Energy&Climate Intelligence Unit

Stuck on the starting line

How the UK is falling behind Europe in the race to clean steel

May 2021

Executive Summary

The future of steel production is low carbon and there is a global race underway to get there.

Nowhere is this transition more acute than in Europe, where many nation's steel industries having shrunk significantly in recent decades under pressure from imports from Asia and oversupplied markets.

Hydrogen-based steel production, the likely long-term low carbon successor to using coking coal, is already blossoming in numerous European countries. This report finds that there are 23 projects either planned or underway across the continent spreading from France to Romania and Sweden to Italy.

In the UK, for comparison, there are no concrete plans for using hydrogen to produce primary steel, and only vague plans for one carbon capture-based project.

There are a number of reasons behind this occurrence, most notably different policy environments and support for both steel decarbonisation and clean hydrogen production. Germany's hydrogen strategy, for example, brought about rapid investment decisions from industry giants Thyssenkrupp and RWE.

In the UK, the £250 million Clean Steel Fund was launched in 2019, aiming to decarbonise the sector, yet current plans are that this money will not be available until 2023. Delays to the government's Hydrogen Strategy are also not helping.

Steel production is not just important for the UK nationally, but also provides a foundation for a number of local employment markets – particularly in South Wales and the North East where integrated steelworks are located. A lack of foresight and ambition to upgrade these industries for a low-carbon future could be particularly damaging to these areas.

The issue of decarbonising steel is particularly pressing in the UK, with a domestic steel sector struggling to attract investment and uncertain of its long-term survival. This danger is further manifested in a lack of plans for clean steel projects which, as this report finds, are surging in number in Europe instead.

Growing momentum for corporate and national-level net zero targets brings an opportunity to reboot a struggling sector, providing low-carbon steel for manufacturing and infrastructure, thereby locking in long-term, high-skilled and secure industrial jobs for decades.

The UK government has stressed the strategic importance of a domestic steel industry and therefore the findings in this report are particularly stark. By the time the UK develops a clean steel industry, on current plans, the European steel sector is likely to be even further ahead.

Introduction

> *"Lack of investment in the UK steel sector has meant that UK steel companies have fallen behind their international counterparts"* – UK Government[1]

The UK has a proud steelmaking history, with production dating back over 200 years. Despite a fall in both output and in the number of integrated production sites over recent decades, making primary steel remains a strategically important sector for the UK economy.[1]

The UK government has stated its aims to refresh national infrastructure, a goal that will require millions of tonnes of steel and other raw materials.[2] Railways, wind turbines and nuclear power stations, among many others, all require vast quantities of high-quality steel.[3] Despite the UK's longstanding steel industry, recent governments have faced criticism for relying on steel sourced from overseas for new projects.[4]

The steel industry is also a vital source of employment, providing direct jobs for more than 33,700 workers. This number more than doubles when employment in supply chains is included.[5] Steelworks support a large proportion of jobs in areas in which they are located. Port Talbot provides 12.9% of all employment in Aberavon, with British Steel accounting for 7.2% of jobs in Scunthorpe.[6]

Steel sector jobs are well paid, especially in relation to regions in which they are located. In 2020 the average steel worker salary was £34,000 per year, almost 50% more than average salaries in Wales and Yorkshire and the Humber (both areas hosting integrated steelworks) and 33% above the national average.[7]

The UK steel sector contributes £2.1 billion per year (GVA) towards the UK economy, a figure that jumps to £4.8bn when supply chains are included. The sector directly contributed £1.7 billion to the UK's balance of trade in 2020.[8] In addition to pressure from global supply chains, the UK industry is also impacted by Brexit and Covid-19, with exports to Europe down by a third in the first quarter of 2021.

