Decarbonizing Metals Part One:

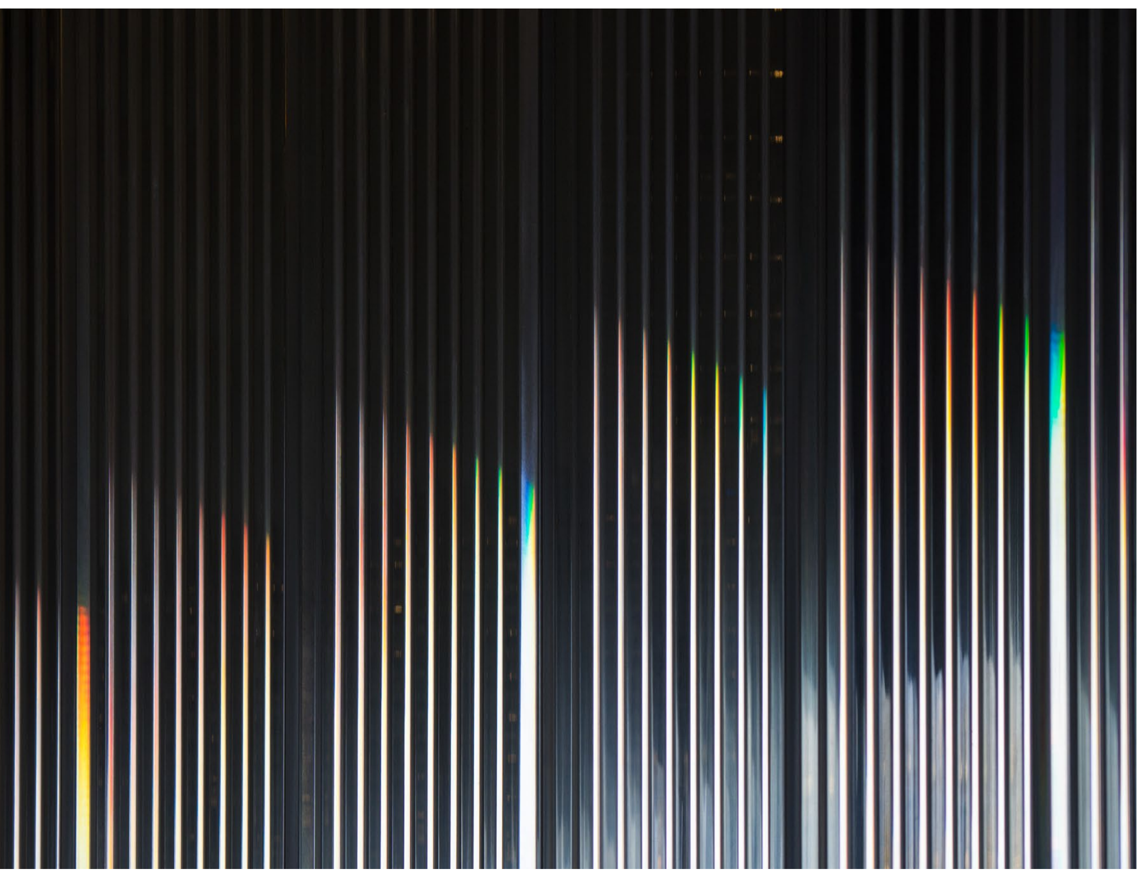
A Pressing Issue With Uncertain Fixes

June 3, 2024

Steel and aluminum companies are positioned to meet their decarbonization targets for this decade, but longer-term goals will involve significant cost and technological uncertainty.

This research report explores an evolving topic relating to sustainability. It reflects research conducted by and contributions from S&P Global Ratings' sustainability research and sustainable finance teams as well as our credit rating analysts (where listed).

This report does not constitute a rating action



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This S&P Global Ratings' research explores how companies in the metals sector are approaching climate transition risks. We focus on steel and aluminum, the most produced metals, and on major, rated metal-producing companies in the U.S., Europe, and APAC. We first assess greenhouse gas (GHG) concentrations in key manufacturing processes used by metals companies. We then look at the operational strategies and solutions that companies are adopting, or considering, to reduce their GHG emissions, including for challenging-to-address emissions. Finally, we assess how regulatory developments could affect metals companies and regions. Part Two of our research, "Decarbonizing Metals Part Two: Financial Strength Mitigates Rising Credit Risk," assesses decarbonization strategies' specific credit risks, how they can be mitigated, and how they might influence our credit rating analysis.

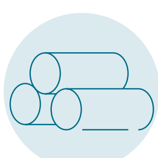
Key Findings

- The metal sector has attracted attention as one of biggest carbon emitters, prompting producers to increasingly set decarbonization targets. Nonetheless, steel and aluminum production remains dominated by relatively high-emission processes.
- Metal companies could achieve near-term decarbonization goals with increased use of scrap and direct reduced iron (DRI) technologies (though these are constrained by raw materials availability), efficiency improvements, and renewable energy adoption.
- Longer-term decarbonization prospects are less certain given that large scale implementation of new technologies will be difficult. For example, industrial-scale green hydrogen production will be costly and require vast renewable energy capacity.
- The sector is subject to carbon-related regulations and Europe, in particular, is implementing increasingly stringent policies. An inconsistent global regulatory environment could add uncertainty to metal companies' investment plans.

Decarbonizing metals--by the numbers

High emissions

Steel and aluminum production accounts for about **7%** of global emissions, which are growing with demand.

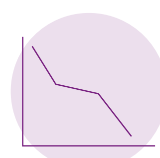


EU regulations

Carbon costs in the EU will rise for both domestic and imported metals, with full implementation of CBAM regulations by **2034**.

