Briefing

Sourcing iron for UK steelmaking

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green alliance…

After decades of underinvestment and decline, the UK's steel industry is now at the heart of discussions about the nation's resilience and industrial future. The government's forthcoming steel strategy presents a once in a generation opportunity to futureproof the sector, putting it on a more stable footing and ensuring it makes the products needed by the UK and to meet growing global demand for clean steel. Thousands of jobs and supply chains are reliant on the UK steel sector and a clear long term plan is essential to ensure it, and they, thrive.

The changes underway involve a shift away from ageing and polluting coal fed blast furnaces, which make primary steel from iron ore, to electric arc furnaces (EAFs). EAFs predominantly use recycled scrap steel, expected to be the main source of UK made steel in future, with some steel grades requiring virgin iron added into the mix.

In the short term, this iron could be provided through the retention of one or more of the UK's current blast furnaces, which would also allow for a more gradual workforce transition. However, this should be a temporary measure. The blast furnaces are aging and have significant direct and upstream greenhouse gas emissions.

In this briefing we explore the options available over the medium and longer term for the UK in sourcing or producing 'clean iron' for a modern UK steel industry.

We conclude that the government should be wary at this point of committing substantial investment in one form of domestic iron production for the steel industry. High operating costs are likely to leave ironmaking's long term profitability dependent on government support. Committing to pay a security premium may be unnecessary. In the medium term, the security implications of either importing iron ore for UK processing or already processed iron are unlikely to differ significantly.

What would be preferable is to diversify the iron supply chain, including exploring emerging production technologies and partnerships with other countries producing clean iron more cheaply than the UK. This would allow more UK investment in the high quality jobs and capabilities involved in downstream steel processing and scrap sorting.

Context

With the closure of Port Talbot's last blast furnace in September 2024, ahead of a transition to EAF based steelmaking, British Steel's Scunthorpe plant is now the last remaining site operating blast furnaces in the UK. With the Scunthorpe site now under control of the UK government and likely to make the transition away from blast furnaces in the coming years, there will be a substantial reduction in the greenhouse gas emissions and air pollution associated with steel production.[1] These two sites were the UK's second and fourth largest single emitters in 2023.[2]

EAFs can produce a wide range of steel products, including defence and automotive grade steels, by using high quality scrap and fresh iron where necessary.[3] Overall, the industry will be made more resilient, relying less on iron ore imports and making good use of the UK's abundant scrap steel resources.[4]

Investment in UK steelmaking is much needed. The industry has seen declining output and employment since the 1970s, leaving the UK with a much smaller steel industry than comparable economies like France, Italy and Germany. The industry's decline has continued over the past ten years, with production output halving.[5] Factors such as high UK electricity costs and the global oversupply of steel have created a difficult economic environment. President Trump's 25 per cent tariff on steel exported to the US is another potential blow, even if it affects only about four per cent of UK steel production.[6,7]

A lack of forward planning to help manage the industry and its workers has led to high job losses, affecting the communities around steelmaking sites, following the closure of the Redcar Steelworks in 2015 and 2,500 job losses at Port Talbot in 2024.[8,9] Avoiding the loss of another 2,000 to 2,700 jobs at British Steel's Scunthorpe site required emergency legislation to put the site under government control.[10,11]

However, there are opportunities to use the new steel strategy and £2.5 billion promised by the government to stabilise and potentially grow the steel sector by meeting more of the UK's steel demand domestically. An estimated £21 billion worth of steel will be needed by 2050 to support the offshore wind industry alone.[12,13] Recent announcements about increasing defence spending indicate another source of potential growth.[14]

We have previously set out the case for a phased transition to a steel industry with a larger focus on recycling in EAFs, but with inputs of 'clean iron' (see below).[15] We also set out the conditions needed to increase investment to support this transition, including addressing uncompetitive UK power prices, the prompt introduction of a carbon border adjustment mechanism (CBAM) and boosting domestic markets for clean steel, through measures such as public procurement and product standards.[16]

Although some of these steps have been taken, one major question outstanding is how to source the iron to support the UK's new EAF production facilities.