Current methods of primary steel production in the UK are highly carbon intensive. Steel is the UK's largest industrial emitter and will need to be decarbonised within 15 years in order for the UK to achieve its net zero emissions target, Climate Change Committee modelling shows.[9,10]

The UK's two remaining integrated steelworks, TATA in Port Talbot and British Steel in Scunthorpe, make up more than a sixth of total industrial emissions and 95% of emissions from the domestic iron

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1 https://publications.parliament.uk/pa/cm201516/cmselect/cmbis/546/54607.htm
2 https://www.gov.uk/government/news/pm-a-new-deal-for-britain
3 https://britishsteel.co.uk/who-we-are/uk-steel-charter/
4 https://www.theguardian.com/business/2021/mar/30/infrastructure-projects-should-use-more-uk-steel-says-trade-body
5 https://www.makeuk.org/insights/publications/uk-steel-key-statistics-guide-2021
6 https://www.ukonward.com/greeningthegiants/
7 https://www.makeuk.org/insights/publications/uk-steel-key-statistics-guide-2021
8 https://www.makeuk.org/insights/publications/uk-steel-key-statistics-guide-2021
9 https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2020
10 https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

and steel sector. Decarbonising these sources of industrial emissions is vital for the UK to achieve its net zero emissions goal.[11] More than 80% of UK-produced steel is made in blast furnaces at Scunthorpe and Port Talbot, with just 17% produced from scrap steel via electric arc furnaces (EAFs).[12]

The necessity to decarbonise the steel sector comes at a challenging time for the global industry. Since 2013 international markets have suffered from systemic oversupply, exacerbated by a dip in demand at the same time as subsidised mills produced ever-greater quantities of virgin metal.[13] Both of these phenomena are particularly centred on China, itself responsible for 53% (1053 Mt) of global steel production, as well as being the largest national consumer of steel.[14]

To meet the government's 2030 emissions target, a 68% drop on 1990 levels, steel sector emissions will need to fall by 23% on 2020 levels, the Climate Change Committee advises.[15] The recently accepted Sixth Carbon Budget, writing into law a drop in emissions of 78% on 1990 levels by 2035, is based on all ore-based steelmaking (primary steel production) being near-zero emissions in the 2030s.[16]

Blast furnace steel production was pioneered in the 1950s and has improved greatly in efficiency since – 21st century steel production is 45% less energy-intensive than it was in the 1970s.[17] Blast furnaces, however, have largely reached their efficiency limits with further improvements unable to significantly cut the energy intensity of primary steel production.

At the same time, they utilise coking coal as a reducing agent (a substance that removes oxygen from iron ore) and operate at very high temperatures; two discrete challenges that will need to be addressed as the sector decarbonises.

The UK does produce some secondary steel, currently around 1.6 million tonnes per year, recycled from scrap via four electric arc furnaces located across the country.[18] If powered by low-carbon electricity, EAF steel production can be very close to zero carbon, and therefore compatible with national zero emissions goals.[19]

Although decarbonising rapidly and largely free of electricity from coal, the GB power generation mix still contains a large amount of natural gas. As such, the carbon intensity of a tonne of secondary steel can range from 280-750 kgCO_2 per tonne.[20] This is significantly lower than the c.2 tonnes CO_2/tonne steel produced in blast furnaces.