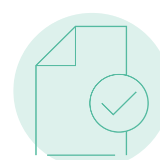
Decarbonization potential

The most innovative technologies could reduce emissions by about **90%** but remain distant for now.



Short-term targets

Rated metals companies target an about **30%** emissions reduction by **2030**.



CBAM--Carbon Border Adjustment Mechanism. Source: S&P Global Ratings.

The Metals Sector's Decarbonization Challenges Are Proving Intransigent

Demand for metals has increased consistently, driven by decades of population growth and economic expansion. Steel and aluminum, which as the largest segments of the metals sector by production and emissions are the focus of this research, are a key input across multiple sectors including building, infrastructure, appliances, and packaging, and provide significant contributions to global economies. The pair will also play a key role in enabling the energy transition where they will be major components in infrastructure such as wind turbines and transmission lines, as well as electric vehicles.

Global steel production increased about 16% between 2015 and 2022 (and has doubled since 2000) according to the World Steel Association. Aluminum production increased 18% over the same period, according to the International Aluminium Institute. That output produces substantial GHG, equivalent to about 7% of global carbon emissions in 2022, according to the International Energy Agency (IEA), with total emissions from steel production about 10 times those of aluminum.

The sector is among the biggest and most intensive GHG emitters

Metals companies' emissions have increased, despite a reduction in emissions intensity per unit of revenue. According to our study of global emissions trends, (see "Climate Transition Risk: Historical Greenhouse Gas Emissions Trends for Global Industries," Nov. 22, 2023) GHG emissions of listed companies in the materials industry group (including the makers of steel, aluminum, cement, and chemicals) ranked second to utilities in 2021 and were distinctly higher than other industries (based on revenue-weighted Scope 1 (direct emissions) and Scope 2 (indirect emissions) carbon intensity). Within the materials group, listed metals and mining companies collectively accounted for the greatest source of absolute Scope 1 and Scope 2 emissions and were second to the construction materials subsector in terms of emissions per unit of revenue (see table 1).

Rated metals producers' Scope 1 and Scope 2 emissions' intensity per unit of revenue declined about 5% between 2016 and 2021 but increased 14% on an absolute basis due to increased overall output. Most metals companies' emissions occur on-site, with Scope 1 emissions representing about 86% of total emissions by intensity and on an absolute basis.

Table 1

Metals and mining companies' total emissions growth outpaced other industries, despite declining average emissions per unit of revenue

	Scope 1 and Scope 2 emissions: CO2e (mil. tons)		Scope 1 and Scope 2 intensity CO2e (tons)/revenue (mil. US$)	
	2021	Change: 2016-2021	2021	Change: 2016-2021
Metals and mining	2,866	+48%	1,139	-13.7%
--of which, rated metal producers	1,080	+14%	1,423	-5.5%
Chemicals	1,028	+47%	621	+1.8%
Construction materials	986	+23%	3,483	+3.8%
Containers and packaging	71	+12%	287	-13.3%
Paper and forest products	131	+28%	672	-9.8%

CO2e--Carbon dioxide equivalent. Sources: S&P Global Sustainable1, S&P Global Ratings.

Scope 1, Scope 2, and Scope 3 emissions in metals production

Classification of metals companies' emissions can vary depending on the operating model they employ. This complicates comparison and means assessment of emission profiles and targets should consider operating models.

Emission "scopes" originate from the GHG Protocol, an international reporting standard, which differentiates between GHG emissions that are directly or indirectly caused by an entity. Scope 1 emissions include GHG generated by a company burning fossil fuels and from processes that it directly owns or controls. Scope 2 emissions refer to GHG related to consumption of purchased electricity, heat, and steam. Scope 3 emissions are all other indirect GHG emissions relating to activities in the value chain, including from purchased materials and the use of sold products.

Those classifications mean that a metals company that generates its own power for an electric arc furnace (EAF) would include the resulting emissions in Scope 1. Yet, a company that purchases electricity for the same purpose would account for the associated emissions in Scope 2. Similarly, an integrated metals company with mining activities would include mining emissions as Scope 1, yet a company that purchases ores or minerals would tally mine-related emissions as Scope 3.

Fossil fuels account for most metals production emissions

Energy use and GHG emissions vary widely depending on production processes and power sources. For example, steel production can emit 0.7 metric tons (tons) to 2.3 tons of CO2 per ton of steel, with a global average of 1.9 tons of CO2 per ton of steel in 2022, according to the World Steel Association (see chart 1). Those differences are predominantly due to manufacturing methods:

