

Net-zero steel: Overcoming the inertia of a fragmented transition

Steel is and will remain the material backbone of the global economy and a **strategic asset**: governments across the political spectrum are competing to retain or expand steel capacity as a foundation of industrial sovereignty, supply-chain security and employment. Steel is also responsible for 7–9% of global greenhouse gas emissions, more than any other material. There is a viable path to decarbonising the iron and steel industry by mid-century. But how fast the sector can decarbonise while navigating regional demand shifts, fragmented policy and weak green demand signals, rising trade frictions, and intensifying economic security and competitiveness imperatives, matters not only for climate, but for every government and investor trying to determine which producers will remain competitive as the sector navigates the transition.

Steel-IQ, Systemiq's open-source global techno-economic model of the iron and steel sector, reveals **four forms of inertia obstructing the transition** under almost any scenario.

Investment cycles are long, and carbon emissions lock-in is being decided now. Under the business-as-usual scenario (i.e., without wide-spread carbon pricing or other policy support), Steel-IQ shows that almost 500 Mt of blast furnace ("BF") capacity remains operational in 2050. This is largely concentrated in China, with its young BF fleet, and India and Southeast Asia, where new BF investments are being made to address growing local demand. This threatens to embed high-carbon capacity well into the second half of the century.

Decoupling ironmaking from steelmaking is economically rational but politically resisted. The emergence of 'green iron' as a traded intermediate creates a viable path for high-energy-cost regions such as Europe, Japan and South Korea to remain competitive in steelmaking by sourcing iron from lower-cost renewable energy regions. But this logic runs directly into political resistance: employment is at risk, and the operating cost gap between green routes and depreciated domestic blast furnaces makes the economics of transition deeply uncomfortable for both plant owners and governments – especially without durable carbon pricing or guaranteed green demand. The result is deferred decisions and continued lock-in in those regions.

Feedstock constraints are physical, not just political. Conventional DRI-EAF routes require high-grade iron ore to operate efficiently, and that ore is physically scarce. Any strategy assuming that DRI can fully replace blast furnaces at scale without ore-flexible technologies underestimates these physical constraints. And while global scrap volumes will more than double by 2050, scrap quality may limit its use in high-specification products. Technological breakthroughs could lift both ore and scrap constraints, but most likely not at scale within the critical investment window.

OEM capacity is a binding constraint. Even where finance and policy align, execution remains at risk. Achieving a net-zero trajectory requires retrofitting roughly 100 Mt of ironmaking capacity per year during the coming two decades. The engineering queue is already forming; position in it has strategic value independent of any policy scenario.

The time for reliance on long-term targets has passed. The case for acting on feedstock security, flexible capacity and early OEM engagement does not rest on any single scenario prevailing. It rests on the recognition that the physical constraints are already here, and the window to build around them is narrowing.



Observations on the challenges of sector transition and insights from the first fully open-source global steel model: Steel-IQ
Executive summary of this insights brief is available [here](#)

Steel is the material backbone of the global economy, underpinning everything from urban infrastructure to energy, mobility, and defence. It is a strategic asset: governments across the political spectrum are vying to expand steel capacity as a foundation of industrial sovereignty, supply-chain security and employment. Steel is also responsible for 7–9% of global greenhouse gas emissions, more than any other material.

open source. Unlike proprietary "black box" forecasts, Steel-IQ offers a transparent view of how technology costs, resource constraints, policy interventions and regional demand dynamics interact over time.

Our analysis confirms that steel sector's deep decarbonisation is achievable but exposes four key forms of deep-seated inertia: long investment cycles, political resistance to decoupling of iron- and steelmaking processes, hard physical constraints on raw materials, and a bottleneck in engineering and OEM capacity. This insights brief explores what Steel-IQ reveals about these constraints, and what must change to accelerate the transition.

500Mt

of blast furnace capacity remains operational in 2050

There is a viable path to decarbonising the iron and steel industry by mid-century. But how fast can it decarbonise while navigating regional demand shifts, fragmented policy and weak green demand signals, rising trade frictions, and intensifying economic security and competitiveness imperatives? The answer remains not only for climate, but for every government and investor trying to determine which producers will remain competitive as the sector navigates the transition.

To interrogate this question, we developed Steel-IQ – a global techno-economic model of the iron and steel sector, built with granular, leading and released as

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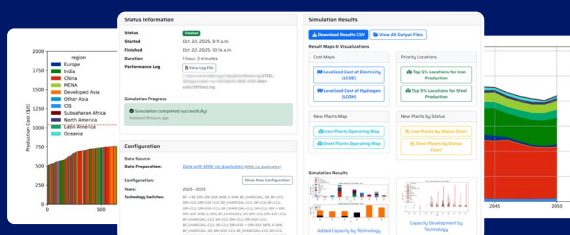


Steel-IQ adds a new benchmark in open analytics for heavy industry, enabling stakeholders to design, test, and evaluate pathways to a low-carbon, competitive global steel industry.

Explore more at www.systemiq.earth/steel-iq



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Steel-IQ is Systemiq's open-source techno-economic model of the global iron and steel sector. The new version 2.0 (released May 2026), is significantly faster and more user-friendly, while maintaining the richness, flexibility and transparency valued by users across industry, policy, finance and civil society.