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[11] https://www.gov.uk/government/consultations/creating-a-clean-steel-fund-call-for-evidence
[12] https://www.theccc.org.uk/wp-content/uploads/2017/04/Steel-competitiveness-impacts-Cambridge-Econometrics-March-2017.pdf
[13] https://www.mckinsey.com/~/media/McKinsey/Industries/Metals%20and%20Mining/Our%20Insights/The%20current%20capacity%20shake%20up%20in%20steel%20and%20how%20the%20industry%20is%20adapting/The-current-capacity-shake-up-in-steel-and-how-the-industry-is-adapting.ashx
[14] https://www.worldsteel.org/media-centre/press-releases/2021/Global-crude-steel-output-decreases-by-0.9--in-2020.html#:~:text=Global%20crude%20steel%20production%20reached,by%200.9%25%20compared%20to%202019.&text=Asia%20produced%201%2C374.9%20Mt%20of,up%20by%205.2%25%20on%202019.
[15] https://www.theccc.org.uk/wp-content/uploads/2020/07/UK-Steel-response-The-Sixth-Carbon-Budget-and-Welsh-emissions-targets-Call-for-Evidence.pdf
[16] https://www.theccc.org.uk/publication/sixth-carbon-budget/
[17] https://www.makeuk.org/insights/publications/value-of-the-uk-steel-industry
[18] https://www.makeuk.org/insights/publications/value-of-the-uk-steel-industry
[19] https://www.mckinsey.com/~/media/McKinsey/Industries/Metals%20and%20Mining/Our%20Insights/Decarbonization%20challenge%20for%20steel/Decarbonization-challenge-for-steel.pdf
[20] https://www.mpiuk.com/downloads/industry-papers/SI-Series-Paper-05-Decarbonisation-of-the-Steel-Industry-in-the-UK.pdf

Not all grades of steel, however, can be produced by electric arc furnaces, and the presence of contaminants in scrap feedstocks can alter physical properties of secondary steel thereby rendering it unsuitable for some applications.[21] As such, to avoid relying entirely on imported steel, the UK government is looking to preserve its primary steelmaking facilities.[22]

Decarbonising primary steel production can be achieved by installing carbon capture facilities onto existing plans, or by switching fuels and feedstocks to low carbon alternatives. It is becoming increasingly accepted that the latter route, specifically switching to hydrogen-based production, will be the main means of decarbonising steel.[23]

Primary steel production can be decarbonised by using hydrogen in two ways, by injecting hydrogen as a reductant into existing blast furnaces or by directly reducing iron ore to form sponge iron, that can then be converted into steel.[24]

Changing reducing agent alters the thermodynamics of the reaction, with the use of hydrogen instigating a reaction that absorbs energy (endothermic) rather than one that releases energy (exothermic) when coking coal is utilised.[25] This change of chemistry leads to vastly different conditions inside the blast furnaces, with more energy needed to drive forward the hydrogen-based reaction and potentially higher reaction temperatures as a result. As such, it can have a damaging effect on the inside layer of the blast furnace and shorten furnace lifetimes. Direct injection of hydrogen into blast furnaces is therefore seen as a transition towards decarbonised steel via direct reduction of iron (DRI).

Switching to the use of DRI as an already-reduced feedstock negates the need for the reduction reaction to take place in a blast furnace. DRI, also known as sponge iron, can be used in a range of steel production facilities, including in electric arc furnaces, offering greater flexibility than traditional integrated steelworks.[26]

Modernising primary steel production to utilise clean fuels, reagents and production methods will be a major trend over coming decades.[27] Steel industry investment cycles are very long – a blast furnace can operate for 30 years – therefore timing is hugely important. Aligning investment with natural cycles can significantly reduce the risk of technology lock-in or higher costs.

A head start on competition could be the difference between a UK steel industry that thrives, or one that continues along the current trend of long-term decline. Without intervention from government, this transition is unlikely to take place, either in the UK or in other countries.

This report will examine efforts being made to decarbonise the UK steel sector and compare them to those across Europe, providing a ‘snapshot’ of current progress and assessing likely future trajectories for a crucial British industry.

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21 https://www.televisory.com/blogs/-/blogs/steel-scrap-contamination-affecting-steel-recycling
22 https://www.gov.uk/government/consultations/creating-a-clean-steel-fund-call-for-evidence
23 https://greenallianceblog.org.uk/2021/02/09/why-europe-doesnt-need-cumbrias-coking-coal/
24 https://bellona.org/news/climate-change/2021-03-hydrogen-in-steel-production-what-is-happening-in-europe-part-one
25 https://www.jstage.jst.go.jp/article/isijinternational/52/8/52_1523/_pdf
26 https://www.mpiuk.com/downloads/industry-papers/SI-Series-Paper-05-Decarbonisation-of-the-Steel-Industry-in-the-UK.pdf
27 https://www.ft.com/content/46d4727c-761d-43ee-8084-ee46edba491a