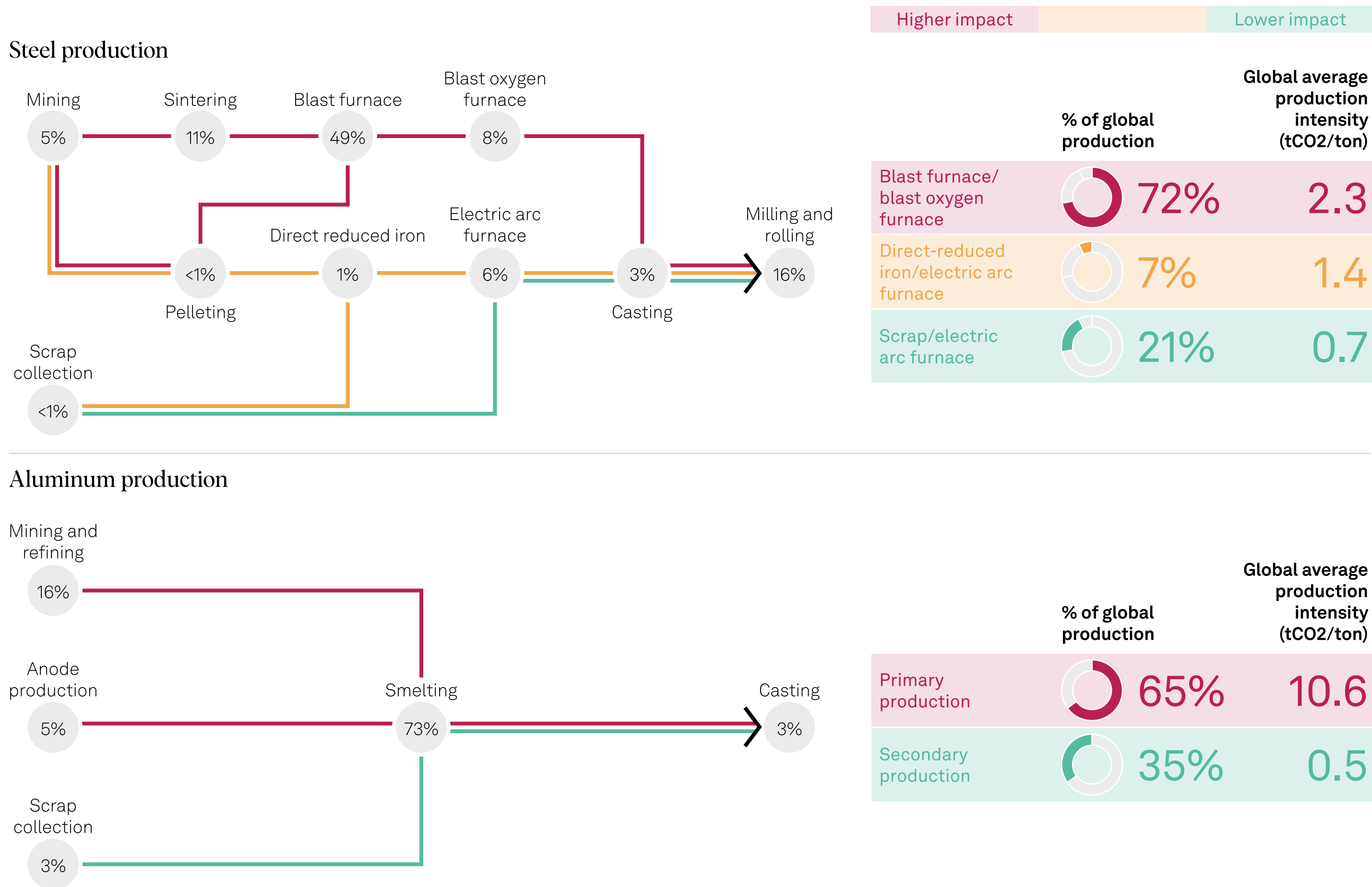
- Steel made from iron ore using older but common blast-furnace-basic oxygen furnace (BF-BOF) technology will likely top that range. Blast furnaces require coal, used for both heat in the furnace and to produce coke--a key component in the chemical transformation of iron ore into steel.
- Direct Reduced Iron (DRI), a newer production method, tends to produce less emissions because it replaces coal with hydrogen (normally sourced from natural gas) in the steel-making process.
- Steel produced from scrap using an electric arc furnace (EAF) is typically at the lower end of the emissions range, with much of the GHG produced emanating from the power source.

Power is also the major source of GHG emissions in aluminum production, equating to about 60% of the total, while much of the rest relates to the carbon-based anodes essential for electrolysis. Power-related emissions can vary widely depending on the mix of fossil fuels and renewable energy sources. Emissions from primary aluminum production are much higher than that of steel on a per unit of production basis, but far lower in total emissions terms due to aluminum's lower production volumes. Mining activities, meanwhile, typically only represent a small part of the total emissions in finished steel and aluminum products.

Chart 1

Ironmaking and smelting drive steel and aluminum production emissions

Historical share of metal production emissions by production route and emissions intensity



Data as of 2022. tCO2--Metric ton of carbon dioxide. Sources: World Steel Association, International Aluminium Institute, International Energy Agency, Wang et al, S&P Global Ratings.

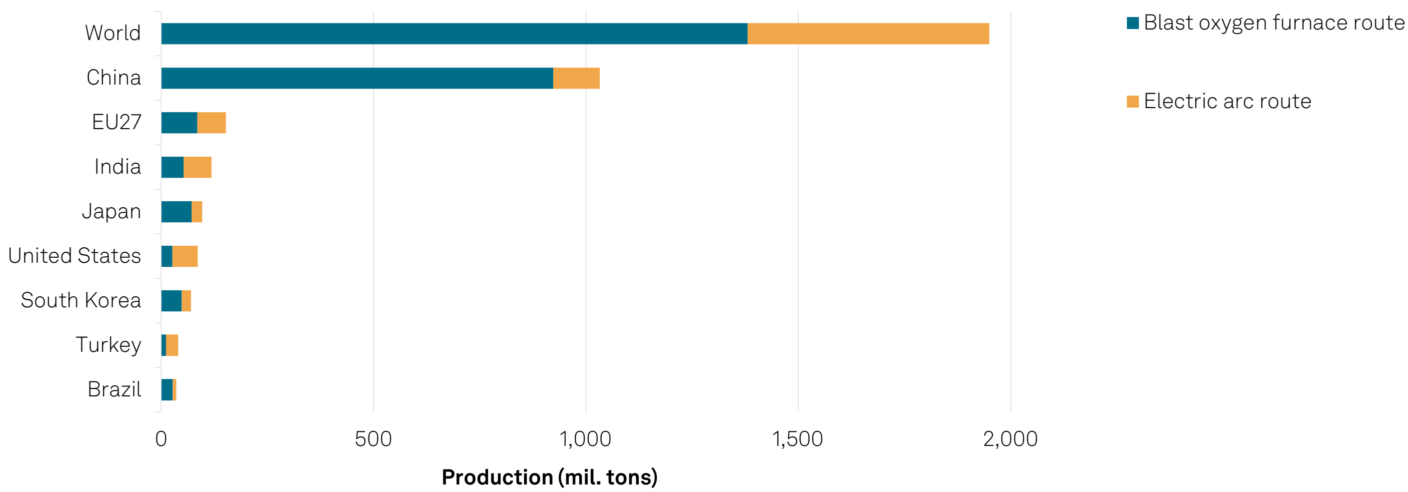
Carbon-intensive blast furnaces are (and will continue to be) the dominant steel production technology

