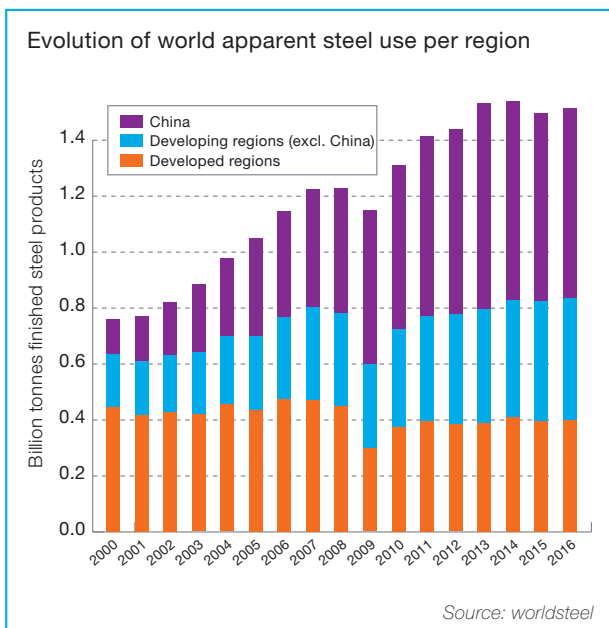
In Japan, another R&D programme "COURSE50", supported by the government, is currently proceeding from a laboratory to a pilot phase.

In North America, work is continuing under the American Iron and Steel Institute's CO₂ breakthrough programme with co-funding support from the US Department of Energy to develop an innovative flash ironmaking process. Furthermore, the Pacific Rim countries collaborated in a summit to produce a technology handbook titled State of the Art Clean Technologies (SOACT) to share technology and energy efficient steelmaking processes. Elsewhere, other initiatives (notably the POSCO programme in Korea and the China Steel Corporation programme in Taiwan) continue to make progress.

Carbon capture utilisation and storage technologies are not yet mature for the steel industry and will require government and public support to become viable options.

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Furthermore, worldsteel provides a forum in which these various national and regional research and development programmes can exchange information on their projects and share best practices.



• LCI database

Over the past 20 years, worldsteel has established and made available the largest and most authoritative database of life cycle inventory data for the production of a wide range of steel products based on actual data received from its members worldwide. This database is being updated in 2017 for more than 16 steel products and will be available as global and regional average data. This LCI database is being used extensively by steel customers, academia and other stakeholders in taking a life cycle approach.

• Technology sharing

In cooperation with its member companies, worldsteel produces technical reports on subjects impacting the steel industry. Many of these reports are kept up to date through internal online sharing and benchmarking systems and contribute effectively to improving the environmental performance of steel plants around the globe. Recent examples include air quality, by-products, energy use, maintenance and reliability, raw materials, and water management.

• Market development programmes

worldsteel has a number of market development programmes that focus on improving the energy efficiency in steel-using sectors.

The WorldAutoSteel partnership has a major programme for optimising steel use in future vehicles, including electric and hybrid.

worldsteel is further investigating good examples around the world where steel is more predominately used in infrastructure and large public buildings as well as offices and residential buildings and where these provide better energy efficiency and/or climate resilience. The purpose is to share techniques or designs.

• Climate Action recognition programme

worldsteel members have developed and agreed a common calculation methodology for the CO₂ footprint of steel plants. This methodology was subsequently transformed into an international standard (ISO 14404:2013). worldsteel encourages all its members, and indeed non-member companies, to participate in its climate action programme, which is the collection and reporting, on a confidential basis, of CO₂ emissions plant-by-plant using the methodology. From the start of the programme, in 2008, participating steel plants have been actively measuring where they are among peers in terms of CO₂ emissions, evaluating their own trend of emissions, setting up priorities for improvement and monitoring progress.

The Climate Action methodology has now been widely adopted throughout the steel industry. The data is being used in public communications such as sustainability reports and websites.

Also at worldsteel.org:

- Steel in the circular economy: A life cycle perspective
- Life Cycle Inventory data and Life Cycle Assessment methodology report
- Fact sheets on energy and raw materials use, technology transfer and breakthrough technology and by-products
- Technical reports on energy use, raw materials improvement and by-products
- Climate Action recognition programme

CLIMATE ACTION PROGRAMME MEMBERS

The following companies are accredited members of the 2017-2018 Climate Action programme:

(The companies and associations marked with one asterisk (*) have contributed to the CO₂ data collection programme for at least five consecutive years. The companies marked with two asterisks (**) have contributed to the programme for 10 years).

Acciaierie Bertoli Safau**
Altos Hornos de México (AHMSA)*
APERAM
ArcelorMittal**
BlueScope Steel Limited**
CELSA Steel Group**
China Steel Corporation**
Companhia Siderúrgica Nacional (CSN)
DEACERO SAPI de CV**
Deutsche Edelstahlwerke (DEW)*
Electrotherm (India) Limited
Emirates Steel Industries (Emirates Steel)*
Essar Steel**
EZZ Steel**
Georgsmarienhütte Holding**
Gerdau*
Gunung Steel Group
Hyundai Steel
IMIDRO (Mobarakeh Steel Complex)**
JFE Holding Inc.**
Jindal Steel and Power Limited (JSPL)
JSW Steel Limited
Kobe Steel, Ltd.**
Liberty OneSteel**

NatSteel Holdings**
Nippon Steel & Sumitomo Metal Corporation**
Nisshin Steel Co.**
Nucor Corporation**
Outokumpu Oyj
Ovako AB**
POSCO**
Qatar Steel Company (QSC)**
Rashtriya Ispat Nigam Limited (RINL)*
Saudi Basic Industries Corporation (Hadeed)**
SIJ Acroni**
SSAB**
Steel Authority of India (SAIL)
Tata Steel**
Tenaris**
Ternium**
TimkenSteel Corporation*
Trinecké železářny**
TUNG HO GROUP**
UGITECH*
U. S. Steel Košice
USIMINAS*
Vallourec*
voestalpine AG**



Contributing associations

American Iron and Steel Institute (AISI)**
Asociación Latinoamericana del Acero (Alacero)*
The Japan Iron and Steel Federation*

About the World Steel Association

The World Steel Association (worldsteel) is one of the largest and most dynamic industry associations in the world. worldsteel represents over 160 steel producers (including 9 of the world's 10 largest steel companies), national and regional steel industry associations, and steel research institutes. worldsteel members produce around 85% of the world's steel.

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