A FORK IN THE ROAD FOR THE GLOBAL STEEL SECTOR

71% of global steel blast furnace capacity needs reinvestment by 2030

Introduction

Steel is a crucial input for multiple key sectors such as construction, renewable energy production and transport and is a fundamental material for the transition to net zero. The global steel sector is at an early yet critical stage in the transition to net zero. While progress is accelerating, it is significantly behind where it needs to be on a Paris-aligned pathway.[1]

The 2015 United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement is a testament to the global determination to limit increasing global temperatures to 1.5°C. To achieve this limit, all sectors of the economy must decarbonise rapidly, reducing emissions by nearly half by 2030 and to net zero by 2050.

However, only a few economic activities operate at or near zero emissions today. In addition, most sectors require substantial financing, clear guidance, and a framework of supportive policies to transition to net zero. Decarbonisation pathways are less obvious for some sectors, known as hard-to-abate, including chemicals, fossil gas, cement, and steel production. Greater attention is now being paid to these hard-to-abate sectors, and detailed decarbonisation plans and pathways are being published, showing that feasible low/zero-emission solutions are possible within a reasonable timeframe.

The decarbonisation pathways used in this paper follow IPCC guidance and the 2021 International Energy Agency (IEA) *Net Zero Roadmap*. In the latest IPCC Working Group III report, IPCC scientists forewarned that without immediate and deep emissions reductions across all sectors, limiting global warming to 1.5°C is beyond reach.[2]

Investing in the transition of hard-to-abate sectors presents a unique opportunity for countries to lead on the climate agenda by supporting the development of innovative technologies and scaling up renewable energy.

Failure to grasp this opportunity, and a continuation of business-as-usual, will risk missing vital climate targets and expose countries to higher physical climate risks. It would also lock in billions of dollars of stranded assets and a disorderly and chaotic transition, exposing the real and financial economies to transition risks and possible financial crises.

Table 1. Policies impacting the steel industry across the value chain[3]

UPSTREAM	MIDSTREAM	DOWNSTREAM
Low-carbon energy and infrastructure	**Low-carbon production processes**	**Increasing demand for low-carbon steel and enhancing its circularity**
Establish supportive framework for hydrogen investment	Establish carbon contracts for difference	Implement green public procurement
Plan and finance CO_2 infrastructure for steel industry	Define standards and sector criteria for steel production	Strengthen environmental criteria and circular economy requirements for steel waste treatment
Define low-carbon energy standards to favour credible investment	Implement carbon pricing with effective framework against risk of carbon leakage	Scale up off-take agreements
Plan and finance low-carbon energy and related infrastructure		Establish a “green window” for trade of zero/near-zero carbon steel

The importance of the steel sector

Steel production accounts for around 7% of worldwide energy-related CO_2 emissions, making it the largest contributor to industrial emissions. Steelmaking's energy intensity has remained stable recently, with coal accounting for 75% of total energy consumption. However, steel demand is expected to rise steadily in the coming decades, particularly in emerging market countries (EM). It will make a vital contribution to the construction of infrastructure and products that will enable the transition, such as electricity and pipeline infrastructure and the manufacture of electric vehicles. China produces more than half of the world's steel, and the top five global producers account for about three-quarters of worldwide output: China's Baowu Group, Ansteel Group, and Shagang Group, Luxembourg-based ArcelorMittal, and Japan's Nippon Steel.[4]

Steelmaking can be classed as primary (making new steel from iron ore) or secondary (using mainly recycled steel), see Figure 1 and 2.[5]

Blast Furnace – Basic Oxygen Furnace (BF-BOF) CO_2 emissions intensity is 2.3 tons of CO_2 per ton of crude steel (global average intensity for scope 1 and 2 in 2018) whilst Electric Arc Furnace (EAF) production intensity is 0.7 tons of CO_2 per ton of crude steel (global average intensity for scope 1 and 2 in 2018).[6] Increasing the share of EAF production using renewable electricity would enable rapid emission reduction because of the process' significantly lower carbon intensity. However, such an increase would depend on supplies of scrap steel and renewable electricity, and EAF capacity.

Scrap-based production in EAFs and induction furnaces accounts for around 20% of total production. Scrap is also employed at a rate of 15-20% with ore-based inputs in BF-BOF production, improving the energy efficiency of this technology. Scrap inputs constitute around 30% of total crude steel production.

Rising steel demand in EM will require at least 170 Mt additional steelmaking capacity. However, meeting this demand with coal-based facilities would result in long-term carbon lock-in and stranded assets (due to the long-life cycle), threatening jobs and putting the Paris-aligned pathway out of reach.[7]

Steel facilities have long lifetimes (approximately 40 years), meaning that 2050 is only one investment cycle away.[8] Global steel transformation must begin in the 2020s. Key low-carbon technologies are ready for deployment. The pipeline of green steelmaking capacity that will come online before 2030 is continuously expanding. 40 Mt of DRI capacity is already planned, and several companies have announced plans to switch to EAF steel production.[9]

Figure 1. Blast furnace steelmaking (EUROFER)