BF-BOF's position as the dominant steel production method reflects its ability to use abundant iron ore to produce steel at scale and poses a significant decarbonization challenge. Because much of the BF-BOF capacity has been added in the last 10 to 15 years, plants still have decades of production ahead of them (furnaces can have a lifespan of 30 to 40 years with continued investment), meaning BF-BOF could remain an important steel production route (and ongoing emissions issue) for decades to come. China produces more than half of the world's steel using that technology (see chart 2). Meanwhile, adoption of alternative technologies tends to be limited by input restrictions. For example, a lack of available scrap has limited the deployment of EAF, particularly in growth markets, such as China and India, where there isn't enough scrap to meet demand. DRI production is limited by the availability of the necessary iron ore, which is higher-grade compared to that used in BF-BOF.

Chart 2

China, Japan, South Korea, and the EU have the highest concentrations of BF-BOF assets

Steel production by country/region and technology



BF-BOF--Blast furnace-blast oxygen furnace. Data as of 2022. Source: S&P Global Ratings, World Steel Association.

The distribution of production between BF-BOF and EAF (and thus the intensity of steel-making emissions) appears unlikely to radically change in the near term. More than half of announced and in construction steel plants plan to adopt BF-BOF technology, according to Global Energy Monitor, meaning higher-emission production will be locked in for longer. This could leave those that continue to deploy these technologies exposed to regulatory or stakeholder pressure, potentially increasing their overall transition risk in the future.

Decarbonization Targets' Near-Term Focus Hints At The Difficult Path To Longer-Term Carbon Neutrality

Major, rated metals companies have responded to regulatory and stakeholder pressure by setting decarbonization targets, with most articulating near-term targets, longer-term net-zero aspirations, and strategies they believe will deliver those goals.

Large producers are targeting short-term 30% carbon reduction

Most of the major steel and aluminum producers we rate have set near-term targets to reduce GHG emissions (see table 2). Most have also outlined ambitions to completely decarbonize by 2050, although few have produced detailed plans to achieve these longer-term goals--a situation that we think reflects the uncertainties and challenges they face. A majority of large companies' short-term targets have coalesced around 2030 and cover Scope 1 and Scope 2 emissions, while a few have included other emissions sources, such as mining activities, as Scope 3 targets.

Companies' have set diverse decarbonization targets. Some have opted for absolute targets, which apply to total emissions regardless of output. Others have opted to set intensity-based targets, based on emissions per unit of production, meaning their total emissions could increase if sales growth outpaces per-unit GHG emission cuts.

Table 2

Near-term carbon targets of large, rated steel and aluminum producers

Company	Targets
ArcelorMittal	25% reduction in production-intensity GHG emissions (Scope 1 and Scope 2) between 2018 and 2030.
SSAB	35% reduction in absolute GHG emissions (Scope 1 and Scope 2) between 2018 and 2032. SBTi verified.
Norsk Hydro	10% reduction in absolute GHG emissions (Scope 1 and Scope 2) between 2018 and 2025. 30% reduction in absolute GHG emissions (Scope 1 and Scope 2) between 2018 and 2030. 30% reduction in upstream GHG emissions (Scope 3) per ton of aluminum between 2018 and 2030.
Tata Steel	30% to 40% reduction in absolute GHG emissions in Europe between 2018 and 2030.
Nippon Steel	30% reduction in absolute GHG emissions between 2013 and 2030.
Baoshan Iron & Steel	30% reduction in production intensity GHG emissions (Scope 1 and Scope 2) between 2020 and 2035.
Aluminum Corp of China	Targeting peak carbon emissions by 2025, then a 40% reduction by 2035.
POSCO	10% reduction in absolute GHG emissions (Scope 1 and Scope 2) between 2017-2019 and 2030.
Alcoa	30% reduction in production intensity GHG emissions (Scope 1 and Scope 2) between 2015 and 2025. 50% reduction in production intensity GHG emissions (Scope 1 and Scope 2) between 2015 and 2030.
Nucor	10% reduction in production intensity GHG emissions (Scope 1, Scope 2, and Scope 3) by 2030.
Vale	33% reduction in absolute GHG emissions (Scope 1 and Scope 2) by 2030. 15% reduction in absolute GHG emissions (Scope 3) by 2035.

SBTi--Science Based Targets initiative. Sources: Company disclosures, S&P Global Ratings.

Existing technologies can reduce but not eliminate emissions

Energy efficiency, deployment of renewable or low-carbon energy, and incremental deployment of DRI and EAF technologies could deliver near-term decarbonization in our view, but fully decarbonizing primary steel production will require difficult changes to production processes. We think decarbonizing steel manufacturing will prove particularly difficult for China, Japan, and Europe, for example, because a higher proportion of their producers use blast furnace assets (see chart 2) and will struggle to deliver significantly lower GHG emissions without changing their manufacturing assets. Countries with a larger share of EAF production should face fewer issues, though the path to carbon neutrality will still prove challenging.

Rated steel and aluminum companies are adopting, or are preparing to adopt, a range of key pathways to decarbonization over shorter- and longer-term horizons. We believe those pathways each come with challenges and potential impacts that will have to be confronted by the metals sector (see table 3).

