WORLDSTEEL BOARD OF DIRECTORS 2008-2009
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OUR VISION

The steel industry should be profitable over the complete business cycle. It rewards shareholders and re-invests in new products and processes. Steel companies minimise their environmental footprint and conduct their operations in a sustainable way. The steel industry has strong growth potential in developing and industrialised countries. The world steel industry must be free of government involvement that distorts the market and prevents fair competition. Steel is a high-tech industry with skilled people working in a safe environment. It attracts bright people to follow a career in steel. It aims to be an accident-free industry. Steel is the most innovative, recyclable and sustainable material of the 21st century.

A sustainable steel industry in a sustainable world.
Steel is a uniquely versatile material. It is involved in virtually every phase of our lives from housing, food supply and transport to energy delivery, machinery and healthcare. In fact, it is so versatile that pretty well everything people use every day is either made from steel or is provided by steel.

Steel has facilitated our quality of life, underpinned humankind’s development and even helped us to understand our planet and the eco-systems it supports.

Without being aware of it, society now depends on steel. Humankind’s future success in meeting challenges such as climate change, poverty, population growth, water distribution and energy limited by a lower carbon world depends on applications of steel.

Steel’s claim to be right for these times is not solely based on its claim as the most versatile man-made material. Recyclability is another of its key performance characteristics. Steel can be recycled again and again without loss of quality. This differentiates steel from many other materials where there is a loss in performance at each recycling.

Infinite recycling means that steel is perfectly aligned to meet the continuing and increasingly demanding requirements of the 21st century.

The industry can draw on a long heritage of continuous technological development, of process refinement and product innovation, to help it spread best practice and evolve to work successfully on new challenges.

In October 2008, after 41 years as the International Iron and Steel Institute, we changed our name to World Steel Association (worldsteel). The world for steel had changed substantially since 1967 and so had we as an organisation.

We are now a truly global organisation, representing 130 of the world’s leading steel companies, including seven of the top 10 producers in China.

Our new name provides a simple description of our role and clarity to our purpose.

worldsteel is the representative body of an essential industry that takes a leadership role through environmental, social and economic programmes.

Our activities are focused on helping the industry meet society’s requirements. We run life cycle assessment programmes to help customers factor in different steels’ performance in different applications (p. 19). We coordinate research into new steel products and processes (p. 27) because it has strong growth potential both in developing and in industrialised countries.

And to help the industry make the most immediate impact on CO₂ emissions with existing technology, we run a worldwide programme that enables companies to reference their performance against the best in class (p. 16).

Steel companies will succeed in this technologically-driven environment where they have the skilled people working in a safe environment (p. 12) and that is attractive to bright young people (p. 11).

To meet increased demand, minimise steel’s environmental footprint and continue conducting operations in a sustainable way will require a massive investment by the industry and national governments. The current financial crisis has done nothing to help. Yet, investment will have to be sustained if progress is to follow (p. 9). The best way to ensure that this happens is to encourage dynamic competition in open and fair markets, so that all producers and markets are subject to shared global pressures that will encourage shared solutions (p. 23).

Ian Christmas
Director General
The Hermitage Plaza project in Paris includes two buildings formed by interlocking steel triangles. This diagrid structural system is extremely weight efficient and uses less steel than a conventional frame. Image courtesy of Foster + Partners, architects.
In the five years before the start of the global financial crisis, the steel industry worldwide enjoyed a boom in demand. This enabled steel companies to achieve a level of profitability that funded new investments, acquisitions and continued consolidation within the industry.

Much of the industry’s expenditure went on environment-related plans and projects: to lighten its footprint, as well as long-term process and product development.

This virtuous circle of growing output and beneficial investment came to a halt when steel demand collapsed in the third quarter of 2008.

When the downturn began, it was categorised as a banking crisis, linked primarily to the US and Europe, where the banks had over-extended in making loans on property and buying mortgage securities. It seemed likely that the US and the UK economies might be hardest hit and others might well escape its worst effects. However, the banking crisis quickly became an economic crisis on a global scale affecting demand in developing and developed countries, in trade surplus economies as well as those in trade deficit.

The pace of change was breathtaking. By the first quarter of 2009, many countries had officially entered recession.

Steel, a global industry, now saw the negative side of globalisation. Demand crashed worldwide. Large economies such as Germany and Japan were far from badly hit as other regions, because of the impact on key steel-using customers as markets for their goods disappeared.

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Manufacturing markets, especially automotive and mechanical engineering, evaporated. As the financial crisis worsened, supply chains de-stocked, banks refused to lend so credit dried up and business confidence sank.

As a result, apparent steel use – which had enjoyed over 7% growth before the crisis – collapsed in the fourth quarter of 2008. Apparent steel use in 2008 was 1.8% down on 2007.

As the crisis continued in the first half of 2009 in most of the world, apparent steel use in 2009 is expected to go down by a further 8%-9%.