Clean steel in the UK

> *"Decarbonising these two blast furnace sites and the wider steel sector will be essential to the decarbonisation story of UK industry"* – UK Government

In recent years, the reduction in UK steel sector emissions has been a result of an industrial base that has declined in size, rather than a concerted effort to refresh and modernise outdated and polluting equipment. To cut current levels of emissions in line with CCC advice (23% by 2030) and ensuring that the industry thrives for decades to come, it is increasingly clear that a change in approach is needed.

The government's Industrial Decarbonisation Strategy, released in March 2021, contains references to modelled pathways in which the steel sector is 'virtually decarbonised' by 2035. It also contains a pledge to 'consider implications of the recommendation of the climate change committee to "set targets for ore-based steelmaking to reach near-zero emissions by 2035" and to work towards a business environment necessary to support this transition'.[28]

On actionable policies and pledges, though, the Strategy falls somewhat short.[29]

The main framework to support steel decarbonisation in the UK remains the Clean Steel Fund, introduced in 2019 with £250m of government spend to support new technologies and processes.[30] The Fund has three priority areas: switching to lower carbon fuels, carbon capture, usage and storage (CCUS), and energy and material efficiency.

On current plans, the Clean Steel Fund will not begin to allocate spending until 2023. This seems to be due to uncertainties on the best way to decarbonise, highlighted by industry groups in response to a recent call for evidence.[31]

Of the three options, it is switching to cleaner fuels that likely holds the most promise in decarbonising steel production. Efficiency upgrades alone will not be sufficient to put the sector on a trajectory towards net zero if fossil fuels are still used, while CCUS has been identified as a potential risk of 'technology lock in', tying British industry to a route that may not be the optimal means of decarbonising and likely to differ from that chosen elsewhere.[32]

The UK's Materials Processing Institute (MPI) has identified a switch to hydrogen as the best route for cleaning up UK steel, specifically the use of hydrogen DRI technology which it says is "the most adapted solution for the UK industry".[33]

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28 https://www.gov.uk/government/publications/industrial-decarbonisation-strategy
29 https://eciu.net/blog/2021/industrial-decarbonisation-strategy-not-quite-firing-on-all-cylinders
30 https://www.gov.uk/government/consultations/creating-a-clean-steel-fund-call-for-evidence
31 https://www.gov.uk/government/consultations/creating-a-clean-steel-fund-call-for-evidence
32 https://www.mpiuk.com/downloads/industry-papers/SI-Series-Paper-05-Decarbonisation-of-the-Steel-Industry-in-the-UK.pdf
33 https://www.mpiuk.com/downloads/industry-papers/SI-Series-Paper-05-Decarbonisation-of-the-Steel-Industry-in-the-UK.pdf

In its 2021 report, the MPI highlighted that DRI is associated with limited technological risk compared with CCS, and that could have an immediate impact on UK industrial CO_2 emissions.[34] It is also described as being particularly suited to smooth transitions to clean production at both Port Talbot and Scunthorpe, allowing the domestic steel sector to maintain its current full range of steel production.

In its Ten Point Plan for a Green Industrial Revolution, the UK government announced a target of 5 GW of hydrogen production capacity by 2030.[35] This commitment also ties in with the MPI recommendation to back a hydrogen-based route to clean steel. The UK's vast renewable energy potential – largely a result of geography that results in windy conditions and shallow seas that are highly suited to offshore wind – places it is in excellent position to advance the 'green' hydrogen production that is vital for DRI steel to be truly low carbon.

