



Energy
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Catalysts of change: accelerating and enabling
the steel industry transition

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Where we stand on the decarbonisation of steel in June 2024



Rarely do multiple competing production pathways co-exist at scale in heavy industries, and the expectation that H2-DRI is the solution is rising – especially in Europe. Private finance now believes in the business case.



A set of projects are proving that low-emissions steel is possible, but they require significant public support and a positive (or expectation of positive) policy and enabling environment to be 'bankable'.



Iron ore grades and scrap quality are falling. For IO, this is because the richest deposits have already been turned into iron. For scrap, downcycling of steel exacerbated by more efficient use of complex steel grades (e.g. vehicle lightweighting) means the proportion of high-grade scrap is falling.



China is about to undergo a profound structural change in its iron and steel, with falling demand and significant volumes of scrap becoming available.

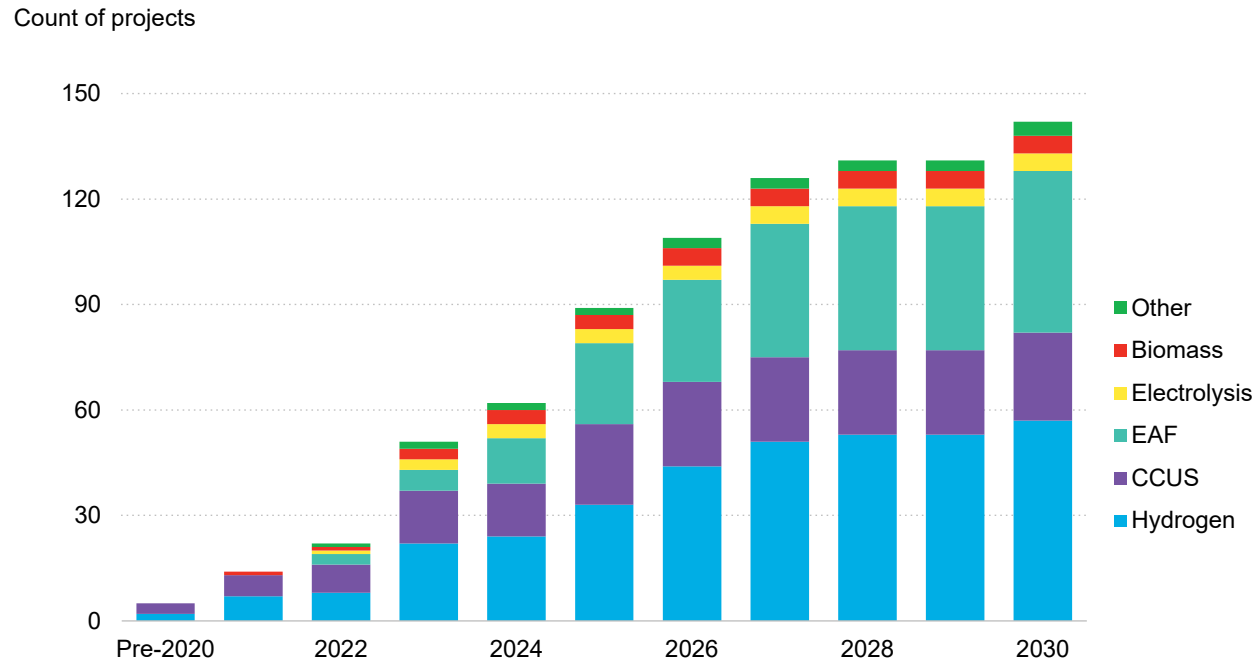


The IO status quo is not an option if carbon-neutral steelmaking is to become a reality on the prescribed timescale. Low availability of high-grade iron ores will push the costs of DR ironmaking. The jury is still out there on who will bear that cost.