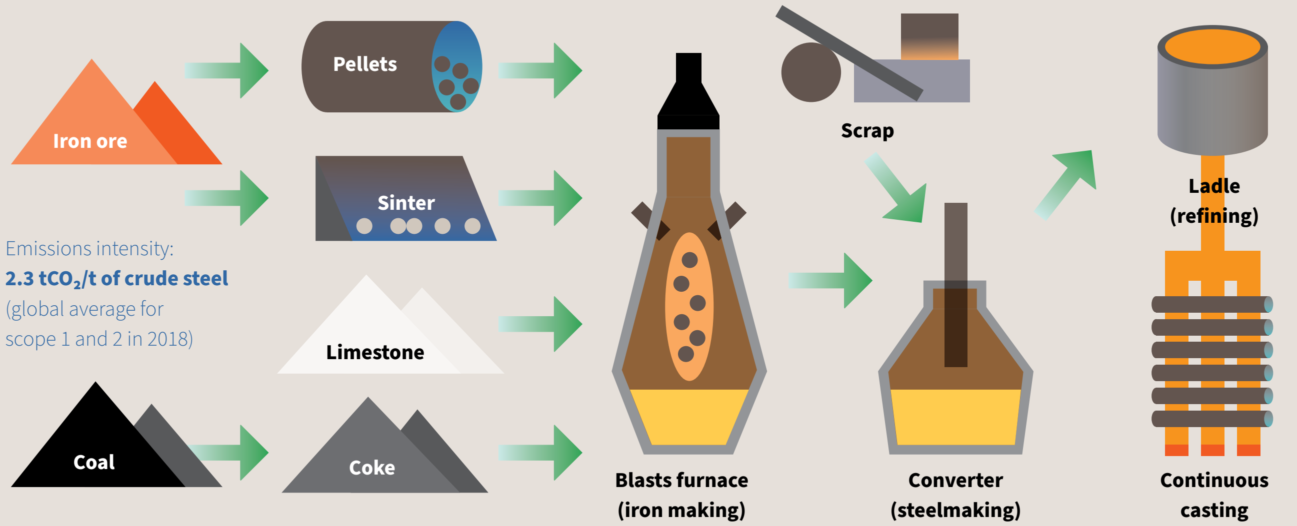
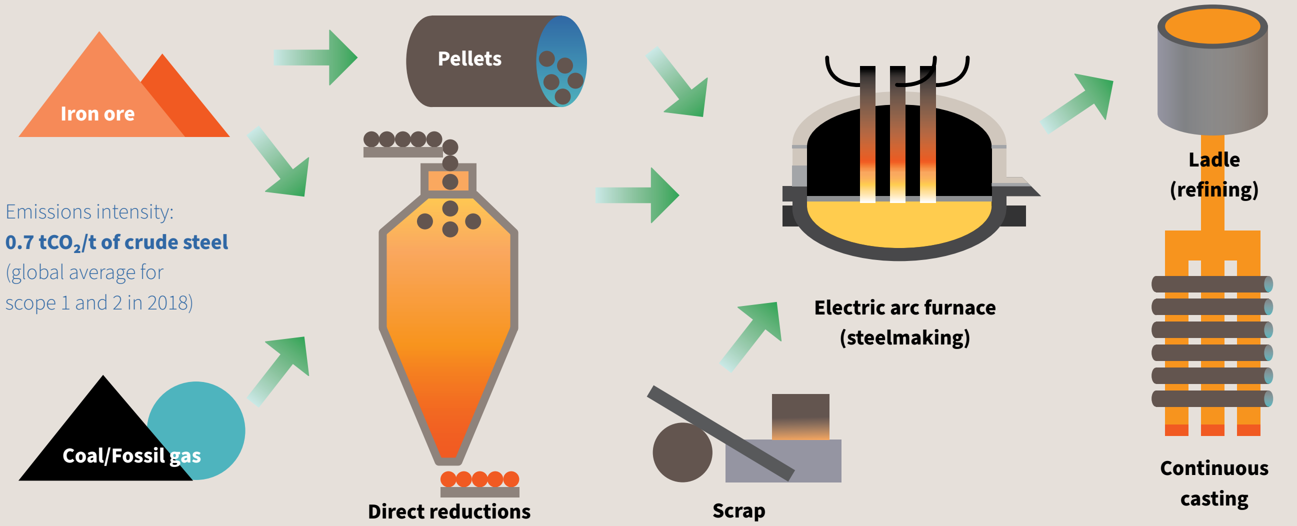


Figure 2. Electric arc furnace steelmaking (EUROFER)



A fork in the road

This decade offers a perfect opportunity for the steel industry to transition. Blast furnaces have a life span of decades, and coming investment cycles will lock plants into a specific production process. As the next investment cycle will not happen for at least two decades, failing to transition the steel sector could threaten government pledges to reach net zero by mid-century. Policymakers must guide industry and investors onto a climate-aligned pathway for steel. Green hydrogen and electrification, together with carbon capture use and storage technologies, present an opportunity for the steel industry to transition.

The global steel sector has therefore reached **a fork in the road**. Before 2030, 71% of existing coal-based blast furnaces (1090 Mt) will reach the end of its lifetime and require major reinvestment, see Table 2.[10]

This presents countries with a narrow window to implement the policies required for the steel sector to transition to net zero. As regulations are tightening globally to reduce emissions and limit climate change, many steel companies have started to outline decarbonisation and net-zero targets, such as ArcelorMittal, Baowu Group, and Tata Steel.[11] In addition, pilot projects are being introduced to test and scale up new and emerging technologies, see Box 1.