The world is moving towards 'clean iron'

EAFs can make most steel grades by recycling scrap steel, but contaminants like copper generally mean that some fresh iron input is also needed for applications like automotive sheet steels and some packaging materials. This could be sourced from blast furnaces in the short term, but a net zero compatible steel sector will need this iron also to be 'clean', ie to have a low carbon footprint.

Making direct reduced iron (DRI) is a process that typically involves the use of natural gas to remove oxygen from iron ore. But natural gas can be replaced with green hydrogen, made using renewable electricity, to make 'green DRI'. This is the strongest candidate for making clean iron. Other methods, like electrolysis (see annex for details), might become available over time and better separation and sorting of scrap could reduce the amount of iron needed.

Some countries in Europe plan to start building DRI facilities. Sweden, Germany, Spain and Portugal all have projects at various stages of planning and development. Most started with ambitious plans to use green hydrogen with large government subsidies, but many projects have dialled back on these plans as hydrogen supplies are likely to be more expensive than originally expected.[17] Some operators have paused their plans, but most have opted to use a 'natural gas first, green hydrogen later' approach. Plants can be compatible with either fuel and can transition once the price of green hydrogen is more reasonable.

There is potential for a global trade in green DRI, via so-called 'green iron corridors'.[18] As ironmaking is a highly energy intensive process, production is expected to be drawn to areas with both iron ore and cheap, abundant renewable energy resources. It can then be shipped long distances in a more compact form called 'hot briquetted iron'.

Green hydrogen DRI is already underway in Sweden on a small scale, and it is planned in Canada, Brazil, Australia and countries across Africa, many of which are already iron ore exporters. Germany has been one of the first movers in this space, forming a partnership with Namibia and directly investing in the first green iron works in Africa.[19]

Should the UK produce or import its iron?

It is a critical time for the steel sector. The future of the Scunthorpe steel plant needs to be decided soon and the government's steel strategy is expected imminently, including a decision on how to spend the £2.5 billion it has committed in support.[20] Primary steel is central to this conversation and the Materials Processing Institute is conducting an independent review for the government into its production.

Our assumptions, based on our previous research, are that the UK's steel industry will need somewhere between 1.2 and 1.6 million tonnes (Mt) of iron a year, with the higher estimate reflecting significant sector growth.[21]

Supporters of domestic DRI production say it will provide UK jobs and offer the secure iron supply needed by the steel industry. But what will the trade offs be? Should the UK develop a domestic industry, or look to the fledgling global trade in green DRI for its supply?

Cost implications

Most dedicated DRI plants being built in Europe have a capacity of around 2.5Mt at an average cost of £1.2 billion.[22] A smaller facility to match UK needs is likely to be cheaper than this.

Given uncertainties over future operating costs we make two comparisons here.[23] In the most optimistic case for domestic production costs, importing green hydrogen-based DRI will be approximately 24 per cent cheaper than similar domestic production in 2035. Equivalent to a difference of about £160 million a year for the iron the UK needs. The more realistic estimate puts imports 36 per cent cheaper, equivalent to about £280 million a year.

Operating costs are highly dependent on the fuel used: green hydrogen, natural gas or a combination of the two. Green hydrogen, made using renewable electricity, is the lowest emission option and is likely to be the ultimate choice for a net zero compatible ironmaking process. However, its production is very energy intensive. Domestically producing hydrogen to meet the UK's iron needs would require about 4.3TWh of electricity annually, more than that used to power Birmingham.

High electricity costs in the UK also makes hydrogen production expensive. £9.50 per kg was the price reached in the UK's first green hydrogen funding round.[24] Previously, we have estimated that production costs will come down to £3-5 per kg by 2035.[25] But this still does not compare well with the forecast for places abundant in renewables, which could be as low as £1.50 per kg, meaning a cheaper ironmaking process.[26]

A UK DRI plant would be likely to take the 'natural gas first, green hydrogen later' approach of most EU projects. However, in 2035, based on current natural gas prices, domestic production using natural gas could be the same cost as importing green DRI, even without carbon prices. A transition to domestic green DRI is likely to rely on heavy government subsidy to compete with imports.[27]