The crisis has underlined the ever-increasing importance of emerging economies even more, due to their relative resilience. In late 2008 and 2009, China and India continued to register growth in industrial production. In the developed world, steel use was down by 30%.
Capacity

In the past five years global steelmaking capacity grew at a compound annual growth rate (CAGR) of 7.9%, reaching 1,713 mmt by the end of 2008.

Most of this expansion came from the emerging economies, where steel demand was growing particularly fast. During 2001-2008, Brazil, Russia, India and China (BRIC) accounted for 89% of world steel capacity expansion, of which China had the lion’s share.

As steel demand collapsed in late 2008, plant capacity utilisation rates fell from the 85%-90% range that characterised the previous five years, to below 60% in December 2008.

New projects have been delayed or cancelled and many plants idled. However, in some cases expansion plans have simply been delayed and new capacity will come on stream in the next few years. Coping with overcapacity will be a key industry challenge.

Recovery

Emerging economies, including China and India, started to improve in the first quarter of 2009. Signs of recovery also started to show in developed economies in the second half of 2009.

Some restoration of consumer and business confidence could be seen everywhere. Surveys in developed and developing countries showed that consumers were starting to perceive an improvement in the economic situation. They are more optimistic about the future and spending patterns are being adjusted accordingly.

The US housing market showed a remarkable rebound in July 2009. German manufacturing showed the start of an export recovery. By August, there was broad consensus that the worst of the crisis was over and that the world economy was on the road to recovery.

A major factor has been the government stimulus packages and monetary-easing policies pursued everywhere in the world.
Even though stimulus packages pulled the global economy out of the worst recession since World War II, questions remain as to how stable and resilient the recovery will be. In developed economies, the rebound is partly explained by the end of massive destocking and start of stock accumulation. The immediate challenge is how momentum can be sustained if governments rein in their efforts to boost spending and the inventory rebuilding process is over.

Investment and infrastructure spending will continue to pull steel demand in the emerging economies. In developed economies, weak housing markets and investment will make growth less steel-intensive. The overall implication of the crisis for the steel industry will be less growth in steel demand and an increased importance of the emerging economies.

### Monthly crude steel production, year-on-year by region, July 2008 to August 2009

![Graph showing monthly crude steel production by region from July 2008 to August 2009.](image)

### The China effect

During the economic crisis, China impressed the world with its GDP growth of 7.1% in the first half of 2009 and over 8% GDP growth expected for 2009. The increased demand from China helped recovery in other Asian economies, including South Korea and Taiwan, China.

This rebound was largely attributable to the success of the US$586 billion domestic stimulus package announced at the end of 2008 to offset the slump in external demand for Chinese goods. However, the jump start from the Chinese government stimulus policies cannot be maintained forever. With no strong recovery in the developed economies forecast, a key challenge will be how to maintain growth without the support of a vibrant export market.

Efforts to overcome the crisis will make the industry stronger in the long term. Steel companies with sound structures and healthy finances will emerge prepared for the upturn as it develops.

The industry has already spent billions of dollars on consolidation, restructuring, reorganising and upgrading. This process must be allowed to continue so that after the recession companies that continue to serve their customers are fitter, leaner and competitive. It is important that there is a free and fair market for steel. Governments must resist any measures or support for their steel industry that provides unfair advantage.
Successful organisations are those that develop their most important resource: the people they employ. One way to do this is by adopting innovative training and development practices that have a measurable impact on performance.

In the steel industry, there is constant pressure to innovate and implement advances in production processes. Steel companies must also ensure that employees have the skills to exploit these improvements. This is crucial to productivity, job satisfaction and employee retention.

The growth of the steel industry also increases the need to develop the next generation of steel industry professionals. The industry recognises that it is important to manage knowledge of metallurgy and steelmaking, particularly when more professors and experts are retiring than are joining the industry.

Promoting industry knowledge

Although the steel industry employs people with diverse skills and capabilities, steel companies around the world face a shortage of talent in metallurgy, materials science, physics, chemistry, engineering and mathematics. As a result, the industry has to secure its workforce from an increasingly smaller pool of potential recruits.

Recognising this trend, the industry has introduced many initiatives to attract, develop and retain talented people as well as improve the industry’s image. One such initiative, steeluniversity.org, plays an important role.

steeluniversity.org is a free on-line initiative developed by worldsteel. With financial and technical support from worldsteel member companies, it provides highly interactive e-learning resources on steel technologies. They cover all aspects of the iron and steelmaking processes through to steel products, their applications and recycling.

steeluniversity.org gives students the opportunity to study and apply the basic scientific, metallurgical and engineering principles, that underpin the production and use of steel. At its heart is a series of realistic, game-like simulations of the main steelmaking operations. Students can even test what they have learned as they progress through the modules.

The resources are intended for use by undergraduate students, their teachers, lecturers and professors and also by employees and their trainers in steel companies.