Massive investment is needed to develop and roll out low-carbon steelmaking technologies to transform the global steel sector. The transition is supported by governments' emission reduction goals and associated policies. As of September 2022, around 140 countries had stated or considered net-zero targets, representing about 90% of global emissions, up from 130 countries covering approximately 70% of emissions in May 2021.[12]

Financial flows need to be aligned with a Paris-compatible scenario, avoid lock-in, and be in place for the next investment cycle, considering the long life of steel assets. Steelmaking is a very capital-intensive industry. An estimated **USD47bn** annually is required to meet growing steel demand by 2050 while maintaining existing facilities. Therefore, an **additional USD9bn per year** will need to be invested to transition the steel sector to net zero.[13]

The Mission Possible Partnership's steel sector transition strategy states that the scale of investment needed in enabling infrastructure such as CO_2 pipelines, hydrogen infrastructure, and zero-carbon electricity production is likely to dwarf that of the steel assets themselves.[14] For example, delivering sufficient zero-carbon electricity to meet the needs of the steel sector, including the generation of the necessary volumes of green hydrogen, will take approximately USD2tn in cumulative investment over the next three decades. That equates to 3% of the total expected investment in electricity generation, transmission, and distribution in a net-zero economy.

As low-carbon steel is expected to become competitive within the coming decade, the industry must rapidly assess the transition pathways and start the transition to avoid holding stranded assets.

Table 2. Existing coal-based blast furnaces needing reinvestment by 2030 in selected regions

Country/ region	Share of existing blast furnace capacity reaching end of operating life and needing reinvestment by 2030[22]	BF-BOF shar of total crude steel production in 2018[23]	Total crude steel production in 2021 (Mt)[24]
China	78%	≈90%	1,032.8
EU-27	74%	≈60%	152.5
Japan	76%	≈75%	96.3
South Korea	72%	≈65%	70.6
United States of America	96%	≈30%	86.0

Box 1. Low-carbon steel projects

H2 Green Steel aims to build large-scale green steel production in northern Sweden and is on course for large-scale green steel production from 2024, replacing coal with green hydrogen. It aims to achieve a 95% reduction in CO_2 emissions compared to traditional steel making, annually producing 5 Mt of green steel by 2030.[15] In August 2022, H2 Green Steel secured EUR190m in series B equity financing from a select group of investors.[16]

Hydrogen Breakthrough Ironmaking Technology (HYBRIT) aims to use hydrogen instead of coal to eliminate around 90% of emissions.[17] It has already delivered the first fossil-free steel and plans to bring it to volume production in 2026.[18] The hydrogen used in the process can be used directly or stored. Using the stored hydrogen provides an opportunity to stabilise the energy system by producing it when there is plenty of green electricity. In September 2022, the pilot facility for the storage of green hydrogen was put into operation.[19]

In March 2022, **ArcelorMittal and Greenko Group** announced the development of a renewable energy project in Southern India with a capacity of 975 MW.[20] The USD0.6bn project will combine solar and wind power and will be supported by Greenko's hydro-pumped storage project, which will help to overcome the intermittent nature of wind and solar power generation. The project is expected to be completed by mid-2024 and ArcelorMittal acknowledged the potential of replicating this approach in other locations.

In July 2021, **ArcelorMittal and the Spanish government** committed to investing EUR1bn in green steel. A DRI unit and hybrid EAF will be installed at the company's Gijon site. The company envisages that the government contribution will cover around 50% of the cost. The new DRI unit will be in operation by 2025 and will rely on the Hydeal consortium to supply green hydrogen, forecasted at EUR1.5/kg by 2030. The company plans to transport 1.1 Mt/yr of the DRI produced in Gijon to its Sestao facility and reduce the site's CO_2 emissions to zero by 2025.[21]

The role of standards and sector-specific criteria

Climate Bonds has designed science-based guidance for finance and industry stakeholders to identify companies, assets and project following 1.5°C-aligned pathways and support informed investment decisions consistent with the IIGCC net-zero steel investment approach and the RMI Centre for Climate Aligned Finance STEEL Principles.[25]

In the absence of formal consensus by governments or industry bodies, the wide variety of actions, targets and commitments emerging from industry players may not align with a 1.5°C future. Risks include investing in projects to extend the life of highly emitting assets that will rapidly become stranded. To transition to a 1.5°C-consistent trajectory, global steel emissions must reduce by at least 50% by 2030 and 95% by 2050, compared to 2020. Accelerated emission reductions along these lines will need significantly more transformation of manufacturing sites and supply chain infrastructure than has been achieved so far.[26]

Several studies and pathways for steel decarbonisation have been modelled. Each of these pathways is based on different scenarios and assumptions and varies depending on the regional focus. Consequently, the paths differ but provide a valuable indication of the potential to reduce GHG emissions and the role of low-carbon technologies.

The steel sector transition to a 1.5°C-aligned pathway will be achieved by implementing a mix of technologies either by improving existing processes or installing new facilities. However, one type of technology alone or just implementing a single measure in a plant to lower emissions will not reduce emissions to net zero in the sector.

Scientific standards, such as the **Climate Bonds Standards and sector-specific eligibility Criteria**, will guide investment in credible transition activity and provide asset owners with the right path to decarbonise existing facilities or switch to new net-zero steel production plants. Policymakers can also utilise them in setting regulations and incentives for sector decarbonisation.[27]

Ensuring that capital mobilises towards projects within a net-zero trajectory is an essential piece of the puzzle to decarbonise steel.[28] The Climate Bonds Standard and Certification Scheme is an easy-to-use screening tool that provides a clear signal to investors and intermediaries on the climate integrity of Certified Climate Bonds. The steel sector criteria expand the use of the standard to this sector by setting climate change benchmarks for steel plants. This can be used to screen assets and capital projects so that only those with climate integrity will be certified through their contribution to climate mitigation, and/or to adaptation and resilience to climate change. Climate Bonds steel criteria also include a pathway that can enable Certification of an entity (a company or part of a company) and any debt issued by them such as Sustainability-Linked Bonds (SLBs).[29]

The requirements set out in Climate Bonds Steel Sector Criteria aim at keeping steel production emissions within the IEA Net Zero Emissions pathway. The intent is to achieve this by establishing assets already in alignment. These capital investments will enable steel production to achieve compliance. As a result, these companies have credible plans to get in line with the decarbonisation pathway and emissions mitigation in existing facilities without locking out the targeted long-run vision.