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Steel decarbonization project count by technology (cumulative)



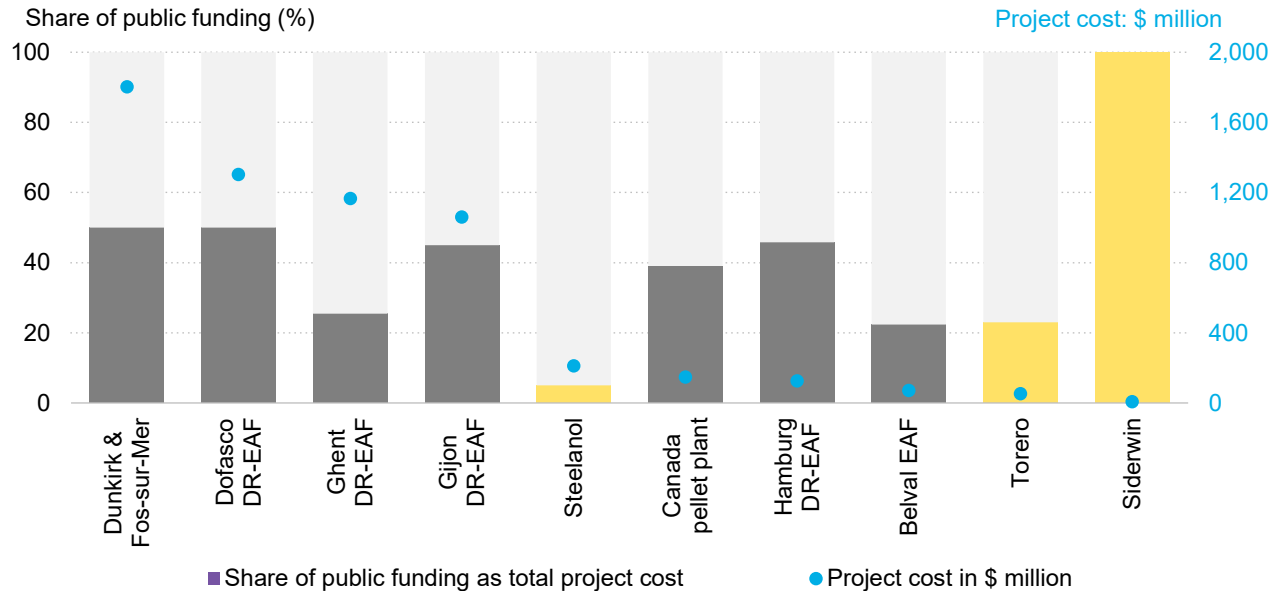
- Will 5-6 FoAK plants go on to scale in wholesale markets?
- Is pathway dependency likely?
- Where does that leave CCS and electrolysis?
- What are the implications of engineering capacity constraints?



Source: BloombergNEF 2024. Note: CCUS is carbon capture utilization and storage. EAF is electric arc furnace. Data is accurate as of November 2023.

A set of projects are proving that low-emissions steel is possible, but they require significant public support and enabling policy environment (or expectation of it) to be 'bankable'

ArcelorMittal's steel projects with disclosed government support



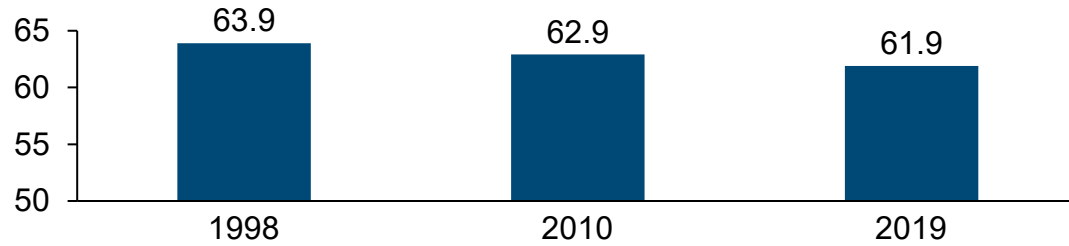
Source: Company filings, BloombergNEF 2024. Note: Purple refers to direct grants from local governments. Yellow refers to EU-level grants. BNEF estimates these to be around 50% of project cost. The Steelanol and Torero projects also received €75 million of loans from the European Investment bank. Disclosure is updated as of July 2023. DR-EAF refers to direct reduction-electric arc furnace.