Extract from the electric arc furnace steelmaking module

The electric arc furnace (EAF) is the major production route for recycling steel scrap, often into higher quality steel. The steps in the process involve:

- Select the appropriate type of scrap and quantities for production order
- Divide the scrap into mixed batches
- Charge the scrap into the furnace where it is melted using a high voltage electric current
- Refine the product with the injection of appropriate elements and alloys
- Deliver the molten steel to the ladle.

Student learning outcomes for this module include:

- Understand the function of an EAF
- Identify the broad range of steel scrap
- Describe the chemical reactions that take place during the refining process
- Understand the different strategies for maximising yield.
The annual steelmaking challenge

To encourage greater use of steeluniversity.org each year worldsteel runs a steelmaking challenge. The challenge is based on one or more of the steelmaking simulations. Participants compete against other teams and individuals in a 24-hour worldwide competition.

In 2008, the challenge involved the manufacture of steel plates for the production of 25 wind turbine towers for an offshore wind farm. Taking on the role of plate rolling mill manager, the challenge was to supply an order of steel plates for the 25 towers built from three separately rolled sections.

The participants were required to select the appropriate steel grade and then manage the production of the plates to meet the correct mechanical and dimensional property constraints. Once a successful result was obtained, the team focused on optimising the processing to achieve the lowest cost for the order.

The industry winners were from Baosteel in China. France's Ecole Nationale Supérieure des Mines de St-Etienne provided the academic champions.

Breakdown of attempts by country

In 2008:

<table>
<thead>
<tr>
<th>Total number of teams</th>
<th>478</th>
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<tbody>
<tr>
<td>Total completed attempts</td>
<td>16,446</td>
</tr>
<tr>
<td>Total successful attempts</td>
<td>1,513</td>
</tr>
<tr>
<td>Average completed attempts per entrant</td>
<td>34</td>
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Promoting excellence in safety and health

“Nothing is more important than the safety and health of people who work in the iron and steel industry.” The worldsteel Board of Directors recognise that this guiding principle needs to be at the heart of every decision, process and action taken in a steel company.

There is a strong correlation between improved performance on safety and health issues and improved performance on key business indicators such as product quality and consistency, process control efficiency, profitability and employee motivation. With involvement from many member companies, worldsteel manages a range of activities focused on promoting excellence in safety and health practices.

Historically, steelmaking has been considered a dangerous process and accidents were thought to be inevitable. Today, steel companies recognise that this perception is not appropriate for a modern and technically-advanced industry. Senior executives, and indeed everyone working in a steel plant, be it employee or contractor, recognise that an accident-free environment requires a strong commitment from the top. A culture must be set where everyone understands that safety and health is the number one priority.

Steel companies strive to improve their safety and health performance with various programmes and initiatives. This work starts by recording lost-time injuries and fatalities. Some companies and steel plants have been going for many years without a recorded incident. These companies know that such performance requires excellence in all aspects of their operations, and continued vigilence.
Sharing experience and good practice

In 1999, worldsteel developed Accident-Free Steel, an initiative that brought together safety specialists and line managers from worldsteel member companies. Through a series of regional seminars, members exchanged ideas, share information and statistics, and developed programmes to demonstrate how to have an accident-free environment in a steel plant.

This initiative continues today. Once a year, senior safety and health managers from member companies meet to discuss ways to improve safety and health performance and to exchange experiences on serious accidents and fatalities.

worldsteel safety and health principles

worldsteel recently published guidelines to help companies implement six principles for improved safety performance. Adopting these principles at the highest level, member companies demonstrate their commitment to an injury-free and healthy workplace.

The guidelines are challenging and require significant effort to implement. The 24-page publication has been translated into more than 10 languages with thousands of copies distributed to member company employees.

Below are some examples of the implications of the principles and how each employee can be involved in their adoption and implementation.

On principle 2 – management responsibility

• If leaders do not visibly change, nothing will.
• Include safety and health results in performance assessments and other career advancement decisions.

On principle 4 – working safely is a condition of employment

• Every employee is empowered to stop any work or process if they believe it to be unsafe or unhealthy.

Excellence Recognition Award

The worldsteel Safety and Health Recognition Award gives member companies the opportunity to showcase specific efforts they have made to eliminate incidents and injuries, and to share them with other companies.

In 2008 five member companies received recognition for their efforts in addressing three key criteria:

• How the practice or programme demonstrated and applied the worldsteel safety and health principles.
• How the project was able to demonstrate measurable improvement and quantify the improvement.
• How the programme was able to demonstrate its relevance and applicability to other member companies.

Six fundamental principles

• All injuries and work-related illnesses can and must be prevented.
• Management is responsible and accountable for safety and health performance.
• Employee engagement and training is essential.
• Working safely is a condition of employment.
• Excellence in safety and health supports excellent business results.
• Safety and health must be integrated into all business management processes.
Detail from the masterplan study of a North Sea ring of offshore wind farms, Zeekracht. Image courtesy of OMA (Office for Metropolitan Architecture).
Technology focused on environmental improvements

Efficient energy use is one of the steel industry’s key priorities, as it has been over the past three decades. During those 30 years steel companies have halved the energy consumed per tonne of steel produced.

