

Maggie Mason
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Dear Ms Mason,

Please find enclosed our expert opinion on the matters raised by you, in relation to planning application 4/17/9007, for the development of an underground metallurgical coal mine, currently before Cumbria County Council.

The Materials Processing Institute is the UK's centre for innovation in the steel and metals industry. The Institute offers research, consultancy and training services from its campus in Teesside, delivering expert advice and new technology to the steel industry internationally. Established 75 years ago as the British Iron and Steel Research Association, the Institute has a team of internationally recognised steel industry experts. Consultancy services include advice on mergers & acquisitions, technology strategy and capital investment.

1. FEASIBILITY FOR DISPLACEMENT OF BLAST FURNACE STEEL WITH SCRAP STEEL

In the evidence from West Cumbria Mining, it is stated that blast furnace steelmaking using metallurgical coal will continue until the end of the century due to:

- i. The limited availability of scrap steel.
- ii. The need for high grade steel for some industries, which cannot usually be made from recycled steel.

In relation to the availability of scrap steel, in 2019 the EU produced 158.8 million tonnes (MT) of steel¹, via a combination of electric arc furnace and blast furnace routes. The total scrap available, including exports was 120.1MT, or 76% of total steel production. For the UK, the total scrap produced was 145% of total steel production. These figures show that from an availability perspective the UK has more than enough scrap to meet its steel making needs, but it would be correct to assert that within the EU as a whole there would be a shortfall of 24% of steel if entirely scrap based routes were pursued.

¹ Source: worldsteel Association



It does not follow however, that there being an ongoing need for primary steel production will necessarily lead to a continuation of blast furnace technology, or a demand for metallurgical coal. In any event, even a partial switch from blast furnace to electric arc furnace production could lead to collapse in the European and global market for metallurgical coal.

Regarding the quality limitations of steel made in the electric arc furnace using scrap, these relate specifically to the presence of elements that cannot be removed in the melting process and which cause quality problems in the final steel product, primarily copper and nitrogen. From a technological perspective, the issue of copper can be dealt with adequately via a combination of high density scrap separation and dilution, or with alternative technologies, such as direct casting. Nitrogen presents a more intractable problem as there are, as yet, no commercialised technology solutions to resolve this. There are ongoing research projects, but they are between five and ten years from full commercialisation.

Accepting the quality limitation of nitrogen described above, it is important to note that the nitrogen issue applies primarily to a small range of high quality strip grades for exposed autobody. Worldsteel estimate that automotive grades account for 15% of global steel production and exposed autobody grades are a small subset of these. It is therefore not possible to assert that a general switch from blast furnace to electric arc furnace processing is not possible for quality reasons, though it is true that a small percentage of high value grades can only be made from primary steel making (non EAF) route. It is also worth noting that even for any blast furnace steelmaking that were to remain, the use of metallurgical coal in these furnaces will decline, due to initiatives such as biomass.

2. ALTERNATIVE TECHNOLOGIES FOR STEEL PRODUCTION

The elimination of coal from the steelmaking process is considerably more difficult than from power stations. In energy generation coal is used as a source of heat, but in the blast furnace it is a chemical reductant. This means that to continue making steel from iron ore into the future, an alternative chemical needs to be found and a process developed that can replace coal. There are currently several such alternative, low, or zero carbon, steelmaking technologies in different stages of commercialisation.

The most mature technology is the electric arc furnace, which can be operated using recycled steel scrap, or with alternative raw materials, such as directly reduced iron (DRI). The latter is a source of virgin iron material that is refined using gas and is preferred in territories where scrap availability is insufficient, gas prices are low, or to dilute impurities in the scrap. As has been described above, wholesale replacement of blast furnaces with electric arc furnaces could be limited by both quality and availability of scrap. The use of DRI would largely resolve this problem, but natural gas based reduction is both expensive and an emitter of greenhouse gases. It is for this reason that many governments and steel companies are investing in hydrogen reduction for steel. This involves the conversion of the DRI process from gas reduction to hydrogen reduction.