- How long can (mainly) Western governments continue to provide capex (and increasingly) opex support to underpin the first projects?
- Are project delays likely as power networks struggle to meet their connection and capacity targets?
- How deep is the pool of 'green premium' demand?

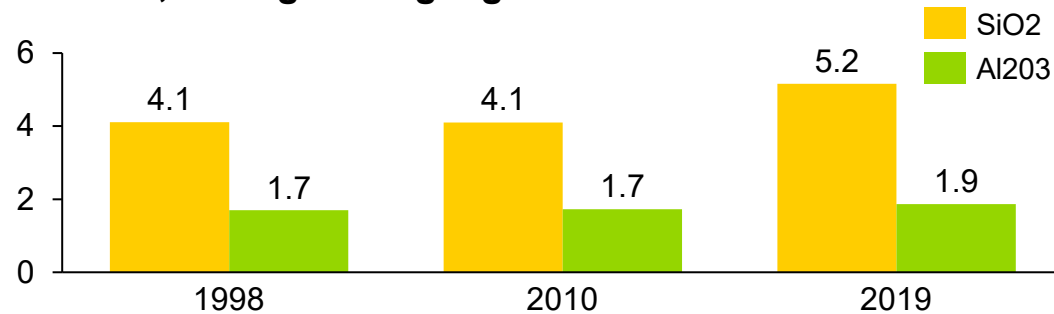


IO grades are falling and the proportion of high-grade scrap is falling as vehicle lightweighting and other innovations impact the scrap pool