Indexed energy consumption/t crude steel produced in North America, Japan and Europe

Looking to the future:

- Steel demand could double over the next 40 years to approximately 2.5 billion tonnes a year, based on the expected growth in developing countries.
- Steel has an important role in creating low carbon intensity construction, housing and transport.
- The difference in carbon emission intensity in steel production between various countries can be reduced by sharing best practices and technology.
- Maximising end-of-life steel recycling and using by-products from steelmaking will reduce CO₂ emissions.
- The best plants in the world are already operating close to the optimum that existing technology allows. Therefore, development of breakthrough steelmaking technologies is vital if global steelmaking CO₂ intensity is to be reduced in the long term.
- Implementation of appropriate new technologies requires significant major investment in research and development, testing in pilot plants and careful up-scaling to commercial volumes.
- In the long term, a truly sustainable solution will depend on near carbon-free electricity generation.

There are 3,000 different grades of steel available to achieve specific properties. Every year, more are developed with unique designs that can minimise the impact on the environment.

The main physical by-product from steelmaking is slag. When used in cement production, slag reduces CO₂ emissions from the process. Slag can also be used as a base in road building. It is also sometimes used as fertiliser.

It is possible to make steel with nearly no waste going to landfill. Current material efficiency rates have reached 97% and some companies have an internal recycling and by-product usage rate of nearly 98%.

Combustible gases produced during steelmaking are reused as an energy source to generate power. They are also used as a source of heat for other processes.

worldsteel recently published reports on maintenance and yield. Projects on by-products and water management will be completed in the coming months. These are all key issues for the industry in reducing its environmental footprint.

Reducing CO₂ emissions

In 2008, worldsteel set up a CO₂ data collection programme. It enables every steel-producing company in the world to submit its CO₂ emissions using a standardised methodology.

CLIMATE ACTION

worldsteel
The emissions inclusions are classified as follows:

**Scope I**: Direct CO₂ emissions from steel production (e.g. coke making, iron making, reheat furnaces)

**Scope II**: CO₂ emissions from upstream processes such as purchased electricity or credits for selling electricity or steam, particularly for recycled steelmaking, casting and reheating

**Scope III**: Other emissions or credits related to purchased goods such as pre-processed raw materials or credits from by-products (slag) sold to other industries that enable them to reduce their CO₂ emissions.

The measurement framework covers all key points that influence CO₂ emissions and energy use. In 2008, over 180 steel-producing sites contributed to the exercise. The database now holds CO₂ and energy intensity data for nearly 40% of global steel production capacity. Worldsteel analyses the data and prepares a report to the companies. The report enables a company to see how each of its plants compares to others worldwide.

The worldsteel Climate Action recognition programme launched in 2009 recognises steel producers who have fulfilled their commitment to participate in the worldsteel CO₂ emissions data collection programme. Two-thirds of the worldsteel membership took part in the first round of data collection, which ended earlier this year.
The Climate Action programme is open to all steel producers, members and non-members of worldsteel alike. Recognition can be obtained at a corporate level or at a site level, as long as CO₂ emissions data for more than 90% of the crude steel production of the company or the site is submitted. The recognition is valid for two years.

The modern steel industry has pushed steel production processes very close to their theoretical minimum CO₂ intensity per tonne of steel output. Some minor gains can be made through the increased use of scrap in primary production. However, scrap availability itself is a limiting factor.

worldsteel estimates that, based on current process technologies and with more scrap available, the EAF share of production could reach 43% of global steel output by 2050, up from 35% today. Along with some other changes, the increase in scrap recovery could lead to a reduction of 200 million tonnes of CO₂.

**Production efficiency**

Every steel company and every steel-producing country is at a different point of maturity and development. worldsteel’s vision is to help steelmakers achieve best-in-class performance by effective and efficient use of their assets.

However, this is still not enough to meet the efficiency improvement targets the industry needs to make, given the probable doubling in demand for steel products over the next 40 years.

worldsteel encourages companies and governments to develop, test and introduce the next generation of steelmaking using breakthrough technologies for a sustainable future (see p. 27).

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### Scrap steel

There are two main sources of steel scrap: excess material from steel production and downstream manufacturing, and the steel at the end of a product’s life.

100% of scrap from steel production and downstream processing is collected and recycled directly into steel production. End-of-life scrap has to be collected and prepared as a consistent and recycle-ready material.

End-of-life collection rates vary significantly across regions and sectors. Average steel recycling rates are very high compared to any other material. However, there is still room for improvement and this is a key priority for the steel industry.

In 2007, ore-based steel production used 31% of all scrap to produce 75% of all steel. The EAF route used 69% of all available scrap to produce 25% of all steel.

Assuming that steel production and use doubles over the next 40 years, scrap availability could grow to approximately 1.6 billion tonnes a year. This is based on a recovery rate increase from the 83% recorded in 2007 to a projected 90% in 2050.