It is estimated that commercialisation of hydrogen steelmaking technology will be possible by 2030. However, the Swedish steel company SSAB aims to replace coking coal entirely with hydrogen and

bring fossil free steel to the market by 2026². The Austrian steel producer voestalpine has invested in the world's largest hydrogen pilot plant, with an aim to reduce CO₂ emissions in steelmaking by 80%³. The German steelmaker ThyssenKrupp⁴ has conducted trials with hydrogen and aims to commission new hydrogen furnaces in the mid-2020s. The world's largest steelmaking company, ArcelorMittal, has demonstrated the replacement of coal with hydrogen in the blast furnace. They are also in the process of converting their Ilva works (the largest steel plant in Europe) to EAF⁵. The first blast furnace is scheduled for closure and replacement with an EAF as early as 2024. Liberty Steel group, operating largely in Australia and Eastern Europe, has announced that it intends to be carbon neutral by 2030. It intends to achieve this by investment in new hydrogen steelmaking technologies.

Whilst there are other potential zero carbon steelmaking technologies available (including electrolysis⁶), hydrogen is the clear leader, with significant investment both from companies and governments in Europe, including in the UK. Some of the companies highlighted above aim to achieve zero carbon steelmaking and some aim to be carbon neutral, but none foresee the continuation of the existing blast furnace technology in its current form and all are aiming for a significant reduction in the use of metallurgical coal.

3. FUTURE MARKET DEMAND

West Cumbria Mining expect that there is likely to be a continued demand for metallurgical coal for steelmaking throughout the lifespan of the proposed development, i.e. for fifty years. Sections 1 and 2 above have demonstrated that the demand for metallurgical coal in the UK and Europe is expected to decline considerably from 2030 onwards, as a result of actions being taken by producers to invest in new technologies. It is incorrect to assert that emerging technologies are in their infancy. As has been shown a combination of electric arc steelmaking and alternative primary production, such as hydrogen based DRI, are technologically capable of producing all but a very limited range of steels.

The EU has set out the 'European Green New Deal'⁷, which aims for Europe to be carbon neutral by 2050. Within this there is a European industrial strategy that was published in March 2020⁸,

² <https://www.ssab.com/company/sustainability/sustainable-operations/hybrit>

³ <https://www.voestalpine.com/group/en/media/press-releases/2019-11-11-h2future-worlds-largest-green-hydrogen-pilot-facility-successfully-commences-operation/>

⁴ <https://reneweconomy.com.au/another-nail-in-coals-coffin-german-steel-furnace-runs-on-renewable-hydrogen-in-world-first-55906/>

⁵ Kallanish Commodities, 10 June 2020

⁶ <https://www.bizjournals.com/boston/news/2019/01/10/boston-metal-raises-20m-from-billionaires-energy.html>

⁷ 'A European Green Deal', European Commission, https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

⁸ 'A New Industrial Strategy for Europe', European Commission, March 2020, p7, https://ec.europa.eu/info/sites/info/files/communication-eu-industrial-strategy-march-2020_en.pdf

which states that: ‘the Commission will support clean steel breakthrough technologies leading to a zero-carbon steel making process.’ This ambition for a zero carbon steel industry in Europe (as opposed to simply a carbon neutral European steel industry), is being supported by investment in research and innovation at both the national government and European level.

Given that the operating life of a blast furnace is around 20 years, all of the blast furnaces in Europe will require relining between now and 2030 to 2035 in order to then be phased out prior to the date of the zero carbon target in 2050. The last new blast furnace in the EU was built in the early 2000’s and no further new ones are being planned. In this context, the emerging strategy of steel companies, to invest heavily in zero carbon steelmaking technologies, while also reducing the coal consumption of their existing furnaces makes sense. It is to be expected that the number of operational blast furnaces in Europe will decline considerably and that those that continue to operate will do so with a greater use of alternative fuels, such as hydrogen and biomass. The evidence presented clearly shows that production of steel in the quality and quantity that is likely to be required by society will not require significant use of metallurgical coal in the coming decades.