Table 3

Key decarbonization solutions: our assessment of feasibility and impact

Likely implementation horizon

Short term	Medium term	Long term

Decarbonization solutions	Application	Scope	Development stage*	Disruption level	Estimated cost	Decarbonization impact and/or limitations
Energy efficiency	All processes	All processes	Adoption	Low	Low	Incremental gains up to 10%
Clean power	Renewable power supply	All processes	Demonstration	Low	Moderate	Up to 60% in aluminum production
	Process electrification	Ancillary services (including mining)	R&D	High	High	Incremental gains up to 10%. Scalability constrained by locations and existing assets
Process change	Steel--electric arc furnace	Production	Adoption	Low	Moderate	About 70% to 80% compared to BF-BOF production methods. Scale contained by scrap availability
	Steel--direct reduced iron		Adoption	Moderate	Moderate	About 30% emission reduction compared to BF-BOF. Scale constrained by high-quality ore availability
	Steel--green hydrogen-based DRI production		Demonstration	High	High	50% to 80% reduction compared to BF-BOF
	Aluminum--low emissions heat and inert anodes		R&D	High	High	Around 30% depending on application
Use of scrap	Scrap-based steel and aluminum production	Feedstock	Adoption	Low	Moderate	Limited by availability of scrap
Carbon capture	CCS or CCUS integration	Production	Demonstration	Moderate	High	Up to 90% emission reduction possible

*Scale: R&D -> Demonstration -> Adoption. R&D--Research and development. CCS--Carbon capture and storage. CCUS--Carbon capture, use, and storage. Source: S&P Global Ratings.

Decarbonization solutions in detail

Energy efficiency

Energy recovery, off-gas recycling, and better controls and processes should continue to yield small reductions to emissions. Energy efficiency has long been a focus for metals makers due to its direct link to operating costs and support costs, and as a route to emissions reduction. Some energy efficiency measures will be cost effective, but once the low hanging fruit has been picked the cost payback of incremental gains could prove limited. One of the key potential sources of energy efficiencies are waste gases, which can be used in on-site electricity cogeneration, or to produce bioethanol (as ArcelorMittal plans to do at a plant in Ghent). Industrial processes that avoid the need to reheat metals during manufacturing also offer energy savings but usually requires adoption of faster industrial processes, such as rapid casting and hot rolling of steel and aluminum into a final product.

Clean power

Securing sources of low-carbon power is a major challenge for metals producers and while some may be able to develop their own renewable generation it will be difficult for many. The need for continuous electricity supply means that self-developed, 100%-renewable power solutions will likely require energy storage, which adds complexity. Some efforts have already been made. For example, Norsk Hydro operates hydroelectric assets to power its aluminum production, Tata Steel has said it plans to develop more renewable power, while ArcelorMittal is exploring the use of biomass to produce heat for its Belgian plants. We think companies with existing fossil-fuel power assets, particularly those with many years of service remaining, will prove reluctant to invest in new, clean power, especially given renewables significant upfront capital expenditure (capex) needs. The potential to electrify mining equipment, trucks, and other operations, is limited by difficulties securing reliable electricity sources, given the remoteness of many operations.

We expect metals companies will increasingly look towards Power Purchase Agreements (PPAs). These reduce operational complexity by relying on utilities to supply low-carbon power while also providing energy price certainty. Alcoa, Norsk Hydro, and ArcelorMittal have been amongst the most active metals companies in securing PPAs to date, according to data from S&P Commodity Insights. Still, sourcing a completely renewable supply in all regions will be difficult, at least in the short term, given competing demand from other sectors and the long lead times for new supply.

Process change

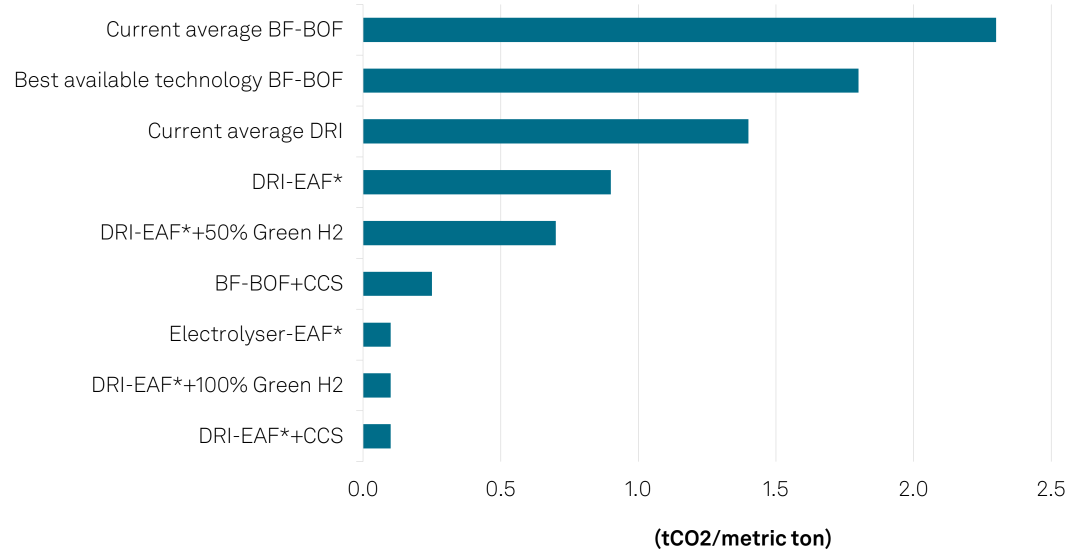
Steelmakers' increased deployment of DRI and EAFs could be a key contributor to decarbonization if they replace carbon intensive BF-BOF production. EAFs are a proven steelmaking technology, with lower energy demands than BOF, and most rated steel companies have plans to increase usage where possible. DRI, which has also been deployed, offers efficiencies in primary iron ore production through better use of ore as well as reduced dependency on coal. Its adoption could, however, be hampered by difficulties securing the relatively high-quality iron ore on which it relies. And DRI is a capex-heavy technology that is difficult to integrate into existing operations, meaning we think it is more likely to be considered for new projects rather than integrated into existing steelmaking locations. Companies with ambitious decarbonization goals will have to make strategic decisions on how, when, and where to invest in the new technologies to minimize business disruption. For steelmakers with higher BF-BOF capacity, such as those in parts of Asia and across Europe, those decisions could prove particularly challenging.

