Climate Change and the Production of Iron and Steel: an Industry View

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World Steel Association (worldsteel)

Green Steel World

Essen, April 5th 2023

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Disclaimer

worldsteel – who we are

worldsteel represents steel producers, national and regional steel industry associations, and steel research institutes.

Members represent around 85% of global steel production.

It has headquarters in Brussels, Belgium. A second office in Beijing, China, opened in April 2006.

The World Steel Association (worldsteel) is a non-profit organisation.

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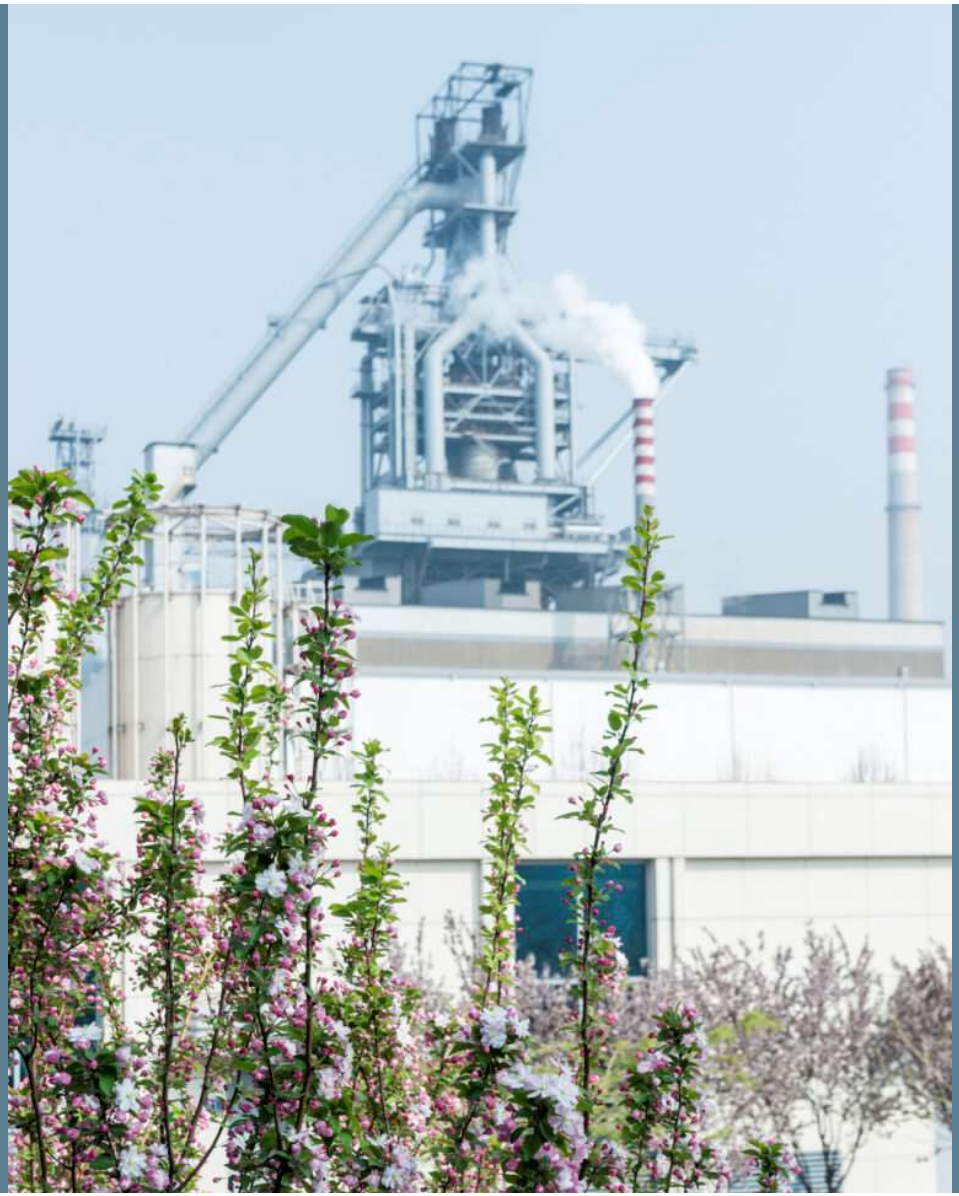