Sources of emissions

An EAF running on green electricity and using DRI made using natural gas reduces the carbon emissions associated with steelmaking by approximately half, compared to traditional blast furnace production.[28] However, EAF steelmaking using clean electricity and DRI made with green hydrogen could reduce emissions by up to 95 per cent.[29]

Transportation emissions are quite low, even over large distances. Compared to blast furnace production, the ocean freight of DRI would be responsible for less than one per cent of steel's carbon footprint.[30] Importing DRI is likely to have lower transport emissions than domestic production as DRI weighs about 40 per cent less than the ore needed to make it.[31]

Security of supply

Iron ore imported into the UK comes from all over the world, with Canada and Brazil supplying about half. The likely big players in green DRI exports will tend to be those countries with both available iron ore and cheap, abundant renewable energy. There will be a large crossover with current iron ore exporting countries. Canada, Brazil, Australia and countries across Africa are already planning for these opportunities.

In the early development stages of the global green DRI trade there will be fewer suppliers, meaning less redundancy of supply. But, over time, it is likely there will be little difference in how secure supplies of iron ore and green DRI are.

The best security option is to go for diversity. Being able both to produce clean iron domestically and import it from reliable partners offers a flexibility which becomes more important should national resilience become stretched amid growing global tensions.

Where will the jobs be?

A UK based DRI facility might not provide a high number of jobs. Europe's DRI facilities are not yet fully operational. However, as an example, a natural gas DRI plant in Ohio in the US with 1.6Mt capacity has just 140 employees.[32]

There is far more potential for good quality employment in steel processing. In Germany, which has a larger domestic steel industry, employment data shows that ironmaking accounts for only four per cent of the jobs in the steel industry, 11 per cent are in steelmaking and 85 per cent are in steel processing.[33]

Investing in steel processing would boost UK employment, creating skilled jobs and capture more of the estimated £21 billion market in steel that the UK's offshore wind sector is expected to create by 2050.[34] Modernisation and expansion of the Dalzell steel plate mill in Scotland would be one option for potential growth, but the location of existing steel workers in Port Talbot and Scunthorpe should be a major factor in decision making.

Conclusion

Deciding on the future of iron sourcing for the UK's steel industry means weighing up complex factors.

Building a large scale UK natural gas DRI facility, to be transitioned to green hydrogen power over time, would provide a small number of jobs and offer a source of secure iron supply. However, the move to green hydrogen is likely to come at a heavy premium. Scarcity and the high cost of hydrogen will mean relying on long term subsidy to keep operations running. There is also a question as to whether DRI will end up being the best way of making green iron.

Importing green DRI to meet some or all of the UK's iron needs may be more cost efficient and flexible, and it would contribute to a more competitive UK steel sector. More funds could then be channelled into expanding the UK's steel processing and scrap sorting facilities, capturing more of the value of the UK's green economy which is dependent on steel.

When considering the options around iron sourcing and the creation of new UK steel industry jobs, the government should:

- form partnerships with green iron exporters, such as Canada, Brazil and South Africa; this could be either directly or through wider trade agreements;
- create an innovation fund to support one or more small volume test plants to produce iron, developing expertise and keeping the UK's

options open for more substantial domestic ironmaking; this could include a DRI facility or more speculative options like electrolysis (see annex for details);

- channel investment into steel processing and scrap sorting in the UK to fill gaps in capability, provide more highly skilled jobs in the sector and capture more value from the green transition, for instance by modernising and expanding Dalzell steel plate mill and creating new facilities in Port Talbot and Scunthorpe;
- create new markets for clean steel produced in the UK to help overcome global competition, including through public procurement and product standards;
- make investments from the £2.5 billion allocated to the steel industry conditional on a just transition involving workers in decisions and net zero aligned plans;
- continue to investigate all available options to address uncompetitive industrial power prices.

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Annex

Making iron using electrolysis

As we have discussed, green DRI is the most established low carbon method of iron production. However, electrolysis is a very promising method being explored, with small scale production showing higher energy efficiency and compatibility with using lower grade iron ore, which is cheaper and more abundant.[35]

Electrolysis is already established as a method to produce other metals, including lithium, aluminium and magnesium. Instead of using a chemical process to remove oxygen from ore, electrolysis applies electricity directly to liquid metal.