4. SOCIETAL NEED FOR STEEL IN THE UK

The evidence from West Cumbria Mining, makes the following assertions:

- i. That future needs could be compromised ‘in the event that metallurgical coal production, and by extension steel production is significantly curtailed’.
- ii. That ‘much of the infrastructure required to facilitate the UK’s transition to low carbon energy production and transport... will be dependent on steel using metallurgical coal’.

The UK has and will continue to have a need for steel, in line with all modern advanced economies. Indeed, the UK demand for finished steel is forecast to grow in line with GDP and population⁹, to a level of 11mt pa by 2030. The primary demand growth is anticipated to be in coated sheet, stainless steels, hot rolled coil, rebar and heavy sections. These five product lines account for two thirds of future predicted growth.

The steel most used in infrastructure (including both transport and low carbon energy as highlighted above), are: coated sheet, hot rolled coil, rebar and heavy sections. It is therefore correct to state that the UK has a societal need for more steel in these areas and that strong growth is forecast in the need for steel. However, the claims from West Cumbria Mining assert that these particular steels are dependent on the availability of metallurgical coal. This is not the case. Of the steels mentioned, stainless steel and rebar are already produced in the UK using 100% electric arc furnace (EAF) steelmaking, a process which does not use metallurgical coal. Heavy sections are produced at the Lackenby Beam Mill in Teesside, using blast furnace-route steel from Scunthorpe.

⁹‘Future Capacities and Capabilities of the UK Steel Industry’, BEIS Research Paper No. 26, Summary Report, December 2017,

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/668089/UK_Steel_Capabilities_-_Summary_-_FINAL_141217.pdf



However, the new owner of this facility, Jingye Steel, has announced that it will switch this feedstock to electric arc furnace (EAF) production¹⁰.

Both hot rolled coils and coated coils are produced at the Tata Steel Port Talbot steelworks. These steels are currently produced via the blast furnace route using metallurgical coal. However, it is incorrect to assert that these steels must be produced via this route. Several steel producers in the USA¹¹ are producing hot rolled coil, galvanised and coated sheet from the EAF route. For the period in question, production of these steels in the UK need not therefore 'be dependent on steel using metallurgical coal'.

For completeness, it is worth noting that future transport and infrastructure investment will include rail. The UK has one rail steel mill based at Scunthorpe and supplied currently via the blast furnace route. However, there is no technical, or metallurgical barrier to this production being switched to electric arc furnace (EAF) production, as is the case in other countries¹².

GENERAL COMMENTS RELATING TO THE MARKET

It was noted that the proposal is to supply coal at a rate of 360,000tpa to the UK steel industry, from total production of 2.78mtpa. The total UK metallurgical coal market is currently in the region of 2mtpa. As steel producers blend a variety of different coals, with different properties, to achieve the most economic and technically desirable outcome, the proportion of total planned output being intended for the UK market seems reasonable given the current size of the market.

¹⁰ 'China's Jingye acquires British Steel; to expand into EAF steelmaking on Teesside', S&P Global Platts, 9 March 2020, <https://www.spglobal.com/platts/en/market-insights/latest-news/metals/030920-chinas-jingye-acquires-british-steel-to-expand-into-eaf-steelmaking-on-teesside>

¹¹ Big River Steel: <https://bigriversteel.com/products/hot-rolled>
Nucor: <https://www.nucor.com/products/Steel-Sheet>
Steel Dynamics: <http://www.steeldynamics.com/Products/Flat-Roll.aspx>

¹² Steel Dynamics: <http://www.steeldynamics.com/Operations/Steel/Structural-And-Rail-Division.aspx>