Presentation outline

- Where we are
- The way forward
- Enablers of transformation

Where we are

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The scale of the challenge

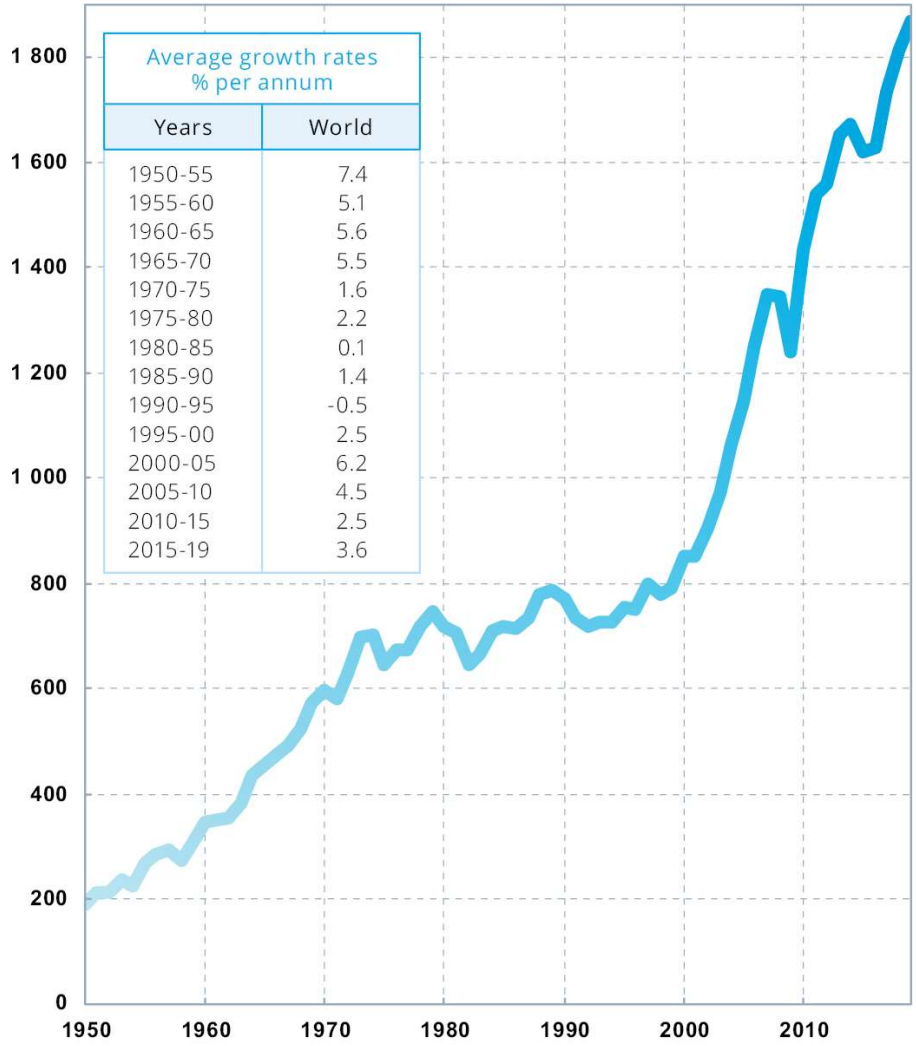
Reducing emissions in a world made of steel

In 2022 1.9 billion tonnes of crude steel were produced, an increase of 120% since 2000

In 2020, on average, every tonne of steel produced led to the emission of 1.9 tonnes of CO_2.

In 2020, the total direct emissions were of the order of 2.6 billion tonnes, representing between 7% and 9% of global anthropogenic CO_2 emissions.

Steel use is expected to continue to grow, so BAU appears an increasingly unsustainable business model.



Global CO_2 Indicator

Adapted from the worldsteel Sustainability Indicators 2022 report:

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Global indicator	**1.75**	**1.82**	**1.8**	**1.87**	**1.87**	**1.83**	**1.81**	**1.85**	**1.89**	**1.91***
BF-BOF										2.32
Scrap-EAF										0.67
DRI-EAF										1.65

The way forward

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We fully support the aims of the Paris Agreement

We will....

