Port Talbot and TATA steel: background information

A model motion of support for TATA steelworkers can be found at cacctu.org.uk/port_talbot

Basic statistics

Steel is an alloy of iron and carbon containing less than 2% carbon and 1% manganese and small amounts of other elements. There are more than 3,500 different grades of steel with many different physical, chemical, and environmental properties.

Steel production accounts for between 7% and 9% of global greenhouse gas emissions. In the UK it is responsible for 2.4% of total UK greenhouse gas emissions (14.2% of UK GHG from manufacturing).

Just over half of steel worldwide is used in construction. Other uses include cars and other transport, mechanical equipment and metal products. It is used for both fossil and renewable energy production (e.g. oil platforms and wind turbines). Global steel production is currently projected to increase by about 10% by 2050.

The UK produces 7.2 million tonnes of crude steel a year, around 70% of the UK's annual requirement. It employs 34,500 people directly in the UK and supports a further 43,000 in supply chains. About half of the UK jobs are in Wales or in Yorkshire and the Humber.

How steel is produced

Blast furnaces

Globally around 75% of steel is still produced in **coal-fired blast furnaces (BFs)**, where in addition to producing a temperature of up to 2,500 degrees C the carbon-based fuel reacts with the iron ore (ie mainly iron oxide) to "reduce" it to iron, with large quantities of CO2 as a by product.

The resulting so-called **pig iron** is then refined in a **basic oxygen furnace (BOF)**, removing excess carbon by reacting the molten iron with pure oxygen and again producing CO2.

Four blast furnaces remain in the UK – two at TATA, Port Talbot and two at British Steel, Scunthorpe.

Electric Arc Furnaces

Steel can also be produced by recycling scrap steel in an **electric arc furnace (EAF)**. This already accounts for about a fifth of UK steel production and about a quarter globally. The quality of the steel produced depends on the quality of the input: though some steel is 100% recycled, most often a proportion of blast furnace iron is added to the scrap to "dilute" impurities. In an EAF-only route this iron would need to be imported. The EAF alone cannot produce **primary (or so-called "virgin") steel**.

Direct Reduction

The main route to decarbonising primary steel is one which replaces the coal fired blast furnace with a "**direct reduction**" method, separating the iron from its ore without melting, using a reductant such as natural gas (methane) whose hydrogen component reacts with the oxygen in the ore to produce water.

The resulting **direct reduced iron (DRI)** can then be smelted into steel in an EAF, using high temperatures to melt the solid iron and separate the impurities which form a **slag**.

The emissions from direct reduction with gas are around half those of a blast furnace. The emissions from the EAF will depend on whether the electricity used comes from renewables or from fossil fuel sources.

Direct reduction with green hydrogen

It will be apparent that the key to further emissions reduction will be replacing the methane used in the process with pure **'green' hydrogen**, i.e. hydrogen produced by electrolysis of water using renewably-produced electricity.

Green hydrogen has a high renewable energy demand (a lot of energy is lost in the process of conversion from electrical energy to hydrogen), and therefore it needs to be reserved for essential uses where no low carbon alternative can be found, to avoid impeding wider decarbonisation of energy. It is currently widely accepted that essential steel production is a priority use, though other reduction techniques are in development (see below).

Such constraints remind us that any industrial transition must concentrate on production for need, rather than on continuous expansion and creating markets for products irrespective of use-value.

Challenges

A major bottleneck in achieving 'green' steel, then, is the availability of renewably-produced electricity, including for green hydrogen production.

A further challenge is that high grades of iron ore (ie, with a high percentage of iron and low impurities) are required to produce a direct reduced iron suitable for the EAF. More impurities in the iron mean higher quantities of slag in the EAF, and some of the iron is lost in the slag – meaning that higher quantities of iron ore, reductant and electricity are needed. This high grade ore is scarce, and often occurs in deposits with low ore content, meaning the amount of material that has to be mined and processed per tonne of usable product is huge and environmentally costly!

A number of alternative solutions have been proposed which would enable blast furnace ore grades to be used in DRI processes; these are at varying degrees of "commercial readiness":

- Replacing the EAF with a submerged arc furnace (SAF), which has higher tolerance for impurities and is expected to enable a more extensive range of steel grades.
- Direct reducing iron using an electrolysis process, rather than a chemical reductant such as hydrogen. Developers claim this works for a wide range of ores and steel types, and reduces the renewably-produced electricity demand relative to using green hydrogen. They say it will be commercially ready in 2026.
- An open slag bath furnace (OSFB) can use direct reduced BF-grade pellet and produce pig iron that can be processed in a basic oxygen furnace. Researchers claim that by using hydrogen in the direct reduction step, renewables to power the furnace, plus carbon capture, emissions can be reduced by 90% relative to the BF-BOF route, and a significant improvement on the hydrogen DRI -EAF route.
- A wholly different proposal is to retain the blast furnace but use a thermochemical process to split the CO_2 produced, recovering CO (carbon monoxide) to re-use as a reductant in place of coke – recycling the carbon in a continuous loop. Researchers claim this system in UK BF-BOFs could reduce steel sector emissions by 88%.

