Written evidence submitted by the Materials Processing Institute (LS0009)

SUBMISSION BY THE MATERIALS PROCESSING INSTITUTE TO THE BEIS SELECT COMMITTEE INQUIRY ON THE FUTURE OF STEEL

SUMMARY

1. The steel industry is a special and strategic industry that underpins domestic economic activity, infrastructure and sovereign capability in any country. Britain is at a decision point and we must commit to zero carbon, high-productivity steelmaking that includes a future for steel communities.

2. Steel is the second largest carbon emitting industry in the world, and the largest in the UK, so the industry faces significant challenges if it is to reduce carbon emissions sufficiently to meet the UK's Net Zero commitments without leading to the offshoring production and closure of British plants.

3. Two-thirds of the steels currently in use did not exist fifteen years ago, so innovation initiatives like the Materials Processing Institute's PRISM programme, funded by Innovate UK, will be essential for making the transition to productivity and competitiveness gains in the Fourth Industrial Revolution.

4. Delivery of a DRI-hydrogen/EAF-based solution for steel decarbonisation in Britain would take a decade and meet all milestones of the Paris climate change agreement whilst allowing a smooth and just transition for the workforce.

MATERIALS PROCESSING INSTITUTE BACKGROUND

5. The Materials Processing Institute is a research and innovation centre serving global steel and materials organisations that work in advanced materials, industrial decarbonisation, the circular economy and digital technologies.

6. It operates as an independent, industry-owned and not-for-profit R&D leader with over 75 years-experience in steel innovation since it was founded by Sir Winston Churchill's government in 1944 ahead of D-Day to equip the British steel industry for post-war reconstruction.

7. The Institute's work conducted on its Redcar campus in the North East of England is internationally recognised for translating fundamental research into practical and profitable products and processes fit for commercial development.

8. Through collaboration with its customers, the Institute provides a range of technology and R&D based services and consultancy. It also has pilot and demonstration facilities and an SME Technology Centre to support supply chain businesses with the development of new technologies and products.

9. The Materials Processing Institute's experts work with steel, metals and alloys, chemical processes, aerospace and defence, energy, mining and quarrying, construction, rail, transport, and infrastructure, offshore, subsea, and nuclear.

WHAT ARE THE CURRENT CHALLENGES FACING THE UK STEEL INDUSTRY AND ITS LONG-TERM VIABILITY?

10. Over the last decade, the UK steel industry has declined with evident periods of crisis. An industry that is essential to our manufacturing economy and which as recently as the late 1990s supplied 80% of the UK's domestic steel demand and was a major exporter, is now capable of meeting less than half of all British demand.

11. The closure of major steel manufacturing facilities in Newport in South Wales, Redcar on Teesside and the Stocksbridge melting shop in South Yorkshire, plus many smaller sites, has dramatically reduced UK capacity and capability, whilst having a devastating effect on local steel communities.

12. At the same time, the plants that remain have faced repeated changes of ownership, scaled back production and still face the challenge experienced by any ageing industrial assets that require significant investment.

13. Add to this the challenge of decarbonisation, some have previously adopted a defeatist approach to Britain's capacity to produce steel by dismissing it as "a sunset industry" that mirrors similar attitudes to the UK automotive industry from the 1970s.

14. Since 2015, this attitude has been in retreat both for a greater recognition about issues of sovereign capability (enhanced by the greater industrial self-sufficiency required by Brexit, as well as problems created by the reliance on manufacturing imports being exposed by the COVID-19 crisis) in addition to a greater understanding of foundation industries underpinning economies of highly industrialised countries as well as the opportunity for nations like the UK which retain a strong innovation lead developing new, valuable and necessary types of steel for the future.

15. Demand for steel in the UK is rising. A recent study on the "Future Capacities and Capabilities of the UK Steel Industry" conducted for BEIS[1] confirms that, on average, every citizen of the United Kingdom consumes about a quarter of a tonne of steel every year and UK demand is set to increase until at least 2030, in part as we invest in new zero carbon technologies, such as renewables and electric transport.

[1] 'Future Capacities and Capabilities of the UK Steel Industry', BEIS, December 2017; https://www.gov.uk/government/publications/uk-steel-industry-future-market-opportunities

WHAT OPPORTUNITIES AND CHALLENGES DOES THE GOVERNMENT'S NET ZERO TARGET PRESENT FOR THE UK'S STEEL INDUSTRY?

16. The opportunities of "Net Zero" by 2050 offer environmental, innovation, productivity and competitiveness gains and the prospect of the UK staking a lead in the Fourth Industrial Revolution and Green Industrial Revolution just as it transformed the world by innovating the technologies and processes of the First Industrial Revolution in the Victorian era. It is also a hugely challenging objective and the scale of this would be increased if the target were to be brought forward to meet climate change imperatives.

17. Net Zero requires three, interdependent pillars of decarbonisation, transformation and 'just transition' for:

    a. ***Decarbonisation*** - Delivering the Green Industrial Revolution by eliminating carbon emissions to meet our net zero commitments, without offshoring production.

    b. ***Transformation*** - Invest in new technologies and innovations (including digital technologies of the 4th industrial revolution), to radically improve competitiveness and deliver a step change in carbon consumption in steel (and other foundation industries).

    c. ***Just Transition*** - Enabling employees in steel producing areas to benefit from productivity improvements and find employment in the wider green economy.