### Scrap recovery rates

<table>
<thead>
<tr>
<th>Sector</th>
<th>Recovery rate 2007 (%)</th>
<th>Recovery rate 2050 (%)</th>
<th>Life cycle in years</th>
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<tbody>
<tr>
<td>Construction</td>
<td>85</td>
<td>90</td>
<td>40-70</td>
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<tr>
<td>Automotive</td>
<td>85</td>
<td>90</td>
<td>7-15</td>
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<tr>
<td>Machinery</td>
<td>90</td>
<td>95</td>
<td>10-20</td>
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<tr>
<td>Electrical and domestic appliances</td>
<td>50</td>
<td>65</td>
<td>4-10</td>
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<tr>
<td>Weighted global average</td>
<td>83</td>
<td>90</td>
<td>N/A</td>
</tr>
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</table>
The Future Steel Vehicle will combine alternative powertrains and advanced high-strength steels to reduce the vehicle’s life cycle footprint.
Developing sustainable products

Ten years ago, the social and environmental footprint of a corporation and its products were afterthoughts to the real business of competing for position in the marketplace. Economic impact was often only measured by the balance sheet and share price.

But the world has changed. Today, life cycle assessment (LCA) and corporate responsibility rank near the top of issues that all companies must address. A plethora of regulations, standards and assessments create the potential for added costs. Corporate social and environmental performance is increasingly driving purchase decisions by business customers who seek to ensure that their suppliers’ performance aligns with their own goals.

Consequently, steel-using customers are increasingly demanding information about the sustainability performance of steel and the companies that make steel.

For nearly 15 years, worldsteel has played a leading role in defining the industry’s progress toward sustainability. Core activities include the development of the authoritative global LCI for steel, the bi-annual Sustainability Report that tracks the industry’s performance against 11 social, economic and environmental indicators, and initiatives that produce industry consensus and action on trends and issues.

In this way, worldsteel helps member companies to:

- ensure that steel is accurately and positively represented in LCA-based studies
- make more informed decisions in the identification of market opportunities, and the development and marketing of products
- respond to customers who need LCA data for their own operating, compliance and marketing activities
- support technology assessment and the development of process and environmental improvement programmes
- increase public awareness of steel as a necessary and positive contributor to the growth of economies around the world.

LCA: enabling informed decisions

An accurate understanding of the impact a material has on greenhouse gas (GHG) emissions and the environment is based on the total emissions throughout all phases of the product life, including production, use and end-of-life (recycling or disposal).

This approach is based on an internationally standardised methodology (ISO 14040 series). It provides systematic benchmarking and analysis of the known environmental burdens of industrial processes, such as total lifetime GHG emissions, energy consumption and water consumption.

The LCA for steel is based on the worldsteel life cycle inventory (LCI) that represents the global environmental profile of steel.

The third round of LCI data collection will be completed in 2009, enabling the development of an up-to-date global profile for 14 steel products. This unique database serves as the basis for LCA studies of products that use steel.

In a series of environmental case studies, worldsteel demonstrates the benefits of today’s high-performance steels. To date, worldsteel has published case studies on wind energy, bridges, automotive steels, food cans and natural gas pipelines. These case studies are available on worldsteel.org.
Requests for worldsteel LCI data

worldsteel receives more and more requests for LCI data each year. Recent examples include:

- a contractor on a government project in the US evaluating the environmental impact of materials for a major power generation project
- a European government updating its tax structures on materials in a consumer product category
- a furniture manufacturer in Asia comparing the environmental impacts of wood and steel
- a manufacturing firm in India seeking “greener” production processes
- a civil engineering firm in Europe comparing the LCAs for alternative materials for a bridge
- a designer of a rail system in North America seeking to comply with local environmental laws
- a carmaker in Asia comparing the consequences of choosing a new generation of steel over standard grades.

The common thread in these requests is the growing importance that LCA studies play in the design and specification of materials all over the world.

Number of requests for LCI data since 2005

Steel’s life cycle

Raw material extraction

Steel production

Pre-consumer scrap

Manufacturing

Post-consumer scrap

Use phase

End of life/Recycling
Advanced steels in housing and automotive designs

Sustainability plays an important role in worldsteel’s other industry market development programmes. WorldAutoSteel uses LCA to demonstrate that advanced high-strength steels and optimised vehicle design can reduce total life cycle GHG emissions while maintaining safety and affordability.

WorldAutoSteel has launched Phase 2 of its Future Steel Vehicle (FSV) programme. It is aimed at creating lightweight, environmentally-friendly steel designs for future battery electric, plug-in hybrid, and fuel cell vehicles. It will use the newest steel grades and technologies available.

International competitions managed by worldsteel’s construction programme, Living Steel, demonstrate how steel can be used in innovative housing design to produce unique, environmentally efficient and affordable housing.

Living Steel’s third international architecture competition

The Living Steel international competition for sustainable housing stimulates innovation in construction. Now in its third year, the competition addresses the economic, environmental and social aspirations of a growing world population.