What is TATA's proposal?

- TATA plans to replace the two blast furnaces with a 3Mt (Megatonne) electric arc furnace, using a mix of scrap, pig iron and hot briquetted iron (a compacted form of direct reduced iron useful for shipping and storage), reducing the plant's emissions by 85%.
- It plans to close one of its two blast furnaces (BF5) in mid-2024, with other 'heavy end' assets – including the second blast furnace (BF4) - to wind down during the second half of 2024.
- There is no current plan to build a direct reduction plant, although TATA has said this would be a possibility in the future, "provided there was financial support available and the business conditions were right (e.g. having access to competitively-priced natural gas and then green hydrogen, which is not the case currently)"
- The UK Government would invest £500 million, with Tata investing a further £750 million. It claims this has "the potential to safeguard over 5,000 jobs" of the 8,000 employed by Tata across the UK – in other words, it posits the alternative as being closure of the works.
- TATA is "consulting" on up to 2,800 job losses across its UK operations, of which around 2,500 could take place during the next 18 months, and the remaining 300 jobs in three years time, likely including the loss of cold rolling operations in Llanwern (this process involves passing the metal through rollers to flatten and extend it, and increase tensile strength).
- A Transition Board" has been set up with £100 million funding to support affected workers, businesses and communities. In addition to this, TATA says it will provide over £150 million for a "comprehensive support package for affected employees, including redundancy terms, community programmes, skills training and job-seeking initiatives".

And what is the union response?

- A "Multi-union Plan for Steel for TATA Steel UK" was developed with help from consultants Syndex, and initially agreed by all three unions, but Unite has since withdrawn and published its own separate plan "A Workers Plan for Port Talbot".
- All the unions representing the steel workers (Unite, GMB and Community) insist that both blast furnaces should stay open until the end of their life: 2027 in the case of BF5, and 2032 for BF4. (the Unite pamphlet has this date as 2034, but Unite has acknowledged that this was an error).
- All the unions also support the introduction of direct reduction facilities as necessary to retain primary steel capability and ensure a supply of suitable direct reduced iron for an electric arc furnace. An EAF- only route to decarbonisation (as planned by TATA) would depend on import of "green" hot briquetted iron and pig-iron, which according to Community are not yet commercially available, meaning that the UK steel emissions would simply be shifted upstream and offshored.
- The Unite Workers Plan for Port Talbot demands that work should begin straight away on DRI facilities, concurrently with the continued operation of the blast furnaces, as this will be needed to feed the electric arc furnace along with high quality scrap. They also refer to the need for advanced scrap processing facilities, which would create additional jobs.
- The Multi-Union Plan emphasises that direct reduction facilities will be needed from 2028 to support the operation of an electric arc furnace. In the case of the second phase of the plan (from 2032) being an open slag blast furnace (see above), using 80% iron ore (BF grade pellets), a 2Mt DRI on site would be the required solution. Alternatively they consider the

possibility of combining with another producer (eg British Steel) to build DRI facilities which could supply all UK steelmakers.

- **A key difference** between the two plans is that Unite wants to retain TATA's plan for a 3Mt EAF, to be built by 2027 when BF5 will be retired, whilst retaining BF4 until 2032 (unless direct reduction technology is available sooner). Community, on the other hand, argues that a 3Mt EAF would necessarily result in the closure of BF4 once the EAF becomes operational.

  This is because the current capacity of Port Talbot is only 3.4Mt (the capacity of the hot strip mill). Community argues that closure of BF4 would mean a drop in output to 2.5 Mt of finished steel, and the loss of up to 3,000 jobs – in other words, the job losses would simply be delayed by three years.

  They argue instead for a staged approach, with a 1.5Mt EAF built to replace BF5 and run alongside the 2Mt BF4, with a likely further option of an open slag bath furnace (see above) from 2032, when BF4 retires.

- Community also point to the fact that a 3Mt EAF would require National Grid to provide a new sub-station, which would mean substantial delays.

- Unite's plan relies heavily upon expansion of production, with additional EAFs a possibility after 2032, so presumably – although this is not made explicit – they would advocate for additional hot strip mill capacity. A key feature of the document is the ideas for ambitious expansion of downstream production in the region – many of them positive ones such as expansion of wind power with locally manufactured turbines, green hydrogen and other renewable energy infrastructure– which could create thousands more

- Whilst Community expresses concerns about the availability of scrap for an EAF-based plan, Unite points out that the UK currently exports 80% of its scrap steel (8 million tonnes per annum), which in theory could cover the UK's requirements. However, a reduction in steel imports and an expansion of UK manufacture of steel products (both part of Unite's plan) would presumably put this under strain - at least until an equilibrium between production and decommissioning of major steel-using products is reached.

- Both union plans refer to the need to maintain UK capability for primary steelmaking, arguing that the alternative is a reliance on imports which could compromise national security. But even a plan for primary steelmaking based on direct reduction would require sizeable imports of iron, for example in the form of pelletised iron ore. UK iron ore is limited and of low quality

Does decarbonising have to mean job losses in steel production?