For ironmaking, the two main electrolysis methods used differ in the type of liquid used, either a water-based iron ore suspension (electrowinning or electroextraction) or a hot, molten iron ore (molten oxide electrolysis, known as MOE).

The high efficiency and low temperature needs of the water-based method make it particularly attractive option. It also can also operate intermittently, making it very compatible with renewable power.

The crux for both methods, however, is production at scale. The companies ArcelorMittal and John Cockerill have announced plans for the first industrial scale water-based iron electrolysis plant. To be built in Belgium, the first phase aims to produce between 40,000 and 80,000 tonnes of iron a year by 2027 (about three to six per cent of the UK's iron needs), eventually ramping up to 300,000 to one million tonnes (20 – 70 per cent of UK needs).[36]

Boston Metals are leaders in MOE ironmaking, aiming to reach commercialisation in 2026. The business has attracted high profile investors since its formation in 2013, although production is at a small scale. Its demonstrator plant produces only a few tonnes a month, though a larger demonstrator is in the pipeline for 2026-27.[37]

Endnotes

[1] British Steel, 27 March 2025, 'British steel to consult on proposed closure of Scunthorpe blast furnaces, rod mill and steelmaking operation'
[2] F Mayo, 2024, 'The largest emitters in the UK: annual review', Ember
[3] UK Steel, 2024, 'Electric arc furnaces and product ranges'
[4] V Viisaisen et al, 2022, *Building the future: a faster route to clean steel*, Green Alliance
[5] UK Steel, 2024, 'UK steel key statistics 2024'
[6] UK Steel, March 2025, 'Trump orders 25% tariffs on UK steel imports to the US, without exemption'
[7] The UK exported an average of 200kt in 2022 and 2023, 3.5 per cent of the average annual production of 5.8Mt over this period. See: UK Steel, March 2025, op cit; and World Steel Association, March 2025, 'Total production of crude steel'
[8] W Carr, 2024, *Ensuring fairness in the net zero transition*, Green Alliance
[9] J Simpson, 11 September 2024, 'Blow for British steel industry as 2,500 jobs go at Port Talbot', *The Guardian*
[10] J Kollewe, 27 March 2025, 'British steel plans to close Scunthorpe blast furnaces with 2,700 jobs at risk', *The Guardian*
[11] J Meierhands, 15 April 2025, 'Why did the government take control of British Steel?', BBC
[12] Community Trade Union, 2025, *Steel reforged*
[13] M Smith and G Gibbard, 2024, 'Bill of works: a review of UK offshore wind steel requirements', LumenEE
[14] House of Commons Library, 26 March 2025, 'UK to spend 2.5% of gross domestic product on defence by 2027', parliament.uk
[15] V Viisaisen et al, 2022, *Building the future: a faster route to clean steel*, Green Alliance
[16] V Viisainen, 2023, op cit
[17] R Parkes, 2024, 'Green hydrogen is too expensive to use in our European steel mills, even though we've secured billions in subsidies', *Hydrogen Insight*
[18] Rocky Mountain Institute, 2024, *Green iron corridors: transforming the steel supply chains for a sustainable future*
[19] German Federal Ministry for Economic Affairs and Climate Action, 6 November 2023, 'Commencement of construction of the first green iron plant in Africa', bmwk.de
[20] Department for Business and Trade, February 2024, 'The steel strategy: the plan for steel'
[21] The estimate is based on our previous calculations that the equivalent of about 21 per cent of steel production will be needed in primary iron, see the methodology of the report: V Viisainen, 2023, op cit, for more details. Applied to the UK's 2024 annual output of 5.6Mt this results in 1.2Mt of primary iron. Applied to the UK's 2024 steel demand of 7.6Mt results in 1.6Mt. See: UK Steel, 2024, op cit
[22] Estimated from four planned DRI sites with 2.5-2.7Mt capacity, in Dunkirk (€1.8 billion), Gent (€1.1 billion), Gallivare ($1.85 billion) and Ohio ($1.3 billion)