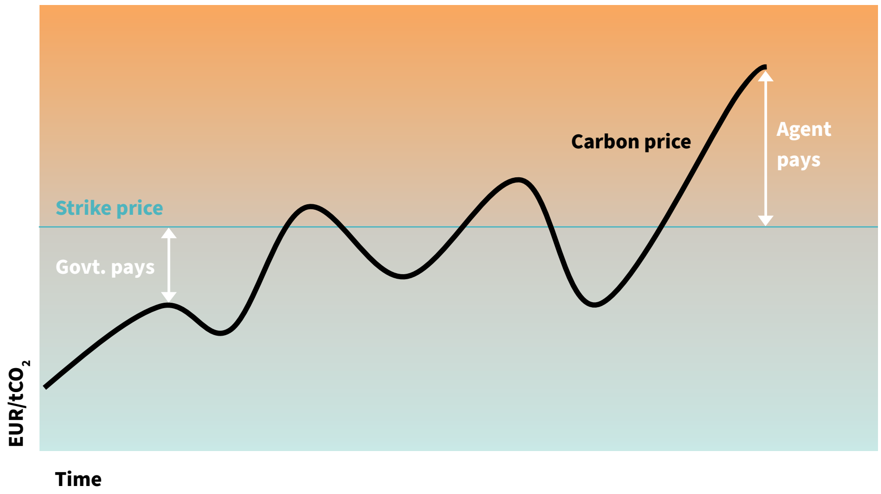
Finance relating to the following within the steel sector can be certified under Climate Bonds Steel Criteria:

- **Whole steel production facilities**
- **Decarbonisation measures in existing production facilities**
- **Steel companies operating production facilities**

The criteria reference existing standards for emissions intensity accounting to keep consistency within the industry and address other impacts by setting qualitative measures such as specific criteria for CCS and CCUS projects, emission intensity thresholds for the use of hydrogen and rules for the procurement of sustainable biomass applicable to all investments, as well as Adaptation and Resilience requirements, see Annex.[30]

Policies to ensure a credible transition

Figure 3. Carbon contracts for difference



Source: https://climatestrategies.org/wp-content/uploads/2021/03/Carbon-Contracts_CFMP-Policy-Brief-2020.pdf

The decarbonisation of hard-to-abate industries will need strong policy support. Robust policy instruments and supply chain coordination are required to support the steel industry transition to net zero, and must start now. These policies apply to different parts of the steel industry value chain: upstream (low-carbon energy and infrastructure), midstream (low-carbon production processes), and downstream (increasing demand for low-carbon steel and enhancing its circularity).

Upstream policies

Abundant **low-carbon energy and enabling infrastructure** (especially for green hydrogen and renewable electricity, as well as CO_2 transport and storage) are necessary for the steel sector transition. However, energy costs show substantial disparity among countries. They account for around 20% of production costs, with material costs accounting for more than 50% and up to 71%. The cost of CO_2 currently represents a fraction of total production costs in countries where carbon pricing is applied, e.g., around 2% in the European Union. However, the cost of carbon emissions will increase rapidly as free carbon allowances (presently covering up to 80% of all steel sector carbon emissions) under the EU-ETS are withdrawn.[31]

Steel industry decarbonisation pathways demonstrate the crucial role of electricity and green hydrogen, together with recycling and resource efficiency.[32] In the IEA's Sustainable Development Scenario, iron and steel emissions are expected to fall by about 90% by 2070, mainly because of the massive deployment of CCUS technologies and hydrogen-based steelmaking.[33]

As no sector can be excluded from the transition to a low-carbon economy, the steel industry will not be alone in needing more access to abundant and affordable decarbonised energy. **Accelerated deployment of renewable energy sources**, and related infrastructure, is necessary to meet the expected growth in demand.

One of the biggest challenges facing the energy transition is related to the fact that, in many cases, industrial energy demand is not located where renewable energy sources can be deployed at scale. This will put pressure on the grid infrastructure and must be addressed with long-range electricity transmission and hydrogen transport solutions. The regulatory framework needs to ensure that the steel industry has access to abundant and affordable low-carbon energy.

The public sector can direct investment and prevent possible bottlenecks by **prioritising specific infrastructure projects** for investment. For example, the EU's Projects of Common Interest (PCIs) receive accelerated permitting and are eligible for financial assistance under the Connecting Europe Facility budget for Energy (CEF-E). PCI allocation is prioritised by those projects that have the largest net zero contribution.[34] This is a particularly relevant example to countries with privatised energy infrastructure provision, allowing energy ministries to steer private investment to meet specific needs.

Policymaking can **ensure the strategic application of CCS and establish robust standards for infrastructure**. Infrastructure development prioritisation schemes can include strategic infrastructure development for transporting CO2 to storage sites. For example, CO_2 transport infrastructure is eligible for EU PCI status.[35] Supportive policies, such as the accelerated permitting of PCIs, can favour **priority sectors** to ensure CCS is reserved for emissions which cannot be prevented.