For the 2008 competition, architects were asked to create energy efficient, single-family detached homes for employees of Severstal in Cherepovets, Russia. The construction had to minimise GHG emissions and be able to withstand temperatures ranging from -49°C to 39°C. The homes also had to be affordable to build and buy.

Peter Stutchbury Architects won first prize in the 2008 competition. Another Australian firm, Bligh Voller Nield Architecture, and Canadian architects RVTR Toronto, received honourable mentions from the jury.

The winning firm receives a €50,000 prize and will begin working with Severstal and a local Russian architect to define the design for construction in Cherepovets. Living Steel plans to showcase a demonstration building in late 2009.

The 12 finalists were chosen out of 246 proposals from 52 countries.

Rendering of the winning project for Cherepovets (see box).
The biggest bulk carrier in the world, the MS Berge Stahl, can carry up to 360,000 tonnes of iron ore. It hauls ore, mainly from Brazil, to ThyssenKrupp Steel in Germany. Photo courtesy of BW Maritime.
A competitive steel industry worldwide

One of the industry’s defining trends over the last 20 or so years has been the decline in state ownership around the world, except in China. Government after government has sold off its interest entirely or opened up markets to competition.

The move to a more market-driven structure in many countries has coincided with some other significant trends. These include globalisation and a fourfold increase in steel traded internationally.

There is also a much stronger focus on delivering customer-specified solutions, which requires steel suppliers to work closely with their customers.

Today, 40% of the world’s steel is traded internationally. The danger remains that governments will seek to support the domestic industry in a way that is anti-competitive. worldsteel has a long-standing and well-supported position on behalf of its members in promoting free and fair trade.

The WTO has consistently warned that trade barriers used by countries to protect their industries risk doing more harm than good.

Some actions are permitted under WTO rules. These include countervailing actions against unfair trade practices which are necessary to maintain fair competition. However, tit-for-tat policies are dangerous, as the Great Depression of the 1930s showed, because they exacerbate the downward spiral in international trade. If governments seek to protect inefficient operators over the short-term, their actions will inevitably put customer companies at a long-term disadvantage.

worldsteel is an active participant on platforms where these issues are discussed, promoting steel’s messages on sustainability and free and fair trade.

OECD Steel Committee

The OECD Steel Committee is the main government forum for the discussion of global issues facing the steel industry. All the major steel-producing countries including BRIC are represented as members or observers of the committee.

The OECD Governing Council decided some years ago to reduce the activities of the organisation in individual industrial sectors and as a result has reduced the level of resources available to the Steel Committee.

To fill this gap, worldsteel now provides the expert reports that were formerly prepared by the OECD Secretariat. Twice a year, worldsteel produces an overview of the outlook for steel demand based on the most recent short range outlook together with a report on raw material trends and a report on steelmaking capacity developments and utilisation. It makes these reports available to the OECD Steel Committee.

The OECD Steel Committee fulfils an important role but it is worth reiterating that it is a forum for discussion and increased understanding rather than for negotiation on particular topics.

Raw materials

The last two years have been a rollercoaster ride for the industry as iron ore, coking coal and scrap prices went through the roof and then fell as the recession took hold. At the same time, the steel industry watched with considerable concern as BHP Billiton attempted to take over Rio Tinto. A merger of two of the three companies who dominate more than 75% of the world market for seaborne iron ore could only have led to an unacceptable concentration and control of the market.

The steel industry responded vigorously. As a result, the European Commission issued a statement of objections which heavily influenced BHP Billiton into withdrawing its bid.
However, earlier this year the issue was back on the table. BHP Billiton and Rio Tinto announced a possible merger of their Western Australian iron ore interests into a joint venture (JV).

worldsteel again immediately issued a statement pointing out that this projected JV did nothing to allay the competition issues that were of concern in the previous bid attempt. worldsteel called on competition authorities to seriously examine the obvious implications for future pricing regimes and the competitive environment for iron ore.

worldsteel has supported the consolidation of steel businesses but not to the extent of endangering competition. Even the largest steel company in the world today accounts for less than 15% of total world steel production. We await the competition authorities ruling on this new threat.

Climate change

Climate change is a global issue that requires a global solution. worldsteel advances the case for a global approach for steel.

Governments that are sigatories to the UN Framework Convention on Climate Change (UNFCCC) are negotiating commitments to reduce GHG emissions after 2012.

The objective is to have agreement in Copenhagen in December 2009 (COP15). Working with other business organisations under the umbrella of the International Chamber of Commerce (ICC), worldsteel was active at COP13 in Bali and COP14 in Poznan.

The Warsaw dialogue set up by the Polish government with support from Japan and the European Commission is another important channel for discussion on the role of steel in climate change.

worldsteel’s key messages to governments have been that all steel-producing countries need to be involved in setting commitments and timetables for future actions.

The responsibility lies with governments to set the right framework and policies for positive action by the steel industry on climate change. The right approach will avoid cost differences in different countries, which increases the serious problem of carbon leakage and will not reduce global GHG emissions.