However, the hydrogen-DRI process is highly energy intensive. Using this method to produce the c.6 million tonnes of primary steel produced per year in the UK would correspond to an additional annual electricity demand of around 20 terawatt hours (TWh). While the costs of renewable energy, and the technologies needed to 'firm' variable renewable output continue to plummet, this is still a sizeable energy demand (equivalent to the output of approximately 4 GW of new offshore wind capacity) and would need to be accounted for in future renewable procurement rounds, potentially starting with the 2021 contracts for difference auctions.[36]

The UK steel industry has identified a number of barriers, which it says are holding back the development of clean steel technologies.[37]

The poor health of the sector, itself a result of decades of underinvestment, means that plant owners have very low appetites for investments beyond essential repairs and maintenance.

The 'chicken and egg' situation with hydrogen production, in which it is risky to build either a consumer or producer of hydrogen in isolation, was identified in responses to a government call for evidence on the future of the steel industry.[38] This argument was made before the recent announcement of the 5 GW production goal and ahead of the incoming Hydrogen Strategy, however, so investors are likely to have greater confidence in supply than previously.

Also highlighted as a blockage to investment was an 'unsupportive policy environment'.[39] Without promotion of specific technological pathways and sectoral emissions targets, as well as increased certainty around project economics, it seems unlikely that significant private sector investment in clean steel production will be forthcoming.

Industry respondents also pointed to relatively high energy costs for heavy industry in the UK, compared with those in Europe and further afield. The UK was slow to insulate industry from policy costs associated with environmental and social policies compared to Germany, for example, although a proliferation of low-cost renewable energy and the opening of new markets such as

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[34] https://www.mpiuk.com/downloads/industry-papers/SI-Series-Paper-05-Decarbonisation-of-the-Steel-Industry-in-the-UK.pdf
[35] https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution
[36] Based on government expectations of offshore wind load factors
[37] https://www.gov.uk/government/consultations/creating-a-clean-steel-fund-call-for-evidence
[38] https://www.gov.uk/government/consultations/creating-a-clean-steel-fund-call-for-evidence
[39] https://www.gov.uk/government/consultations/creating-a-clean-steel-fund-call-for-evidence

demand side response should allow the sector to be more competitive in future years. Energy costs will be discussed in more detail later in this report.

The result of this hesitancy from both government and industry is a deficit of plans to begin clean production of clean virgin steel in the UK, except for vague references to a CCS plant by 2040 as part of plans to develop low carbon industrial clusters.[40]

At the same time, the competition is racing ahead.

Clean steel in Europe

In stark contrast to the UK, across Europe there are more than 20 trial, pilot and full-scale projects underway that use hydrogen to produce primary steel.

European NGO Bellona has identified eight projects in which hydrogen is injected into blast furnaces (Table 1).[41] These span Europe and are, in a number of cases, led by companies with a commercial interest in the UK steel industry.

Company	Location	Notes
ArcelorMittal	Bremen, Germany	DRI plant online from 2026, output 3.5 Mt per year
ArcelorMittal	Dunkirk, France	Direct H_2 injection project with CCS
ArcelorMittal	Asturias, Spain	Direct injection of H_2 into blast furnace
ArcelorMittal	Fos-sur-Mer, France	Carbalyst project with direct H_2 injection
Voestalpine	Linz, Austria	Pilot project already running
Thyssenkrupp	Duisberg, Germany	Already injecting H_2 into blast furnace. DRI plant online 2025, co-located with electrolyser
TATA	Ijmuiden, Netherlands	Pilot online since 2017, electrolyser to be completed in 2024
Dilinger/Saarstahl	Dilingen, Germany	Direct injection of H_2 into blast furnace, in operation since 2020

Table 1: European hydrogen blast furnace projects. **Source:** Bellona

Of the eight projects listed, three have explicitly stated that they will use green hydrogen from the start. Some use 'grey hydrogen', that which is produced by reformation of natural gas without capturing emissions and can produce large quantities of CO_2. The use of 100% green hydrogen is vital in fully decarbonising the European steel industry, however projects initiated with non-

[40] https://britishsteel.co.uk/news/british-steel-backs-carbon-cluster-bid/
[41] https://bellona.org/news/climate-change/2021-03-hydrogen-in-steel-production-what-is-happening-in-europe-part-one

renewable hydrogen have a lower barrier to switching to clean fuels than projects that are not started at all.