DECARBONISATION

18. The scale of the challenge to reach Net Zero by 2050 should not be underestimated. Globally, the global steel industry emits 2.8bn tonnes of CO_2 today with, on average, 1.85 tonnes of CO_2 are emitted for every tonne of steel according to Worldsteel. To comply with the Paris Agreement, the emissions must fall to 600mt CO_2 maximum by 2050. Based on a forecasted production of 2,500 million tonnes in 2050 (+55% compared to 2015), this means that the emissions per tonne must be reduced by 90% to 0.2 tonnes of CO_2 per tonne of steel.

19. The steel industry is the biggest industrial emitter of CO_2 in the UK. Domestic emissions have fallen by 52% since 1990 and whilst some of this has been as a result of improved efficiency, in steel at least the majority of this reduction has been achieved by offshoring both production and emissions. For example, whilst some have celebrated apparent cuts to carbon dioxide emissions in North East England over the past decade, local statistics demonstrate that Redcar's CO2 reduction from 6.99kt to 2.73kt between 2015-16 coincided with the closure of SSI[2].

[2] 'UK local govt and regional carbon dioxide emissions national statistics: 2005 to 2017'; BEIS, 27 June 2019

20. It is a general truth that every tonne of steel produced in the UK is less environmentally damaging than any tonne of steel imported. Figures are usually cited for steel from China, but it should also be noted that steel sections produced within the UK result in 50% less CO2 emitted than steel sections sourced from the EU.

21. For the good of our planet, it is essential that we both decarbonise and grow our domestic industry, to meet UK demand. In common with other foundation industries, the steel industry is recognised as particularly difficult to decarbonise as, for technical reasons, electrification is not feasible for many processes. This is particularly true for the refining of iron ore, where carbon is used as a chemical reductant.

22. Routes to decarbonisation involve significant capital expenditure and technology choices, such as electric steelmaking, hydrogen reduction and carbon capture and storage. Given the right policy framework, the industry itself can be relied upon to make the necessary steel investment, but these sit in a wider industrial context. For instance, moving from coking coal to hydrogen will require national investment in the generation, transportation and storage of green hydrogen. Likewise a steel producer can make their facility ready for carbon capture and storage, but cannot create the whole CCS network.

23. The policy discussions are well documented, but the Institute would advise the Committee to recognise the impact of moral hazard. For instance, were national governments to choose to invest in CCS as a tool to support a national steel asset then one potential unintended consequence could be to ossify a steel producer around older, less productive and inefficient technology where steel producers would have less incentive to invest modern technologies which could be both more green, more productive and more internationally competitive.

TRANSFORMATION

24. Alongside decarbonisation, the steel industry is a leader in the application of the new digital technologies of the 4th industrial revolution. These technologies, when combined with the latest process improvements, have been proven to generate significant productivity gains.

25. The steel industry has the characteristics of being technologically intensive and where there is extensive scope for scientific research. The industry produces a wide range of customised products and consequently operates a large number of sequential batch processes, with complex production routes.

26. The critical applications of the material require product and process control on the same level as the pharmaceutical industry. However, unlike pharmaceuticals, raw

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/812142/2005-17_UK_local_and_regional_CO2_emissions_tables.xlsx

materials are difficult to control, steel is highly capital intensive, requires significant economies of scale, generally has assets with limited volume flexibility, has a high working capital requirement, is weak with regard to suppliers and customers, is intensely competitive and consequently operates on extremely slim margins. This is exacerbated by a willingness, in many jurisdictions, for Government intervention.

27. Given that all steel companies experience similar input costs and product prices, the only opportunity to improve the position of an individual firm is through innovation in the process, the product and customer service. It is the continuous and relentless drive for innovation that has resulted in remarkable strides in efficiency and productivity over extended periods of time. Unfortunately for the steel industry, in terms of profits, these benefits have in the most part been passed on to end users and society at large.

28. UK steelmakers are the cutting edge of innovation in steel that ensures the industry can retain competitiveness in specialist steel to such an extent that two-thirds of the steels currently in use did not exist fifteen years ago.

29. Maintaining Britain's innovation lead is essential for the survival and transformation of UK steel which underpins the Materials Processing Institute's PRISM programme (Programme of Research and Innovation for the Steel and Metals Sector) which was awarded £22 million in the Budget in 2020 to meet this transformation challenge, with funding provided by Innovate UK.

30. With the Institute's commercial and industrial experience, PRISM's objective is to improve the commercial viability of the UK steel and metals sector by providing research and innovation services in the areas of the transition to a low carbon economy, for digital processing, and for the circular economy in metals.