[23] Based on estimates made in: S Bilici et al, 2024, 'Global trade of green iron as a game changer for a near-zero global steel industry? – A scenario-based assessment of regionalized impacts', *Energy and Climate Change*, adjusted for different hydrogen prices. Green hydrogen prices in 2035 have been estimated to be £1.57 per kg for DRI exporting countries and £3 (production using majority curtailed electricity) or £4.50 (production co-located with renewables) for the UK in the optimistic and realistic cases (see endnotes 27 and 26). Note that these hydrogen costs do not include transport or storage costs. A transportation cost of £8 per tonne of DRI was included. This calculation does not include extra energy requirements of further processing for transportation, estimated at 12kWh per tonne, and an energy penalty from the cooling of the DRI and then reheating in the steel production process, estimated at 120-140kWh per tonne. However, the latter penalty would also occur if domestic production was not paired geographically with steel production.
[24] Department for Energy Security and Net Zero (DESNZ), 14 December 2023, 'Hydrogen production business model / net zero hydrogen fund: HAR1 successful projects'; £241 per MWh converted to £9.50 per MWh using the higher heating value of hydrogen of 39.4kWh per kg.
[25] W Carr, L Hardy, S Coulter and R Bullied, 2025, *UK energy security: the benefits of diversification*, Green Alliance. In this report a range of £4-6 per kg represented three green hydrogen production methods: using majority curtailed electricity at £4, co-located with renewable energy at £4.50 and grid-based electricity at £6. These have been adjusted here to include the British Energy Supercharger which reduces system charges contained in electricity prices by approximately £25 per MWh. This reduces the curtailed electricity and grid-based electricity options to £3 and £5 respectively, while not affecting co-location with renewables at £4.50.
[26] International Energy Agency (IEA), 2024, *Global hydrogen review 2024*. This review's forecasts show hydrogen production could reach $2 (£1.57) per kg by 2030 in certain locations. We have estimated a £1.50 price would be more widespread by 2035.
[27] This assumes a per tonne of DRI need of 2.5 gigacalories (Gcal) of natural gas at the average UK 2024 price of £37.50 per Gcal, or 58kg of hydrogen. This results in a £1.62 per kg hydrogen price for cost parity.
[28] G Zang et al, 2023, 'Cost and lifecycle analysis for deep CO2 emissions reduction for steel making: direct reduced iron technologies', *Steel research international*. This assumes a 75 per cent DRI mix.
[29] Deep decarbonisation of up to 95 per cent will require the change of using natural gas in the pelletisation process which can be replaced with green hydrogen, as well as reducing the emissions involved in the mining of iron ore.
[30] Estimate based on a typical 5,740 nautical mile ocean freight route from Brazil to the UK with emissions of 2.5gCO_2 per dead weight tonnage per nautical mile. For a 40 per cent DRI mix this results in 6.5kg CO_2 per tonne of steel. This is 0.33 per cent of the typical blast furnace emissions per tonne of steel, 1,990 kg CO_2. J Boekhoff, November 2022, 'Understanding your shipping emissions', Carbon Chain; and G Zang et al, 2020, op cit
[31] 1,360kg of iron ore is needed to make 848kg of DRI, the quantity of DRI necessary for a tonne of steel using a 75 per cent DRI mix. Transport emissions typically scale by distance travelled and transported mass. If DRI or iron ore are sourced from the

same location, importing DRI is likely to have lower transport emissions than domestic production, having a 38 per cent lower mass than the equivalent ore. G Zang et al, 2023, op cit

[32] Cliffs, 2025, 'Producing high quality HBI in Toledo', clevelandcliffs.com

[33] WV Stahl, 2021, *Employment in the steel industry*

[34] M Smith and G Gibbard, 2024, op cit

[35] K Rippy, R Bell and N Leick, 2024, 'Chemical and electrochemical pathways to low-carbon iron and steel', *Nature partner journals - materials sustainability*

[36] ArcelorMittal, 2023, 'ArcelorMittal and John Cockerill announce plans to develop world's first industrial scale low temperature, iron electrolysis plant', corporate.arcelormittal.com. The calculation is based on a UK need of 1.4Mt of iron.

[37] C Crownhart, 2025, 'This start up just hit a big milestone for green steel production', *MIT Technology Review*