In addition to these direct injection projects, Bellona has identified a further 14 European DRI projects, taking the number of hydrogen steel projects across the continent to 23.[42]

Company	Location	Notes
ArcelorMittal	Hamburg, Germany	Demonstration plant by 2023, target for commercial operation 2025
ArcelorMittal	Dunkirk, France	Feasibility study taking place
ArcelorMittal	Taranto, Italy	Planning stage
ArcelorMittal	Eisenhuttenstadt, Germany	Pilot plant online in 2026
ArcelorMittal	Bremen, Germany	Large scale plant online in 2026
Voestalpine	Leoben, Austria	Commissioning Q2 2021
Salzgitter AG	Salzgitter, Germany	Demonstration project scheduled to go online H1 2022
Salzgitter AG	Wilhelmshaven, Germany	Feasibility study
SSAB	Gallivare-Oxelosund, Sweden	Pilot plant, market production by 2026
LKAB	Kiruna-Malmberget-Svappavaara, Sweden	DRI plant by 2029
Thyssenkrupp	Duisberg, Germany	Production by 2025
Liberty	Galati, Romania	DRI plant to be installed 2023-25
Liberty	Dunkirk, France	Feasibility study taking place
H2 Green Steel	Boden-Lulea, Sweden	Large scale production by 2024

Table 2: European DRI projects. **Source:** Bellona

The number of European hydrogen steel projects has led some of the world's largest producers to set ambitious targets. Germany's Thyssenkrupp is aiming to produce 50,000 tonnes of climate neutral steel per year by 2022, tying in with a renewable-powered electrolyser project with RWE.[43]

ArcelorMittal has a target of delivering 600,000 tonnes of green steel by 2022, spread across a number of European sites.[44] Some concerns have been raised around the continued use of blast furnaces instead of a full switch to DRI, and the use of non-renewable hydrogen, particularly at its

[42] Data supplied in communication with Bellona
[43] https://www.thyssenkrupp-steel.com/en/company/sustainability/climate-strategy/
[44] https://corporate.arcelormittal.com/media/news-articles/arcelormittal-europe-to-produce-green-steel-starting-in-2020

project in Asturias.[45] For the latter, however it is clear that once up and running, the switch to green hydrogen is not an insurmountable obstacle.

Underpinning some of the most forward-thinking hydrogen steel projects is Germany's recently released hydrogen strategy.[46] Backed by €9bn in funding, aiming for green hydrogen and outlining plans for a dedicated pipeline network, this government support has given industry the clarity and certainty to invest in multi-billion Euro projects.[47]

Across Europe, from France to Romania and Sweden to Italy, there is a much more positive story to tell on clean steel than in the UK. Of the 45 clean steel projects identified in a recent global clean steel tracker, two-thirds are in Europe (although this includes CCS projects across the continent as well as the loosely planned British Steel Humber project).[48]

When compared to action underway today on the continent, slow progress in Britain appears particularly stark.

Energy Costs

Electricity costs for industrial users are constantly cited as an impediment for the UK steel industry, with the cost of power for the most energy intensive industries higher in Britain than elsewhere.[49]

In 2020 the electricity price for extra-large industrial consumers (inclusive of levies and taxes) was 11.65 pence per kilowatt hour (p/kWh), compared with an EU-wide median of 6.32 p/kWh, government data shows.[50] Lobby group UK Steel estimates this adds £54m per year onto UK steel production costs compared with competing plants elsewhere.[51]

A 2018 UCL study found a number of reasons for the disparity in electricity prices between the UK and Europe.[52] A lack of long-term contracts for energy intensive users, a more hands-off approach to shielding industry from policy and network costs compared with neighbouring countries, and a lack of coordination when integrating renewables into the UK system were identified as factors leading to higher energy costs in Britain.