Policies to assist technology transfer, Clean Development Mechanism projects or other financial incentives should not distort fair competition in the industry.

<table>
<thead>
<tr>
<th>Shares of seaborne iron ore market</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vale</td>
<td>36.10%</td>
<td>36.1%</td>
<td>32.80%</td>
</tr>
<tr>
<td>Rio Tinto</td>
<td>19%</td>
<td>19.30%</td>
<td>18.60%</td>
</tr>
<tr>
<td>BHP Billiton</td>
<td>14.20%</td>
<td>13.8%</td>
<td>17.10%</td>
</tr>
<tr>
<td>Total</td>
<td>69.30%</td>
<td>69.2%</td>
<td>68.50%</td>
</tr>
<tr>
<td>Ore price increase</td>
<td>19%</td>
<td>9.50%</td>
<td>79.88%</td>
</tr>
<tr>
<td>Ore price index 2003 =100</td>
<td>238.8</td>
<td>261.5</td>
<td>470.4</td>
</tr>
</tbody>
</table>

Source: UNCTAD
Governments must support research and development of breakthrough technologies. The major expenditure required cannot come from industry alone. Government funding needs to be available in terms of primary research and in the more significant sums for pilot plants, to prove the technical and economical feasibility of new technologies. Already, major governmental support is in place in the EU and Japan. More support and new initiatives by other governments are needed.

worldsteel has worked with the International Energy Agency on papers for the G8 on opportunities for CO2 reduction. worldsteel’s input has been to provide knowledge about steel at a technical level.

The World Business Council for Sustainable Development has agreed to a memorandum of understanding with worldsteel. It permits worldsteel to work with the council on climate change issues even though membership is restricted to companies.

Finally, on technology transfer, emissions reduction and breakthrough technology, worldsteel works with the Asia-Pacific Partnership through its member companies.

Asia-Pacific Partnership on Clean Development and Climate

The Asia-Pacific Partnership on Clean Development and Climate aims to accelerate the development and deployment of clean energy technologies.

The partner countries are Australia, Canada, China, India, Japan, Korea and the US. They have agreed to work together and with private sector partners to meet goals for energy security, national air pollution reduction and climate change in ways that promote sustainable economic growth and poverty reduction.

The partnership focuses on expanding investment and trade in cleaner energy technologies, goods and services in key market sectors. Its members have approved eight public-private sector task forces, including one for steel.

The steel task force’s objectives are to:

- develop sector-relevant benchmark and performance indicators
- facilitate the deployment of best practice steel technologies
- increase collaboration between relevant partnership country government, research and industry steel-related institutions
- develop processes to reduce energy usage, air pollution and GHG emissions from steel production
- increase recycling across the partnership.

Action will focus on securing improved benchmarking and reporting, energy and material efficiencies and technology development and deployment.
Design for a new high speed train station in Florence, Italy. Image courtesy of Foster + Partners, architects.
Working for the future

In virtually every phase of our lives, steel plays an essential role. The rails, roads and vehicles that make up our transport systems use steel. Steel provides a strong framework and connections in the buildings where we work, learn and live. It protects and delivers our water and food supply. It is a basic component in technologies that generate and transmit energy.

Steel plays a critical role simply because no other material has the same unique combination of strength, formability and versatility. Consequently, as nations around the world seek to improve their standards of living and lift populations out of poverty, it is inevitable that the demand for steel will increase.

Even as it addresses the needs and challenges of today’s economic environment, the steel industry is looking ahead at the challenges that are just over the horizon. Materials that are stronger and meet higher environmental standards will be needed.

New generations of steel continue to be developed that make it possible for manufacturers and builders to implement durable, lightweight designs. Furthermore, steel can be endlessly recycled without loss of strength, durability or any of its other distinctive properties.

The steel industry is working on delivering long-term solutions, while continuing to meet its customers’ requirements of today. Worldsteel’s four building blocks underpin the industry’s direction for the future. They are to:

• reduce CO₂ intensity per tonne of steel
• spread best practice across the industry
• research and develop breakthrough technologies for steelmaking
• use steel or develop new steel products in applications making a high impact on end product life cycle performance and sustainability.

The first step towards reducing CO₂ emissions has been to establish a common methodology for measuring CO₂ intensity. See pages 15-16 for more about the measurement framework.

Breakthrough technologies

To make a significant difference in CO₂ intensity, new steelmaking techniques are needed. In 2003, Worldsteel launched the CO₂ Breakthrough Coordination Programme to exchange information on new technologies that can be researched and developed in a globally coordinated way. The programme reflects the commitment of the steel industry to respond to the challenge of climate change.

Ore-based steelmaking using blast furnaces has higher carbon intensity per tonne of steel produced than the EAF route, so the focus is on the blast furnace route first.

This is the biggest collaborative R&D project coordination ever undertaken by the steel industry.