Hydrogen-based steel production could deliver nearly carbon-neutral steel, but we believe main-stream adoption remains distant. The combination of DRI, EAF, and green or low-carbon hydrogen could cut steelmaking emissions to a small fraction of their current levels (see chart 3). But this combination is still in development--for example, ArcelorMittal, POSCO and Nippon Steel have said significant hydrogen-based production is unlikely until after 2030. We also see cost challenges due to the price of green hydrogen (see "Hydrogen: New Ambitions and Challenges," Feb. 15, 2024). In the meantime, blue hydrogen (produced by combining natural gas with heated water to create hydrogen) and carbon capture could be used as a steppingstone technology, but are expensive. Nonetheless, most large European metals companies are testing their use, including SSAB and ArcelorMittal. Direct electrolysis (similar to the process used to produce primary aluminum) for steel production is also being tested at small scale.

Chart 3

Process changes could significantly lower steel production's carbon intensity

Estimated CO2 emissions per ton of steel produced



*Assuming 100% renewable energy. BF--Blast furnace. BOF--basic oxygen furnace. DRI--Direct reduced iron. EAF--Electric arc furnace. H2--Hydrogen. CCS--Carbon capture and storage. tCO2/ton--ton of carbon dioxide per ton of steel produced. Sources: World Steel Association, Mission Possible Partnership, S&P Global Ratings.

Aluminum production could also benefit from green hydrogen and new types of anodes to reduce carbon emissions from refining and smelting. Alumina refining requires thermal energy, which could be provided by hydrogen instead of coal or natural gas, though the elevated price of green hydrogen currently prohibits its adoption. The development of inert anodes--which avoid the creation of GHGs when used in the electrolysis process--could meaningfully reduce direct carbon emissions, but remain in research and development, with uncertainty remaining on how they will impact production processes and costs. Meanwhile, several companies are researching and testing more efficient use of current anode technology, although we do not expect to see widescale application of this improved technology in the near term.

Use of scrap

Most Rated metals companies include the use of scrap as part of their decarbonization plans. Scrap is already recognized as a key means to reduce the energy and emissions intensity of all methods of steel and aluminum production and is one of the most economically viable paths to decarbonization. Scrap is easily integrated as an input into existing production methods, making it an attractive and potentially cost-effective element of decarbonization plans.

However, the potential for scrap use is location specific with availability and logistics issues key barriers to adoption. In some regional markets, the supply of scrap is stable thanks to relatively mature collection systems (particularly for post-consumer scrap) and therefore balanced with demand. But in emerging markets, with higher growth in production and much-less developed sourcing of scrap, there will likely be limits to this solution's potential contributions, at least in the near term.

Carbon capture and storage

Carbon capture, usage, and storage (CCUS) could contribute significantly to the decarbonization of steelmaking (and to a lesser extent aluminum production) if technological, cost, and storage limitations can be overcome (see "Carbon Capture, Removal, And Credits Pose Challenges For Companies," June 8, 2023). Notably, CCUS's "end-of-pipe" solutions could be retrofitted to BF-BOF assets, reducing CO2 emissions for coke- and natural gas-based iron reduction and thus extending asset life. CCUS could also be used in tandem with metal producers' self-generated power production.

Despite the challenges, many steel companies include CCUS in their decarbonization plans, and are testing its application in small scale pilots. For example, ArcelorMittal has partnered with Mitsubishi and BHP for testing, Tata Steel is exploring its options (including with a small-scale pilot at its Jamshedpur site in India), while Nucor has agreed to integrate CCS into a DRI plant in Louisiana. We remain wary of the many challenges to CCUS's widespread adoption, and don't expect deployment at scale ahead of the late 2030s, at the earliest.

What is green steel? Green aluminum?

Green steel and green aluminum, while not having a formal definition, are generally characterized by manufacturing that is emission free or very-low emission. Such manufacturing typically employs new technologies, such as the hydrogen-DRI route for primary steel, and renewable-EAF for secondary steel (see previous section for details). Metals companies have begun marketing green products and have found customers in sectors such as auto manufacturing, where manufacturers require low-impact inputs to support their own decarbonization goals.

The lack of a formal definition means calculation of associated GHG emissions can vary, potentially leading to market confusion. The Steel Standards Principles, aimed at harmonizing the reporting of emissions in steel production, were announced at the U.N. Climate Change Conference (COP 28) and could improve confidence in low-carbon claims.