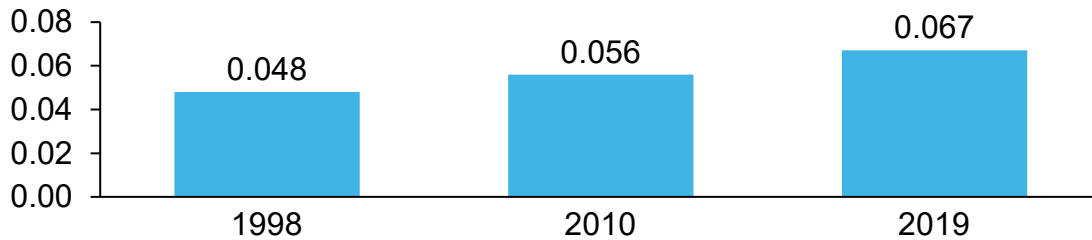
Sinter feed, average Fe %



Sinter feed, average acid gangue %



Sinter feed, average P %



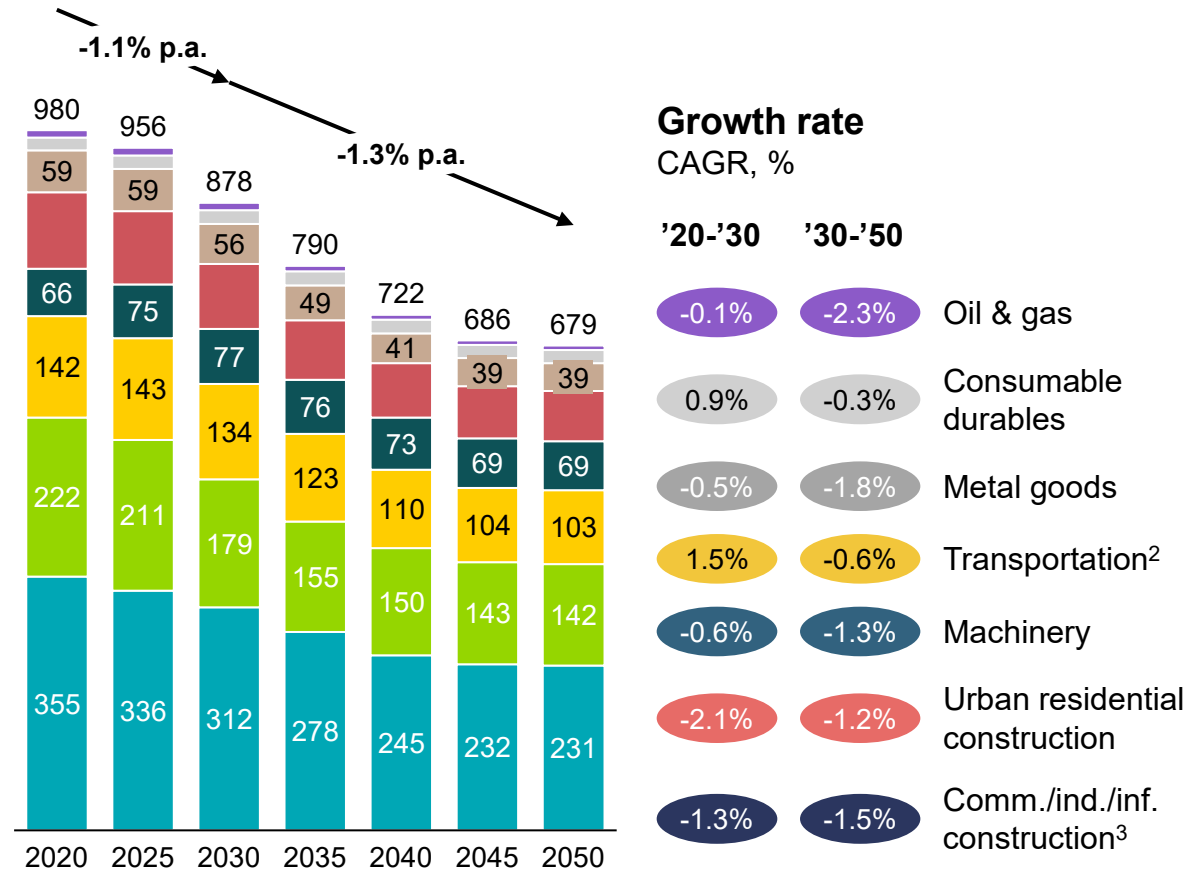
- Will beneficiation follow the furnace technologies or lead it?
- What are the long-run implications of scrap downcycling?
- Might we see consolidations of the fragmented scrap market?



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China's¹ apparent finished steel demand by sector

