Philanthropy Briefs

BUILDINGS

Steel

a series by Active Philanthropy

WHAT IS IT ABOUT?

Historically, steel has enabled much of the world's infrastructure development since the industrial revolution. Its strength, durability, and versatility make it one of the world's most utilised materials. It has become essential especially in the construction of buildings, which uses one third of the 1.7 million tonnes of steel produced annually.[1] **However, the production of steel is a carbon-intensive process, contributing significantly to greenhouse gas emissions and climate change.**

3 FAST FACTS

2 kg

The amount of carbon dioxide emitted for every 1 kg of steel produced.[2]

+20 years

The timespan that reinvestments in coal-fired blast furnaces would lock in fossil-fuelled steel production.[3]

2x

The increase in global steel demand for buildings since 2000.[1]

WHY DOES STEEL PLAY A ROLE IN CLIMATE CHANGE?

Currently, 70 % of steel is produced via the "blast furnace" process, which heavily relies on coal – both as a raw material and as an energy source. This process is responsible for 95 % of the CO_2 emissions caused by steel.[4]

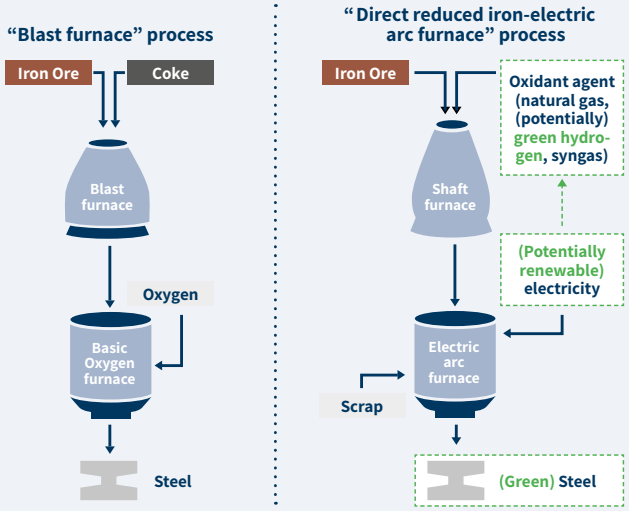
The "blast furnace" process involves two main stages:

1) **Ironmaking:** This stage separates iron from iron ore (rocks) using coke (a carbon-rich material made by heating coal in the absence of air) as a "reducing agent". When coke reacts with iron ore, it indirectly produces CO_2 emissions.

2) **Steelmaking:** In this stage, oxygen (O_2) is blown into molten iron to reduce its carbon content and remove impurities, transforming it into steel. This process emits CO_2 twice. Firstly, the heat required for this process is normally generated by burning coal or other fossil fuels. Secondly, the carbon (C) in the molten iron combines with the oxygen (O_2) introduced into the furnace, producing CO_2 as a byproduct.

It is because of this very process that steel production is responsible for 7.2 % of global carbon emissions.[5] Since almost all buildings are constructed using steel, they embody the emissions caused by the "blast furnace" process, even before anybody has ever set foot in that building.

Solutions to reduce these embodied carbon emissions exist but they are not implemented at scale. In steelmaking, switching from blast furnaces to direct reduced iron-electric arc furnaces (see illustration to the right) is an effective, available technological solution. Promoting it should be a top priority for climate funders as should strategies to address the growing demand for steel worldwide.



The direct reduced iron-electric arc furnace process traditionally used fossil gas but can be adapted to run on green hydrogen. Adapted from IRENA 2022

[1] Systems Change Lab 2024, [2] World Steel Association 2023, [3] Agora Industry 2021, [4] Agora Industry 2023, [5] UNEP and Yale Center for Ecosystems + Architecture 2023

WHAT FUNDERS CAN DO

Supply side

Support the steel workers in the transition: Steel workers have used blast furnaces for centuries, developing deep expertise of this practice. Transitioning to new steelmaking methods, then, is often perceived as a risk to their work culture, identity and job security. Funders can support the wellbeing and resilience of workers by funding retraining programmes that equip them with the skills needed for low-emission steelmaking. By fostering partnerships with key stakeholders such as labour unions, philanthropy can also actively engage workers in the transition process. This collaborative approach turns steel workers into experts of clean steel production, making the industry's transition more inclusive and likely to succeed.

Demand side

Leverage buying power of major purchasers: Through strategic advocacy, funders can promote procurement policies and initiatives like 'Buy Clean', which encourage public buyers to spend taxpayers' money on cleaner steel and other building materials produced with a lower carbon footprint. This approach allows funders to boost market demand and encourage the industry to spur research and development in low-carbon steel. Complementary initiatives like the 'Industrial Deep Decarbonisation Initiative' strengthens buyer commitments for cleaner steel. By simultaneously pushing buyers to make greener choices and challenging the industry to rise to the occasion, funders can enhance market incentives and drive widespread industry transformation.

Stimulating a circular economy of steel: Technological advancements are promising but may not scale quickly due to renewable energy constraints[6] and long investment cycles of blast furnaces. To curb demand for primary steel production, climate funders should prioritise strategies that embrace the principles of reduce, reuse, recycle and replace. For example, supporting research and development into buildings designed for disassembly can promote practices where steel components are easily removed and reused. In addition, advocating for policies that incentivise or require such design principles can help drive wider industry adoption.

There are many different strategies to engage in climate philanthropy. See our Spotlight on Climate Funding Strategies to learn more.

THINGS TO CONSIDER WHEN FOCUSING ON STEEL

Window of opportunity: Over 70 % of existing coal-based blast furnaces are approaching the end of their operational lifespan by 2030, necessitating significant reinvestment. Meanwhile, emerging economies with growing steel demand plan to build new coal-based plants with lifespans extending beyond 2050.[7] This presents a crucial crossroad where philanthropy must step in to support the switch to low-emission steelmaking such as cleaner electric arc furnaces, avoiding stranded assets and preventing a decades-long lock-in to coal-based steel production technologies.

Turning challenges into opportunities: More than half of steel made worldwide comes from China.[8] Given the scale of China's steel production, even a modest shift towards cleaner steel could significantly impact the global market.[9] Although engaging in China comes with complexities and sensitivities, funders should not be deterred by these challenges. Rather than viewing it as 'the elephant in the room', they should recognise the opportunity it presents: Even incremental progress on green steel initiatives in China can lead to transformative change with profound global implications.

Looking for funding opportunities? Explore our Climate Solutions Hub!

Link to bibliography

[6] National Institute for Environmental Studies 2023, [7] Agora Industry 2023, [8] Statista 2023, [9] Voigt et al. 2022