Midstream policies

Carbon contracts for difference (CCfDs) can facilitate the private sector development of breakthrough technologies, especially during the incubator phase.[36]

A contract for difference (CfD) is an agreement between two parties whereby one agrees to pay the other the difference between the value of a commodity (its market price) and a specific value agreed upon by the two parties (the strike price).[37] Hence when the agreed price is higher than the market price, the first party is obliged to pay the difference to the other. In the case of a two-way CfD, the second party would be required to pay the difference in the reverse situation where the strike price was lower than the market price. Such contracts provide long-term price stability to support the large-scale development of nascent technologies, especially more sustainable production processes. However, being a subsidy-type instrument, CfDs can be extremely expensive for public authorities.[38]

A CCfD represents a subsidy agreement between a regulator and a company to finance a decarbonisation project. The amount of such subsidy depends on the difference between the carbon price in a specific context (e.g., in the case of the EU, the average ETS price) and the strike price. The strike price can either be negotiated between public authorities and companies or competitive tendering can be held. The price agreed upon between a regulator and a company equals the carbon price necessary for the project to be economically profitable. In this way, a stable carbon price reduces investment risk in breakthrough technologies needed to transition hard-to-abate sectors, such as the steel sector.[39]

CCfDs are awarded to emissions reduction efforts. However, CCfDs should refrain from incentivising incremental change, and even if a supported project can reduce steel production emission intensity, it needs to be on a Paris-aligned pathway. Technologies allowing for deep emission reduction should be favoured to avoid carbon lock-in.[40] Similar schemes have been implemented in some EU Member States, and Germany plans to implement pilot CCfDs to promote green hydrogen in the steel and chemical sectors.[41] In April 2021, the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety in Germany published a whitepaper listing funding programmes supporting the country's decarbonisation, where the importance of such a scheme was acknowledged.[42] In May 2022, the German government issued a call for expression of interest in CCfDs, to support innovative technologies contributing to the decarbonisation of the hard-to-abate sectors, including steel.[43]

Carbon pricing, through a carbon tax or emissions trading scheme, is implemented to fix market distortions and capture the external costs of carbon emissions by charging emitters, either with a tax on emissions or a cap-and-trade system whereby sectors are allocated emissions allowances. Part of carbon pricing's value is its technology neutrality, enabling the market to find the most cost-effective solutions to carbon-intensive activities. Carbon pricing can improve the business case for green technologies and incentivise efficiency gains by placing an economic value on emissions. To do so, prices need to be high enough to have a material impact and not be weakened by free emissions allowances, as is currently the case for the European steel sector. For the carbon price to encourage clean investment, it must be high enough to prompt action stability. Carbon price volatility will discourage green investment. Carbon pricing cannot be relied on to drive transition alone. Other policies are required to overcome market failures and inertia, increase the green asset pipeline, and channel funding to transition the whole economy.

Concerns over **carbon leakage**, and the relocation of carbon-intensive industries to avoid pricing, have been a barrier to carbon price introduction. While many jurisdictions have provided free emissions credits to specific sectors, this weakens the price signal.

An **international carbon price floor** has also been proposed by IMF staff, suggesting a floor of USD25-75/tCO_2 by 2030, depending on their level of economic development.[44] This would provide long-term green investment certainty globally and help to address carbon leakage concerns.

Carbon **border adjustment mechanisms** (CBAMs) are under discussion to address the risk of carbon leakage. A CBAM applies local carbon pricing to imports of carbon-intensive goods, accounting for any pricing used in the country of production. This can strengthen local carbon pricing, as industries no longer need to receive free allowances to ensure competitiveness. It also incentivises global action, as third countries might implement carbon pricing schemes to capture revenue. Turkey's chief negotiator at the COP26 climate summit declared last year that the EU CBAM was a factor in convincing Ankara to ratify the Paris Agreement.[45]

Downstream policies

Public procurement accounts for up to 25% of the steel demand and represents a high share of consumption in critical sectors for steel activities, such as construction and energy.[46] Therefore, it can be a considerable incentive for developing a green steel market favouring scrap steel, gradually increasing demand at the global level.

Green public procurement (GPP) can increase demand for decarbonised steel goods and its whole value chain. The key to effective GPP is the development of mandatory criteria for its implementation. In some jurisdictions, such as the European Union, GPP remains voluntary, meaning that each public authority can decide whether to follow the EU guidance. However, it could drive demand for sustainable goods and services. As a result, the European Commission and some Member States have defined some general guidance through national criteria on different sectors.[47]

Project-level and product-level GPP are the two most important types of GPP. Project-level targets are meant to assess a project's sustainability instead of individual features. This evaluation is usually more comprehensive than product-level ones, as it considers emissions reduction in more components of the project. Nevertheless, this can be harder to assess because a project-specific environmental assessment should be carried out for each project.[48] On the other hand, product-level targets are easier to implement and only account for specific product sustainability concerning standardised targets. Those usually relate to circular economy and emissions reduction levels.[49]

A **circular economy** aims to maintain the value of products, materials, and resources by returning them to the product cycle at the end of their use, minimising waste generation.[50] For example, blast-furnace slag and by-products of primary steel manufacture can be used in cement production as supplementary cementing materials, replacing the clinker with more sustainable materials. The production of ordinary Portland cement — the most common type of cement — requires clinker, produced by the calcination of limestone, which is heated to temperatures above 850°C to form lime and CO_2. The lime is combined with sand and clay in a 1,450°C kiln to create a clinker.[51]

More significantly, policy strengthening **environmental criteria and circular economy requirements for steel waste treatment** need to be adopted. This would allow countries to recycle within their borders instead of exporting their waste challenges. This would increase their ability to produce recycled steel from scrap and greatly reduce GHG emissions.