Compared to Germany, for example, the UK was slow to insulate heavy industry from the costs of social and environmental policies levied through energy bills. UK steel producers and other heavy industries are now exempt from a large number of additional costs, however a delay between the enaction of these policies and the implementation of measures to protect industry from higher costs has been linked to economic challenges faced by UK industry.

[45] https://bellona.org/news/climate-change/2021-03-hydrogen-in-steel-production-what-is-happening-in-europe-part-one
[46] https://www.cleanenergywire.org/factsheets/germanys-national-hydrogen-strategy
[47] https://www.dw.com/en/germany-and-hydrogen-9-billion-to-spend-as-strategy-is-revealed/a-53719746
[48] https://www.industrytransition.org/green-steel-tracker/ Accessed May 2021
[49] https://www.mirror.co.uk/news/politics/uk-steel-firms-paid-250m-23435754
[50] https://www.gov.uk/government/statistical-data-sets/international-industrial-energy-prices
[51] https://www.makeuk.org/insights/publications/uk-steel-electricity-price-report
[52] https://www.ucl.ac.uk/bartlett/sustainable/sites/bartlett/files/uk_industrial_electricity_prices_-_competitiveness_in_a_low_carbon_world.pdf

UCL researchers made a number of suggestions to close this gap,[53] the majority of which have not yet been implemented. These included removing barriers to low cost, mature renewables such as onshore wind and solar, and to make it easier for industrial sites to sign long-term bilateral deals with generators. They also recommended that barriers to industrial plants participating in energy service markets, capacity markets and other ancillary markets were removed, and that more efforts should be made to open revenue streams from demand side response.

A more coordinated approach to renewables investment, linking up with network investment plans to ensure the system runs as efficiently as possible was another recommendation. Historically UK electricity networks have been slow to upgrade or proactively invest in new capacity, with inertia within the sector as well as lax regulatory oversight to blame for high costs, high profits and low levels of investment.[54]

Ofgem's impending price controls bring an opportunity to remedy this, as does an impending update to the government's Smart Systems Plan, and a potential holistic look at the power sector in general as part of an 'EMR 2.0'.[55] Making the right calls on the future architecture and design of Britain's power network could see this price gap close and make clean steel production, either via renewable-generated hydrogen or by electric arc furnaces more commercially attractive in the UK.

Conclusion

When compared with progress overseas, it is clear that the current level of ambitions for clean steel in the UK are not sufficient to ensure that the industry catches up in the race to clean up steel production.

One tentative-at-best UK project compared to 23 more advanced schemes across Europe clearly shows the disparity in ambition and action between the two regions, with the gap only set to grow if current timescales for government support are maintained.

The Clean Steel Fund, as it stands, is not driving progress in steel sector decarbonisation, nor is the scope of ambition in the government's Industrial Decarbonisation Strategy commensurate with that shown from governments overseas. Factors such as these are highly likely to be taken into account by multinational companies when planning investment, and could see finances flow towards plants in Germany, France and further afield, instead of toward upgrading steel mills in the UK.

With the history and skills that come with a long-standing steel sector, ample renewable energy assets from which to generate clean hydrogen, and a world-leading university and research sector, the UK is poised to charge ahead in the race to clean steel.

Instead, with 23 projects taking shape across Europe and many more worldwide, there is real danger that the UK's proud steelmaking history could be consigned to the history books.

[53] https://www.ucl.ac.uk/bartlett/sustainable/sites/bartlett/files/uk_industrial_electricity_prices_-_competitiveness_in_a_low_carbon_world.pdf
[54] https://eciu.net/analysis/reports/2017/monopoly-money
[55] https://es.catapult.org.uk/reports/rethinking-electricity-markets-the-case-for-emr-2/