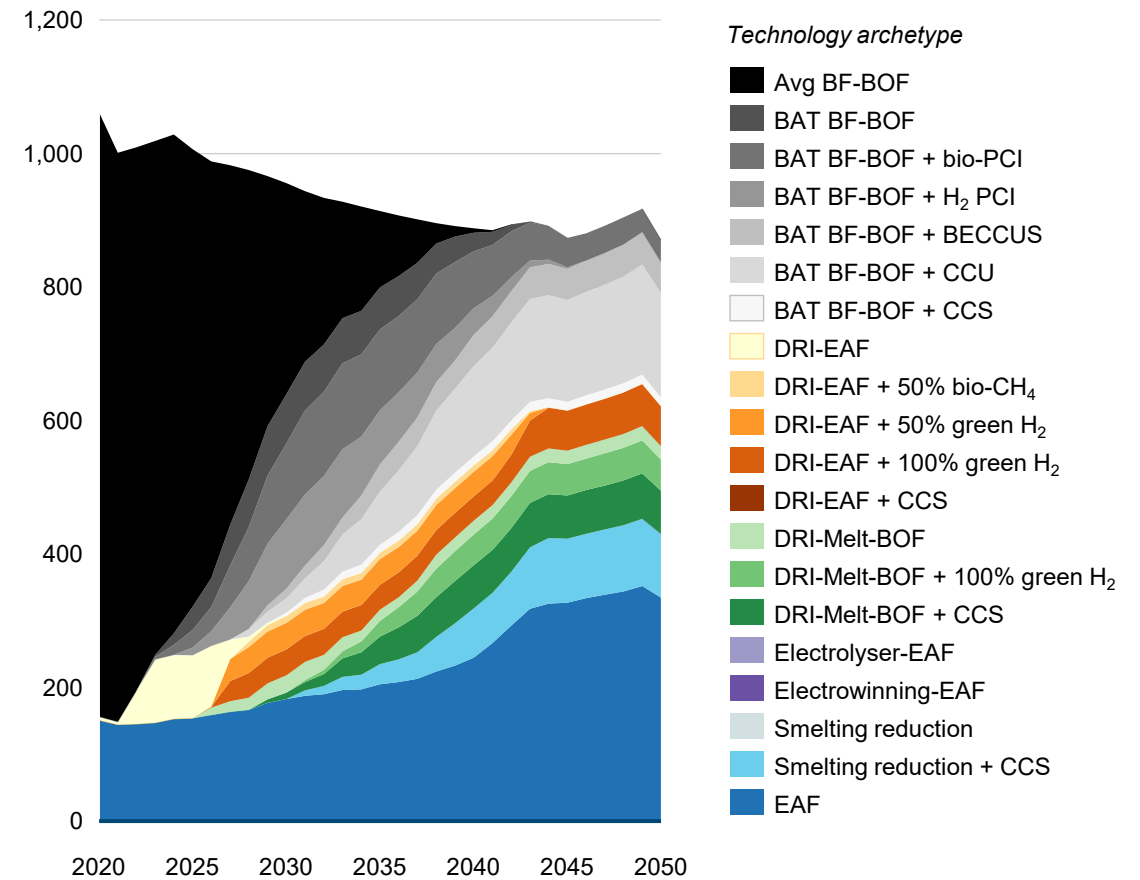
Million metric tonnes



1. Mainland China
2. Auto vehicle, shipbuilding
3. Commercial, industrial, infrastructure, and rural residential construction

China's¹ crude steel production

Million metric tonnes



Source: Systemiq modelling for the Energy Transitions Commission (2022)

Source: CISA; World Steel Association; China Steel Demand Model (2022)

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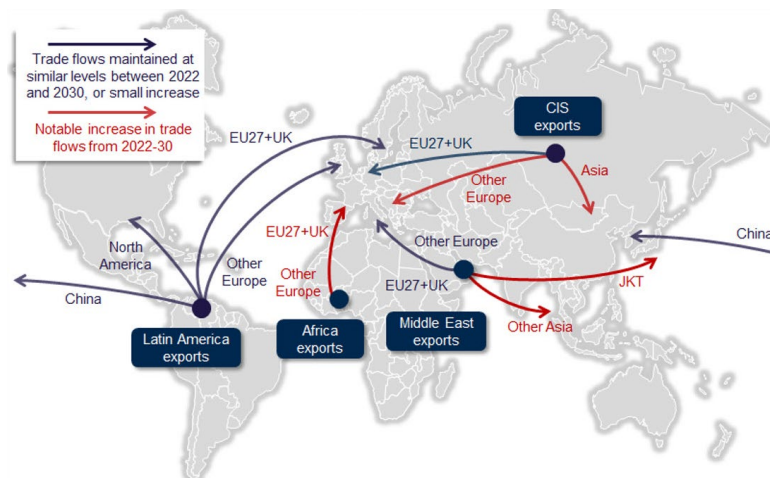
Major inter-regional DRI/HBI trade flows

2022, million metric tonnes



Major inter-regional DRI/HBI trade flows

2022-30, million metric tonnes



- Will engineers find a way around the non-DR ore conundrum?
- How might a potential breakup of the integrated iron and steel value chain play out?
- What might be the new economic development and new market entrant opportunities?