In addition to carbon pricing policies and measures against the risk of carbon leakage, a broad policy platform, **a green window**, would encourage the international flow of green goods, services, and capital.[52] Such a green window could entail reducing tariffs on environmentally friendly goods, services and products produced using green processes. Green steel would be a perfect candidate for such a green window: **zero tariffs on zero-carbon**. This could compensate CBAM's trade curtailments and stimulate green capital flows by reducing restrictions on capital destined for green or transition projects.

Policy instruments can lower the risk of low-carbon steel **off-take agreements**.[53] These represent a future purchase commitment to buying a product, defining the specific terms of the contract several years in advance. These advance purchase commitments carry a risk. Public authorities can address this risk. Targeted R&D initiatives can provide CAPEX funding for innovative low-carbon technologies. Carbon Contracts for Difference reduce the OPEX risk of first movers, who have to deal with higher costs and uncertain carbon pricing levels. As stated above, public procurement is very relevant to the steel sector. Public authorities could green it through off-take agreements, increasing certainty on demand for future low-carbon steel while reducing their GHG emissions.

In May 2022, some companies, including Adient, BMW Group, Electrolux, Marcegaglia, and Mercedes-Benz, pre-purchased approximately 1.5 Mt of green steel from H2 Green Steel. These off-take agreements for about 1.5 Mt per year for 5-7 years represent more than half of the anticipated first yearly production capacity of 2.5 Mt.[54]

Annex: Climate Bonds Initiative Steel Criteria

Table 3. Eligible new iron and steel production facilities and applicable certification criteria for each type of facility

ELIGIBLE FACILITY	FACILITY SPECIFIC MITIGATION CRITERIA
BF-BOF production line with integrated CCUS **Smelting reduction production line with integrated CCUS** **Fossil gas-based DRI-EAF production line with integrated CCUS** **Fossil gas based DRI with integrated CCUS**	CCUS should capture at least 70% of all emissions.[55] CCUS complies with specific additional criteria
Scrap based Electric Arc Furnace (EAF)	The facility: • Needs to use 70%[56] of scrap as total annual inputs; OR • The combined scrap and (100%) Hydrogen based DRI should add to at least 70% of the EAF total annual inputs
(100%) Hydrogen-based DRI **(100%) Hydrogen-based DRI-EAF production line**	Hydrogen meets specific additional criteria
Electrolysis of iron ore steelmaking production line	A plan to address Scope 2 emissions within the term of the bond through different strategies such as: a. Increasing renewable-based[57] captive power generation b. Expanding renewable-based power purchase agreement - A plan shall be provided with evidence of the strategies that will be implemented. Progress of the implementation plan to be assessed every 36 months.

Table 4. Criteria for proceeds that are financing a whole existing production facility

Facility	Mitigation criteria specific to that plant
Electric Arc Furnace	A plan to address Scope 2 emissions through different strategies such as: • Increasing renewable-based captive power generation. • Increasing renewable-based power purchase agreements. - A plan shall be provided with evidence of the strategies that will be implemented. Progress of the implementation plan to be assessed every 36 months.
Production line with a blast furnace (BF) that became operational in 2007 or later	The investment shall not be for relining; AND A bundle of decarbonisation measures has been/will be implemented at the facility that has/will reduce the facility's emissions intensity (tCO_2/t steel) between 2022 and 2030 by: • 20% if the pre-decarbonisation baseline emissions intensity is greater than or equal to 2 tCO_2/t steel. • 15% if the pre-decarbonisation baseline emissions intensity is less than two tCO_2/t steel. The emissions intensity of the facility should be below 1.8 tCO_2/t steel by 2030. - A plan shall be provided with evidence of the decarbonisation measures that will be implemented. Progress against these decarbonisation targets to be assessed every 36 months.
Production line with a blast furnace (BF) that became operational prior to 2007	The investment shall not be for relining; AND A bundle of decarbonisation measures has been/will be implemented at the facility that has /will reduce the facility's emissions intensity (tCO_2/t steel) between 2022 and 2030 by 50%. The emissions intensity of the facility should be below 1.8 tCO_2/t steel by 2030. - A plan shall be provided with evidence of the decarbonisation measures that will be implemented. Progress against these decarbonisation targets to be assessed every 36 months.
Production line with a DRI	Either: **a. if the plant is fossil gas based**: A bundle of decarbonisation measures has been/ will be implemented at the facility that has/will reduce the facility's emissions intensity (tCO_2/t steel) between 2022 and 2030 by 20%. - A plan shall be provided with evidence of the decarbonisation measures that will be implemented. Progress against these decarbonisation targets to be assessed every 36 months; OR **b. if the plant is coal based**: A bundle of decarbonisation measures has been/ will be implemented at the facility that has/will reduce the facility's emissions intensity (tCO_2/t steel) between 2022 and 2030 by 40%. - A plan shall be provided with evidence of the decarbonisation measures that will be implemented. Progress against these decarbonisation targets to be assessed every 36 months; Additional criteria for monitoring, reporting, verification and mitigation of methane leaks applies for coal or fossil gas use.