Research is taking place in:

• the EU (ultra-low CO₂ steelmaking, or ULCOS, supported by 48 EU companies and 15 EU governments)
• the US (the American Iron and Steel Institute)
• Canada (the Canadian Steel Producers Association)
• South America (ArcelorMittal Brazil)
• Japan (Japanese Iron and Steel Federation)
• Korea (POSCO)
• China (Baosteel) and Taiwan (China Steel) and
• Australia (Bluescope Steel/One Steel and CSIRO coordination).

The various programmes call on a range of industrial expertise from steel producers, energy generators, plant designers and equipment manufacturers. They also call on scientific expertise from government-funded materials research and academic institutions.
The programmes have identified the most promising steelmaking technologies that potentially reduce CO₂ emissions to atmosphere by more than 50%. Research is now focused on feasibility at various levels of production, from laboratory work to pilot plant development and eventually commercial implementation.

A significant amount of CO₂ will still be produced if carbon is used as the reducing agent for iron ore. One technique for dealing with the gas is to capture it and store it. This is called carbon capture and storage (CCS).

This will require technical solutions for cleaning the gas and transporting it through pipes into storage sites. These are not always conveniently located near production facilities. Storage options include exhausted gas fields, old coalmines or saline aquifers. CCS will require inter-governmental cooperation on policies and regulations to allow transfer of the gas to suitable sites.

Coal-based ironmaking technologies associated with CCS are the most likely candidates for development. Hydrogen and electrolysis are further into the future, as these technologies will require re-engineering of steel production and the development of new processes from first principles (see box).

Technologies of the future

Top gas recycling in combination with CCS
Blast furnace top gas recycling relies on separation of the off gases so that the useful components can be recycled into the furnace as a reducing agent. The CO₂ has to be captured, transported and stored.

Smelting reduction (HISARNA) in combination with CCS
HISARNA is based on bath-smelting. It combines coal preheating and partial pyrolysis in a reactor, a melting cyclone for ore melting and a smelter vessel for final ore reduction and iron production. CCS is also a key requirement for this process.

New direct reduction in combination with CCS
There would be a single source of CO₂ from the direct reduction furnace. The off-gases would be stored using CCS.

Alkaline electrolysis of iron ore
Electrolysis is commonly used to produce metals other than steel. For steelmaking, large amounts of electricity would be needed. The process would depend on a CO₂-lean electricity source such as hydro or nuclear power.

Molten oxide electrolysis
Molten oxide electrolysis works by passing an electric current through molten slag fed with iron oxide. The iron oxide breaks down into liquid iron and oxygen gas. No carbon dioxide is produced. This process would depend on a CO₂-lean electricity source.

Hydrogen flash smelting
Iron is reduced from iron ore at high temperatures (above 1,300°C) and with very short reaction times. No CO₂ is emitted but producing hydrogen requires large amounts of CO₂-lean electricity.
Future steel use

Choosing steel over other materials offers a range of CO₂ reduction solutions. There are three strategies that reduce emissions through the use of steel.

Material shift

The material shift involves replacing other materials with steel to achieve higher structural performance at lower costs and with less energy.

For example, there is great potential for steel framing to replace concrete in buildings. Steel frames can be pre-assembled off-site. This helps to minimise waste and transport of materials. With the right design, steel framing offers better earthquake resistance and high end-of-life component reuse and recycling.

Compared to a concrete-framed building, steel framing can reduce CO₂ emissions by about 20% over the life cycle of a building. Steel does not rot or split and it will not be consumed by mould or termites. Steel offers the highest strength-to-weight ratio of any building material.

New steel shift

In the new steel shift, traditional mild steels give way to new advanced steels, such as high-strength steels. These innovative steels help reduce CO₂ emissions over the life cycle of many products.

For example, replacing the conventional steel of a typical five-passenger vehicle with advanced high-strength steel (AHSS) results in a lifetime GHG emissions reduction of 6%. This saving in emissions is more than the total amount of CO₂ emitted during the production of all the steel in the vehicle.

For bridges, high performance steels enable longer span lengths, less maintenance and longer service life. As a result over the life cycle of a bridge the use of high-performance steel can result in as much as 40% in emissions reduction compared to traditional steels.

Where electrical energy is generated, electrical steels are used. Continuous development and increased application of new electrical steel grades have reduced energy loss in transformers. This means less CO₂ emissions over the life cycle of every application.

Use shift

The use shift describes a change from one application that uses steel, to another application that serves the same purpose but is less GHG intensive.

For example, the dependency on fossil fuels can be significantly reduced by alternative sources of energy such as wind-generated power. Steels represent approximately 85% of all materials used to construct a wind turbine, excluding the foundation. Producing 1 kWh of electricity with wind instead of coal reduces emissions by as much as 80%.

Steel is also critical for high-speed rail travel. It is expected that more Travellers increasingly prefer this mode of transport over air travel for journeys of between 1 and 2.5 hours. High-speed train tracks use steel rails measuring up to 120 m in one continuous stretch. For short distances, substituting air travel by rail reduces emissions by up to 90% per passenger km.
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