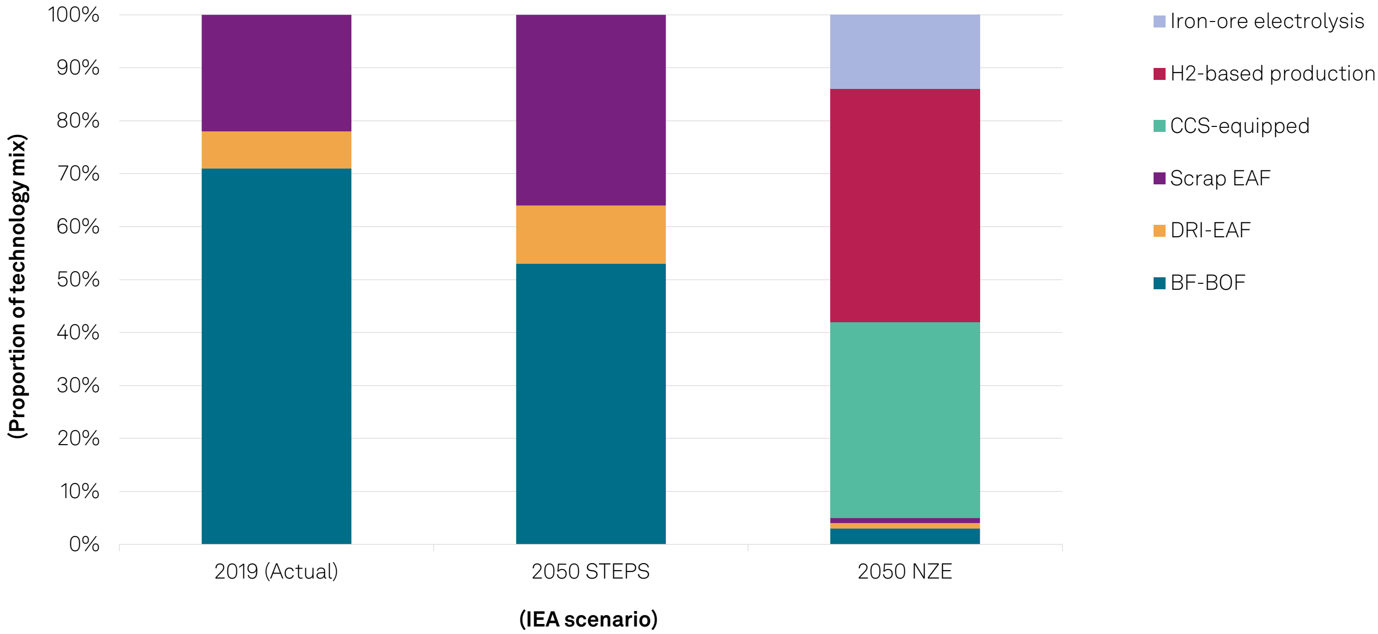
The EU Taxonomy includes criteria for identifying "environmentally sustainable" activities in the steel and aluminum sectors. These set specific criteria (generally based on practices at installations that rank in the top 10% for efficiency) for various metals products, based on production emissions intensity, the amount of energy used, or the proportion of secondary inputs.

Decarbonization will require different and combined solutions

We think increased diversity in metals sector production methods is likely, especially for steel. Most companies we rate highlight a range of possible decarbonization solutions and (given current asset bases, availability of ores and scrap, and regional differences) there will likely be differences in the rate of deployment for solutions. Local sourcing, in particular, will determine companies' access to scrap material, low-carbon hydrogen, and CCS and thus influence their adoption of new technologies. This view of a diversifying metals sector is supported by the International Energy Agency (IEA), whose future energy scenarios include expectations of a reduction in BF-BOF usage out to 2050 and, especially in the case of a net zero scenario, the adoption of a mix of solutions (see chart 4).

Chart 4

Significant emissions reduction will require a transformation in how metals are produced
IEA analysis of the steel-technology mix under different scenarios



IEA--International Energy Agency. STEPS--Stated policy scenario. NZE--Net zero scenario. DRI--Direct reduced iron. H2--Hydrogen. EAF--Electric arc furnace with 100% renewable energy. CCS--Carbon capture and storage.
Sources: International Energy Agency, S&P Global Ratings.

Regulations Will Tighten And Increasingly Span Borders

Emissions regulations are the main source of climate transition risk in the metals sector, though changing customer demands could emerge as an increasingly important factor. As one of the heaviest GHG emitters, the metals sector has been a target for regulations, which have become one of the main drivers for companies to reduce emissions. At the same time, some steel customers are increasingly demanding green products that support their own decarbonization efforts, and some steel and aluminum companies are responding. Among the companies that have actively sought green steel are automakers, including Volvo and Mercedes-Benz. We expect demand for low and no-emission inputs from consumer-facing companies to increase, providing additional motivation for metal producers to invest in lower-carbon production processes.

Europe is setting the agenda with pioneering regulation

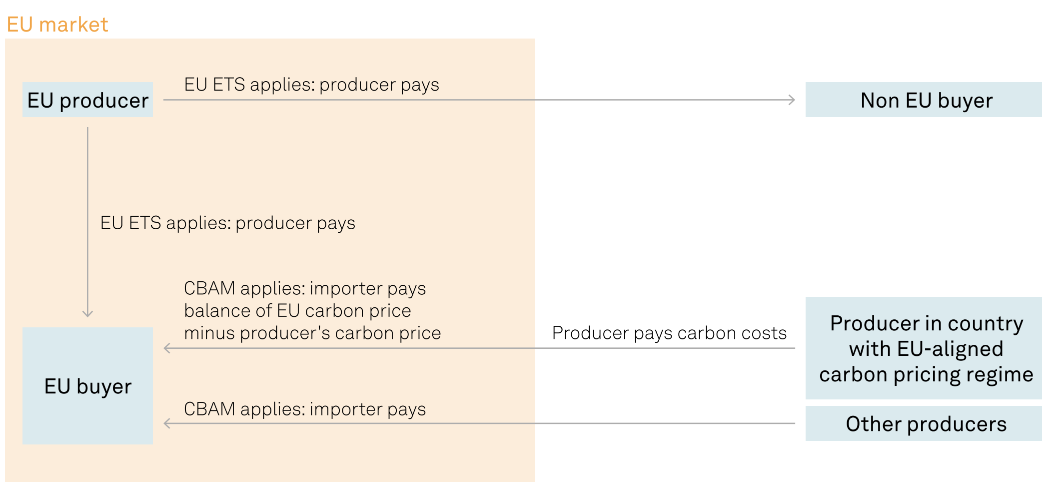
We expect metals companies operating in the EU will face increasing costs related to carbon emissions from 2026. This is when the rules of the European Union Emissions Trading Scheme (EU ETS) will be updated as part of the European Green Deal and Fit for 55 packages. The changes to the existing "cap and trade" scheme will notably result in a significant reduction of tradable, Scope 1 carbon dioxide allowances, known as EU Allowances (EUAs), and the gradual phasing out of free allowances, from 2026 to 2035. Those free allowances currently cover close to 90% of all emissions by metals companies included in the EU ETS. We expect two important consequences for metals companies. First, reducing the number of EUAs will support continued price increases. Second, with the phase out of free allowances, companies that do not reduce emissions will increasingly have to purchase more EUAs through the EU ETS. Together we think these factors will materially increase carbon related costs.