Endnotes

1. IEA, IRENA and UNCC HLC. 2022. The Breakthrough Agenda Report. https://iea.blob.core.windows.net/assets/49ae4839-90a9-4d88-92bc-371e2b24546a/THEBREAKTHROUGHAGENDAREPORT2022.pdf

2. IPCC. 2022. Climate Change 2022: Mitigation of Climate Change. https://www.ipcc.ch/report/ar6/wg3/

3. Agora Energiewende and Wuppertal Institute. 2021. Breakthrough Strategies for Climate Neutral Industry in Europe: Policy and Technology Pathways for Raising EU Climate Ambition. https://static.agora-energiewende.de/fileadmin/Projekte/2020/2020_10_Clean_Industry_Package/A-EW_208_Strategies-Climate-Neutral-Industry-EU_Study_WEB.pdf

4. IEA, IRENA and UNCC HLC. 2022. The Breakthrough Agenda Report. https://iea.blob.core.windows.net/assets/49ae4839-90a9-4d88-92bc-371e2b24546a/THEBREAKTHROUGHAGENDAREPORT2022.pdf

5. Passaro, F., *A Green Future for Steel*, Climate Bonds Initiative 2022. https://www.climatebonds.net/resources/reports/green-future-steel

6. IIGCC. 2021. Global sector strategies: investor interventions to accelerate net zero steel. https://www.iigcc.org/download/global-sector-strategy-steel/?wpdmdl=4810&refresh=627d17afe207d1652365231

7. Agora Energiewende, Wuppertal Institute and Lund University. 2021. Global Steel at a Crossroads. Why the global steel sector needs to invest in climate-neutral technologies in the 2020s. https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021-06_IND_INT_GlobalSteel/A-EW_236_Global-Steel-at-a-Crossroads_WEB_V2.pdf

8. IEA, IRENA and UNCC HLC. 2022. The Breakthrough Agenda Report. https://iea.blob.core.windows.net/assets/49ae4839-90a9-4d88-92bc-371e2b24546a/THEBREAKTHROUGHAGENDAREPORT2022.pdf

9. Agora Energiewende, Wuppertal Institute and Lund University. 2021. Global Steel at a Crossroads. Why the global steel sector needs to invest in climate-neutral technologies in the 2020s. https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021-06_IND_INT_GlobalSteel/A-EW_236_Global-Steel-at-a-Crossroads_WEB_V2.pdf

10. Agora Energiewende, Wuppertal Institute and Lund University. 2021. Global Steel at a Crossroads. Why the global steel sector needs to invest in climate-neutral technologies in the 2020s. https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021-06_IND_INT_GlobalSteel/A-EW_236_Global-Steel-at-a-Crossroads_WEB_V2.pdf

11. https://corporate.arcelormittal.com/media/press-releases/arcelormittal-sets-2050-group-carbon-emissions-target-of-net-zero

12. https://climateactiontracker.org/global/cat-net-zero-target-evaluations/

13. MPP. 2022. Making net-zero steel possible: An industry-backed, 1.5oC-aligned transition strategy. https://missionpossiblepartnership.org/wp-content/uploads/2022/09/Making-Net-Zero-Steel-possible.pdf

14. MPP. 2022. Making net-zero steel possible: An industry-backed, 1.5oC-aligned transition strategy. https://missionpossiblepartnership.org/wp-content/uploads/2022/09/Making-Net-Zero-Steel-possible.pdf

15. https://www.h2greensteel.com

16. https://www.h2greensteel.com/latestnews/h2-green-steel-completes-190-million-funding-round

17. HYBRIT is a joint venture between SSAB, LKAB, and Vattenfall with financial support from the Swedish Energy Agency and, in April 2022, the EU supported it under the Innovation Fund. https://www.ssab.com/en/news/2022/04/hybrit-receives-support-from-the-eu-innovation-fund https://www.europarl.europa.eu/RegData/etudes/STUD/2021/695484/IPOL_STU(2021)695484_EN.pdf https://www.hybritdevelopment.se/en/a-fossil-free-future/

18. Green Steel for Europe. 2021. Investment needs. https://www.estep.eu/assets/Uploads/GreenSteel-D2.2-Investment-Needs-Publishable-version.pdf

19. https://www.ssab.com/en/company/sustainability/sustainable-operations/hybrit-phases https://www.ssab.com/en/news/2022/09/hybrit-milestone-reached--pilot-facility-for-hydrogen-storage-up-and-running

20. https://corporate.arcelormittal.com/media/press-releases/arcelormittal-establishes-strategic-renewable-energy-partnership-with-greenko-group-in-india

21. https://www.argusmedia.com/en/news/2233782-arcelormittal-spain-to-invest-1bn-in-green-steel

22. Agora Energiewende, Wuppertal Institute and Lund University. 2021. Global Steel at a Crossroads. Why the global steel sector needs to invest in climate-neutral technologies in the 2020s. https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021-06_IND_INT_GlobalSteel/A-EW_236_Global-Steel-at-a-Crossroads_WEB_V2.pdf

23. https://worldsteel.org/wp-content/uploads/Steel-Statistical-Yearbook-2020-concise-version.pdf?x25904

24. https://worldsteel.org/media-centre/press-releases/2022/december-2021-crude-steel-production-and-2021-global-totals/