Reduce our own impact

Promote Efficiency and support the circular economy

Develop advanced steel products to enable societal transformations

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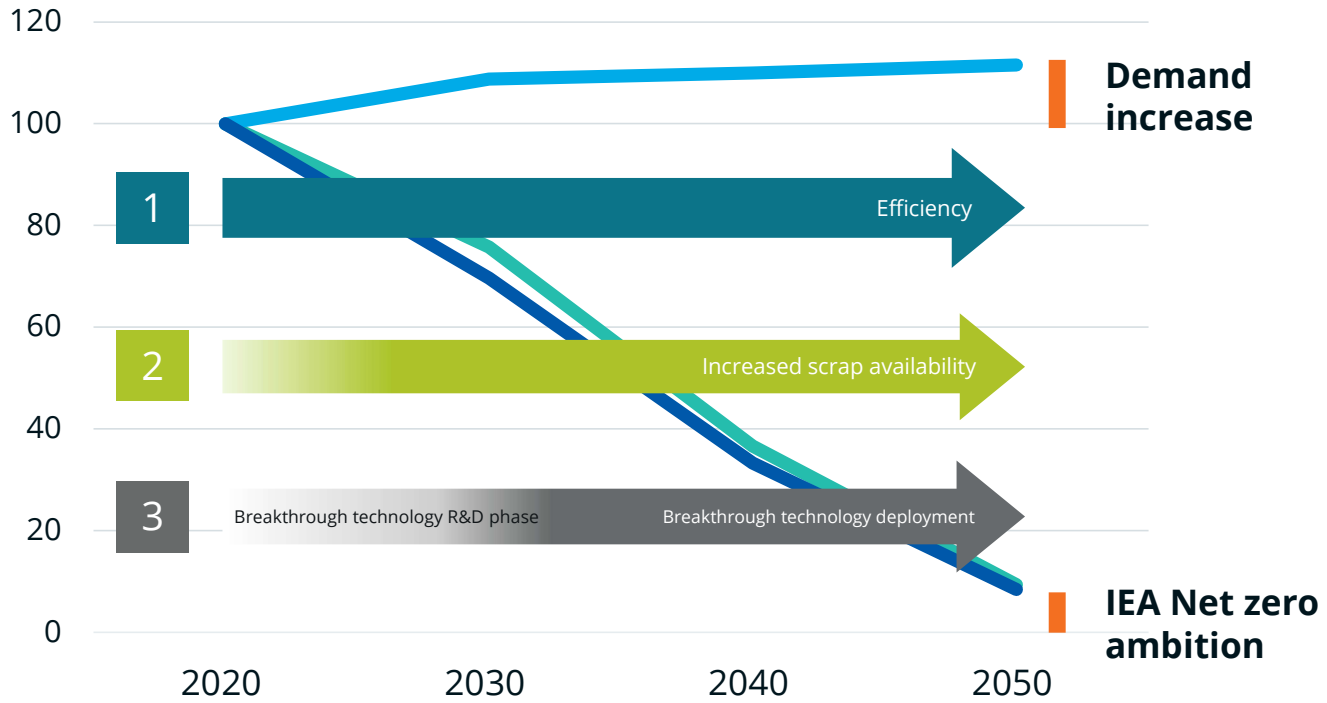
IEA scenarios and our approach

Steel production, total CO2 emissions and CO2 intensity 2020-2050 under the International Energy Agency (IEA) Net-Zero Emissions scenario (NZS)

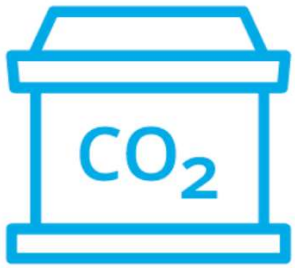


Steel production
CO_2 emissions
CO_2 intensity

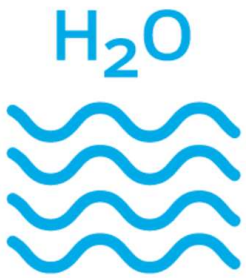
Based on data provided In the IEA Net-Zero Emissions by 2050 scenario, May 2021

Breakthrough technology

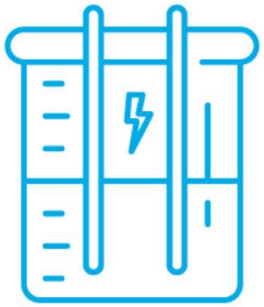
- All available scrap is recycled, but demand growth leads to insufficient scrap supply and continued need for virgin steel
- There are several promising approaches that could be taken to reduce iron ore at industrial scale without the release of CO_2.
- These fall into three broad categories:



Using carbon as a reductant while preventing the emission of fossil CO_2, e.g. using CCUS and/or sustainable biomass.



Substituting hydrogen for carbon as a reductant, generating H_2O (water) rather than CO_2.



Using electrical energy through an electrolysis-based process.

Simplified /combination?.

Which breakthrough solution to deploy will be determined by availability of resources and policy support.