The EU ETS reform will go hand-in-hand with the launch of a Carbon Border Adjustment Mechanism (CBAM), that could affect rated companies outside of the EU. The CBAM seeks to equalize carbon costs between domestically produced and imported products, thereby avoiding so-called carbon leakage--where production moves overseas to avoid carbon-related costs in the EU. Under CBAM, EU importers of key commodities produced outside of the EU, including steel and aluminum, will have to pay additional taxes equal to the cost of EUAs, based on the carbon intensity of those imported products. In practice, this means that the cost of carbon-intensive imports, such as steel and aluminum, will increase in EU ETS participating countries. The introduction of CBAM will be gradual, mirroring the reduction in free EUAs between 2026 and 2034 (see chart 5).

Chart 5

EU-based importers could be liable for some suppliers' carbon costs

Cost allocation under the CBAM and ETS



CBAM--Carbon Border Adjustment Mechanism. ETS--Emissions Trading System. Source: S&P Global Ratings.

Initiatives beyond the EU could increase regulatory complexity

Companies operating outside the EU, but already subject to regional emission trading schemes (ETS), may find themselves less affected by the EU's CBAM program. This is because the EU's carbon pricing mechanism seeks to equalize charges, demanding that EU companies that import from countries with equivalent ETS or other carbon pricing mechanisms pay only the difference in carbon-related costs. Nonetheless, EU allowances are more costly than most other schemes, meaning that in most cases importers will need to pay. Jurisdictions, including major steel producing countries such as Brazil and India, have proposals for ETS-like regulations, although their scope is still being developed.

Other regulations have targeted the sector's energy efficiency and sort to incentivize emission reductions across the supply chain. For example, India introduced its National Mission for Energy Efficiency in 2011, which sets energy efficiency targets for industrial companies, including a mechanism for trading obligations between participants. China has also adopted energy efficiency targets for industrial operators, including steel and aluminum makers, and though its ETS currently only covers power generators it has signaled an intent to include aluminum and steel in the future. Meanwhile, the U.S. Inflation Reduction Act provides significant tax credits for investments in renewables, hydrogen, and CCS. Improving energy efficiency and reducing emissions per unit of production would ultimately reduce companies' exposure to carbon-related costs such as CBAMs.

We consider that differences in CBAMs' implementation across different jurisdictions could lead to a higher credit-risk environment and explore this in more depth in Part Two of this research. As well as the development of ETS, some markets (such as the U.K. and Australia) are also considering their own CBAM in response to the EU's initiative. This appears motivated largely by an attempt to secure a slice of the revenues that would otherwise go to the EU. Others may follow. Metals companies' decisions regarding where to invest will increasingly have to consider not only regulations relating to the location of facilities but also those of the markets they plan to sell to.

Looking Ahead

The metals sector's place among the largest carbon emitters (largely due to steel and aluminum producers) has ensured that its members already face pressure to reduce GHGs. Regulation, particularly in Europe, is clarifying and intensifying--though, globally, solutions remain somewhat inconsistent and uncertain in terms of development.

Metals companies that we rate have begun to take decarbonization steps, and we think the existing technologies should allow them to meet their 2030 targets. However, solutions capable of delivering more substantial reductions in carbon emissions come with significant levels of uncertainty, both in technological and cost terms. Steel and aluminum companies, which remain particularly reliant on traditional, high-emitting production processes, face particularly difficult challenges as they transition their asset bases to achieve their longer-term decarbonization ambitions.

Our research "Decarbonizing Metals Part Two: Financial Strength Mitigates Rising Credit Risk" analyzes the implications of currently available solutions for companies' credit quality, their decarbonization plans, and its possible effects on our credit analysis.

Related Research

- Climate Transition Risk: Historical Greenhouse Gas Emissions Trends for Global Industries, Nov. 22, 2023
- Decarbonizing Cement Part One: How EU Cement Makers Are Reducing Emissions While Building Business Resilience, Oct. 27, 2023
- Decarbonizing Chemicals Part One: Sectorwide Challenges Will Intensify Beyond 2030, Sept. 5, 2023
- Carbon Capture, Removal, And Credits Pose Challenges For Companies, June 8, 2023

External Research

- International Carbon Action Partnership - Emissions Trading Worldwide Status Report, April. 10, 2024
- World Steel Association Sustainability Indicators 2023 report, November 2023
- IEA Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach, Sept. 2023
- Global Energy Monitor - Pedal to the Metal 2023: Time to Shift Steel Decarbonization into High Gear, July 20, 2023
- International Aluminium Institute Greenhouse Gas Emissions Statistics, Jan. 25. 2023
- Mission Possible Partnership – Making Net Zero Steel Possible, September 2022
- Efficiency stagnation in global steel production urges joint supply- and demand-side mitigation efforts, Wang, P., Ryberg, M., Yang, Y. et al., Nat Commun 12, 2066, 2021.

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