25. https://www.climatebonds.net/standard/Steel

26. Yu, S., Lehne, J., Blahut, N., and Charles, M. 2021. 1.5°C Steel: Decarbonizing the Steel Sector in Paris-Compatible Pathways. https://9tj4025ol53byww26jdkao0x-wpengine.netdna-ssl.com/wp-content/uploads/1.5C-Steel-Report_E3G-PNNL-1.pdf

27. https://www.climatebonds.net/standard/Steel

28. IEA, IRENA and UNCC HLC. 2022. The Breakthrough Agenda Report. https://iea.blob.core.windows.net/assets/49ae4839-90a9-4d88-92bc-371e2b24546a/THEBREAKTHROUGHAGENDAREPORT2022.pdf

29. Certification of entities and SLBs will not be possible until the draft Climate Bonds Standard v4.0 has been finalised. This is because the Standard v4.0 includes new, non-sector specific requirements that entity and SLB certifications will need to comply with in addition to the steel-sector specific-criteria below. The Standard v4.0 is currently open for consultation until 4 November 2022. Please see here for more information. We welcome all feedback. It is anticipated that the Standard will be finalised by the year end.

30. https://www.climatebonds.net/standard/Steel

31. https://www.eurofer.eu/assets/news/eu-technical-report-on-production-costs-from-the-iron-and-steel-industry-in-the-eu-and-third-countries/production_costs_from_the_iron_and_steel_industry_-_final_online.pdf https://static1.squarespace.com/static/5877e86f9de4bb8bce72105c/t/61e790b43ddb95393be8dcc1/1642565821704/Global+Steel+Production+Costs+-+Jan2022.pdf

32. Yu, Lehne, Blahut, and Charles. 2021. 1.5°C Steel: Decarbonizing the Steel Sector in Paris-Compatible Pathways. https://9tj4025ol53byww26jdkao0x-wpengine.netdna-ssl.com/wp-content/uploads/1.5C-Steel-Report_E3G-PNNL-1.pdf

33. IEA. 2020.Energy Technology Perspectives 2020. https://www.iea.org/reports/energy-technology-perspectives-2020

34. https://energy.ec.europa.eu/topics/infrastructure/projects-common-interest_en

35. https://energy.ec.europa.eu/topics/infrastructure/projects-common-interest_en

36. https://climatestrategies.org/wp-content/uploads/2021/03/Carbon-Contracts_CFMP-Policy-Brief-2020.pdf

37. https://www.pinsentmasons.com/out-law/analysis/contracts-for-difference-industry-cleantech

38. https://www.mdpi.com/2071-1050/13/22/12626/pdf

39. https://www.tandfonline.com/doi/full/10.1080/14693062.2020.1803040

40. https://www.tandfonline.com/doi/pdf/10.1080/14693062.2020.1803040?needAccess=true&

41. https://www.euractiv.com/section/energy/news/germany-plans-to-promote-green-hydrogen-with-e7-billion/

42. https://www.pinsentmasons.com/out-law/analysis/contracts-for-difference-industry-cleantech

43. https://www.bmwk.de/Redaktion/DE/Publikationen/Klimaschutz/klimaschutzvertraege-bekanntmachung-des-interessenbekundungsverfahrens.html

44. IMF. 2021. Proposal for an International Carbon Price Floor Among Large Emitters. https://www.imf.org/en/Publications/staff-climate-notes/Issues/2021/06/15/Proposal-for-an-International-Carbon-Price-Floor-Among-Large-Emitters-460468

45. https://www.politico.eu/article/eu-carbon-border-adjustment-mechanism-turkey-paris-accord-climate-change/

46. https://iap.unido.org/articles/consumers-can-play-central-role-decarbonizing-cement-and-steel

47. https://ec.europa.eu/environment/gpp/index_en.htm

48. Hasanbeigi and Shi. 2021. Target Setting for Green Public Procurement Programmes. https://www.unido.org/sites/default/files/files/2021-10/Target%20Setting%20for%20Green%20Public%20Procurement%20Programs_20211004_b%20%283%29.pdf

49. Hasanbeigi and Shi. 2021. Target Setting for Green Public Procurement Programmes. https://www.unido.org/sites/default/files/files/2021-10/Target%20Setting%20for%20Green%20Public%20Procurement%20Programs_20211004_b%20%283%29.pdf

50. https://ec.europa.eu/eurostat/web/circular-economy#:~:text=What%20is%20the%20circular%20economy,minimising%20 the%20generation%20of%20waste

51. https://www.nature.com/articles/d41586-022-00758-4

52. https://www.climatebonds.net/2021/09/carbon-pricing-climate-action-new-countdown-cop-policy-briefing

53. https://materialeconomics.com/latest-updates/steeling-demand

54. https://hydrogen-central.com/h2-green-steel-sold-1-million-tonnes-green-steel-customers/

55. There are multiple sources of emissions in a steel mill, which poses an economical and technical challenge for the implementation of CCS. With 70% capture rate we refer to the emissions from all point sources. This aims at promoting investments in 90% capture at the highest emitting point source (e.g. the BF) that should translate in 70% of the overall facility. As technology advances retrofitting the rest of the facility to capture the remaining emissions shall become feasible.

56. Close to the global average use of scrap and according and used in the IEA G7 report as the threshold for scrap to distinguish between primary and secondary steelmaking.

57. Energy produced from renewable sources such as wind, solar, and small hydropower generation.

Lead Author: Fabio Passaro

Acknowledgements: Lily Burge, Fabiana Contreras, Vangelis Papakonstantinou

Design: Godfrey Design

Climate Bonds INITIATIVE