A portfolio of options

- Announcements are growing

Climate Action

ArcelorMittal inaugurates flagship carbon capture and utilisation project at its steel plant in Ghent, Belgium

Climate Action

Baosteel Zhanjiang Iron & Steel Zero-Carbon Demonstration Plant Starts Construction of Million-ton Hydrogen-Based Shaft Furnace

Climate Action

Vow ASA and ArcelorMittal join forces to build biogas plant in Luxembourg

Climate Action

BlueScope and Shell join forces to develop renewable hydrogen projects in the Illawarra

Climate Action

Tenaris, Saipem and SIAD sign a MoU for the study of a carbon capture and utilization project in Dalmine, Italy

Climate Action

voestalpine researching into hydrogen plasma for green steel production

Climate Action 26 January 2023

Nippon Steel, Mitsubishi Corporation and ExxonMobil to Evaluate and Establish CCS Value Chains in the Asia Pacific Region

Climate Action

U. S. Steel to Work with Equinor to Assess Hydrogen, Carbon Capture and Storage Development

Climate Action

Tata Steel commissions India's first plant for CO2 capture from Blast Furnace gas at Jamshedpur

Climate Action

POSCO, Samsung C&T, PIF Promote Green Hydrogen Production Project

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Enabler of transformation

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Enablers of transition

Policy as an enabler of change

- Supportive International and Domestic Policy
- Supportive Trade Regime
- Infrastructure planning and development

Enablers of transition

Industry leadership

- Standards and Methodologies
- Co-operation and partnerships
- Skills and knowledge

Enablers of transition

Supportive ecosystem

- Access to raw Materials & Energy
- Market pull, demand for low carbon materials
- Access to Finance

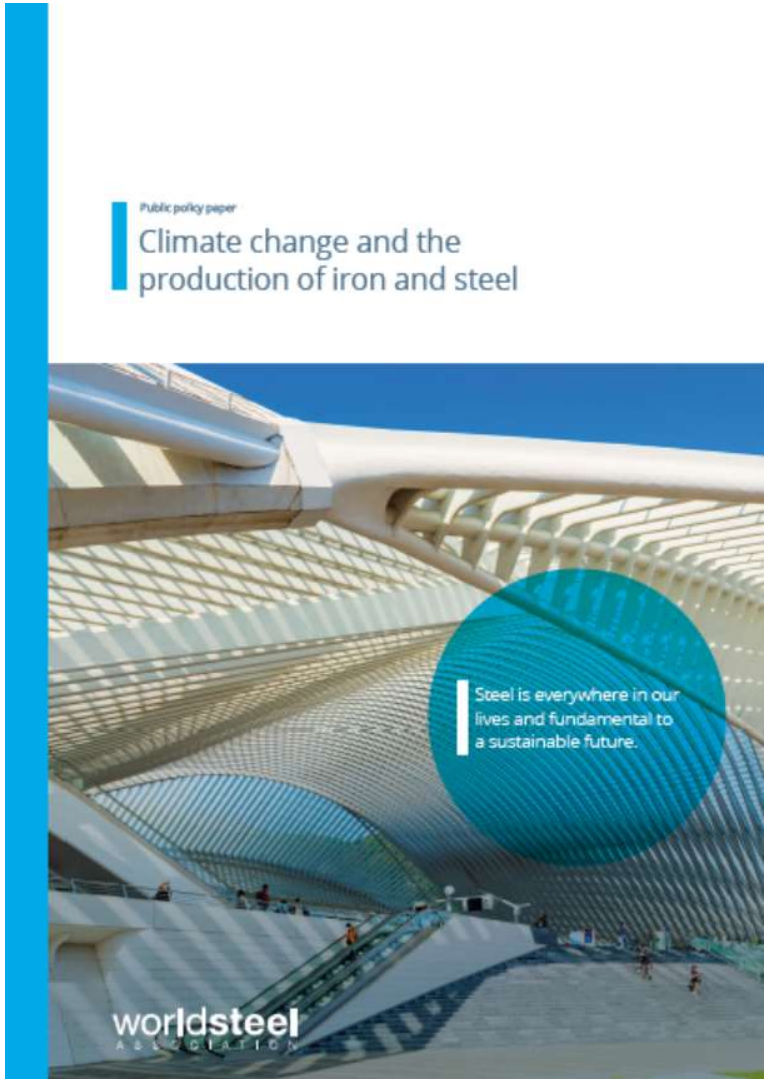
We need first movers to succeed

- First movers are establishing ecosystems to enable low carbon steelmaking and we need them to succeed
- Learning from first of a kind installations will
  - support cost reductions
  - Provide confidence that transition is technically and economically feasible
- First movers will play a key role in showing what can be done and what is needed

worldsteel policy paper

Restructured and expanded public website content in the new Climate Action section includes the policy paper and:

- Fact sheets detailing the suite of low-carbon breakthrough technologies currently under development.
- Examples of member initiatives in related areas, including new business practices encouraging low-carbon market development
- Work being carried out by other international organisations including the IEA and ResponsibleSteel



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