31. PRISM fully aligns with HMG's 10 Point Plan for a Green Industrial Revolution by delivering outputs for:

    a. Wind – supporting manufacture of high-quality plate steel alloys
    b. Hydrogen – both decarbonising heavy industry and providing metal products for energy and transport infrastructure
    c. SMRs – route to new metal alloys and manufacturing techniques
    d. Electric Vehicles – creating circular economy in rare metals and resilient supply chains, and reducing reliance on dubious mining practices
    e. CCS – critical part of industrialisation strategy for metals
    f. Commercialisation – developing technologies for sale of new UK green products & exports

32. PRISM supports the UK national mission to achieve Net Zero by 2050 by improving business productivity and competitiveness with explicit purpose to support innovation across the nations and regions of the UK.

'JUST TRANSITION'

33. One of the greatest public policy challenges is how to implement new low carbon technologies, whatever they are, in such a way as to achieve a just transition for employees and communities.

34. In a recent paper on *"Decarbonisation of the UK Steel Industry"*[3] jointly authored by the Materials Processing Institute and the industrial consultancy, Syndex, it was described how most options for decarbonisation also result in increased productivity and potential loss of front-line jobs. For example, the most efficient steel plants in the world, currently in the United States, can make the same quality products as British competitors, at the same output levels, with one-fifth of the workforce.

35. The challenge facing the sector is that any investment which does not also increase productivity will leave the steel plant unable to compete in the global steel market, or else be displaced by a potential inward investor in the UK, which could be devastating for existing steel communities

36. The consequence of this analysis is that decarbonisation of the steel sector and choices made by individual companies, need to be taken into consideration alongside the UK's wider industrial strategy, particularly with regard for investment and growth in new jobs in the green economy but also with a specific effort on the procurement strategy and the supply chain to support the development of local production as part of a greener solution.

37. The improved competitiveness of the UK steel industry must become the foundation of new era of growth particularly in the downstream activities where thousands of jobs could be created.

DRI-hydrogen/EAF-based solution for UK steelmakers

38. The UK steel industry is mainly based on blast furnace (BF/BOF) technology, with two principal companies in Tata Steel and British Steel facing a similar challenge to that of other international steel producers of deciding today about the technology for the future.

39. Companies must decide soon whether or not to invest in their coking plants. Assuring the long-term sustainability of the coke ovens will cost hundreds of millions of pounds. On top of this, companies will have to invest in the relining of some of their blast furnaces during the next decades and in some cases to rebuild them if they want to continue with the current technology. This choice would require the development of a CCS or CCU solutions, to comply with net zero emission target by 2050. In order to meet the intermediate targets of emissions reduction (2030), the industry would have to start to invest in CCS/U solutions.

[3] https://www.mpiuk.com/downloads/industry-papers/SI-Series-Paper-05-Decarbonisation-of-the-Steel-Industry-in-the-UK.pdf

40. In the paper authored by the Institute and Syndex[4], the transition to a DRI/Hydrogen solution is proposed as a more secure alternative as it could be developed in tranches starting with the implementation of proven technology. This would allow the use of blast furnaces until the end of their life and does not require an immediate, or irreversible decision in relation to blast furnaces. In all the scenarios, the amount of investment will be significant (c. £400-£500m CAPEX for 1mt of steel), which is unaffordable by the UK producers given their current financial situations.

41. Therefore, to enable a transition that would be compatible with existing assets and to achieve a just transition, the Institute and Syndex propose that the Hydrogen-DRI technology seems the most adapted solution for the UK industry to:
    a. Start developing a DRI gas-based steelmaking with a proven methodology with a very limited technological risk with an immediate impact on CO_2 emissions.
    b. Compensate for the decrease of productivity of the coke ovens in Port Talbot and Scunthorpe by adding DRI to the blast furnaces (up to 25%) and therefore allow a smooth transition with a significant CAPEX avoidance on the life extension of the coke ovens.
    c. Preserve the full range of steel produced and the downstream capabilities.
    d. Switch to hydrogen when the technology will be proven (Swedish steelmaker SSAB intends to sell the first fossil-free steel in 2026).
    e. Decide to transition to grey hydrogen first or to wait until 2030 when green hydrogen is expected to become the cheaper source of hydrogen.
    f. Transition more gradually to a new technology (EAF based) and therefore protect the workforce during a fair and just transition which could span between now and 2035 when the technology could be available or later depending on the end of life of blast furnaces.

42. The absence of redundancies during the transition is a condition of the support by the stakeholders without which the changes would have a high probability to fail.

43. A DRI facility could be of interest for the whole of the industry including the current EAF based producers. Nevertheless, most of the players are too small not only to cover the CAPEX requirement but also to legitimate the investment in a large facility. For example, Austrian-steelmaker Voestalpine's 2mt of HBI in Texas which started production in 2018, had a total cost of US$1.1bn.

44. As a first step, a DRI facility could be built separately by a third party and sell its production to the different players. This could allow to develop in parallel a hydrogen facility by another partner. The industry would then mutualise the risks and benefits of the development of the new technology. This would reduce the CAPEX required up front and could also facilitate to support from the government. This support will be key as none of the private producers will be in position to afford the costs of the transition, in the UK as any countries in Europe.

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[4] Ibid.

45. The support to the development of a DRI-Hydrogen facility in the UK will benefit the entire economy as it will allow a significant step toward critical mass for the hydrogen in the UK.

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