In a word – yes, sooner or later, depending what pathways are chosen. An EAF-only pathway clearly needs far less labour, given that it dispenses not only with the blast furnace and basic oxygen furnace but also with coking ovens (to produce coke from metallurgical coal) and sinter mills (which burn a mix of iron ore powder, fluxes and recycled material to create a substance with the right consistency for the blast furnace). In their critique of Unite's plan, Community union suggest that a 3Mt EAF would need fewer than 300 people to operate, whilst a two small EAFs would need around 400 employees.

Direct reduction facilities too require far less labour than the current BF-BOF method. Community union claims that, depending on the capacity of the direct reduction furnace (currently typically 1 – 2.5Mt, with Community suggesting a need for a 2Mt capacity for their plan), between 150 and 300 roles will be added. TATA itself puts a typical figure at 200.

It is unclear what the labour requirements of building the proposed EAF and potential DRI facilities would be, but this work in itself would presumably be short-lived.

The Community/GMB plan pamphlet states that their approach would protect 2,300 jobs for over a decade (implying that the closure of BF5 and replacement by a 1.5Mt EAF would result in about 500 job losses), and "provide time to develop an adequate solution to look after everyone impacted by the decarbonisation". Whether this refers to redeployment within other parts of the industry or downstream manufacture, to supported training and redeployment to other sectors, to negotiated pay-offs or to natural attrition, is not specified.

A key issue, both for the scale and timing of job losses or transitions and for the climate, would seem to be whether or not the EAFs and any direct reduction facilities can be built concurrently with continuing to run the blast furnaces until the "switchover", and whether that switchover can be brought forward.

TATA's decision to close both blast furnaces in 2024 (and with no current plans for a direct reduction plant) appears to be a financial decision, not a technological or environmental one, and could potentially still be reversed, especially given the Labour Party's recent pledge of £3bn funding for the steel sector if they form the next government.

Labour's ambition is to increase UK steel output to 10Mt pa over the next 10 years and retain the UK's primary steel making capacity. Whilst not necessarily generating direct jobs in steel production (given the lower labour needs of new technologies), this does imply rapid expansion of the renewable energy sector with new employment both upstream (energy generation) and downstream (steel-based products needed for energy transition).

A proactive campaign must stress the needed rapid rise in local and regional jobs in renewable electricity generation and its supply chains, essential not only for steel decarbonisation but for the wider transformation of the economy. This might include production of turbine components, specialist vehicles and ships for wind farm installation, extending the electricity grid and building new substations, production of green hydrogen if this is the route chosen, and the training required for (re)deployment to these sectors.

This must all be planned for, and none of it will fall into our laps – it must be fought for! And there are many other jobs to be fought for in local public services, energy efficiency in homes, sustainable land work and much more. Rebalancing the economy towards improved public services staffed by well-paid workers would bring more stability to local economies along with wider wellbeing benefits.

The workforce in a wider transition

Predictions about the size of a potential market for a product are normally based on market forecasts, rather than on deliberate planning. For example, following the market might suggest that a certain quantity of green hydrogen will be available by a certain year, that the demand for new cars will reach a certain number, or that electrolytic reduction of iron will be commercially available by a particular date.

But these things are really political decisions – even if the decision is to leave it to the chaos of the market. A planned transition requires decisions to be made about how much of any material or product is required to meet relevant targets. What happens in an adjacent sector (eg the rate of build-out of green hydrogen for DRI, or of wind turbines as end usage) cannot be regarded as simply the natural environment in which a sector like steel production operates – such interdependent sectors require integrated planning.

The Unite plan goes some way towards this, in terms of discussing the downstream uses of the steel, the synergies between the need for green hydrogen in the steel industry and the requirements of other sectors (some contentious from an emissions reduction perspective!), and the impacts on the wider economy. Arguably, the Community plan is overly restricted to the current realities of the plant and the market, and hence under-ambitious. Any plan for steel needs to be based on the optimal requirements for a rapid and effective economy-wide decarbonisation, in which steel plays a key role.

But neither plan takes as its starting point an analysis of the type and scale of workforce actually needed to accomplish decarbonisation, and what is therefore needed to do this without anyone losing their livelihood. Instead, the starting point is the defence of the incumbent jobs, and the consequent perceived need to create and compete for markets.

The Multi-Union plan, whilst suggesting that it will allow time to find ways of looking after the workers who lose their jobs, makes no mention of the labour *requirements* of the transition whereby decent work and training could be argued and campaigned for – uniting progressive unions with the climate justice movement rather than setting them artificially at odds. We must be clear that it is the operations of the market that threaten people's jobs and our children's futures, not the imperative to decarbonise.

The Unite position is simply to fight for every existing job, irrespective of what that means for the future of the community it purports to protect. But might a unifying campaign be possible, demanding that the transition plans be *accelerated* in keeping with a realistic recognition of the immense dangers of accelerating climate chaos, enabling *both* blast furnaces to be retired by the end of the decade with guaranteed redeployment and protected incomes for workers. This could take place alongside proper assessment of the requirement for domestic primary steel production, in the context of decarbonisation of the wider economy, with facilities planned and built accordingly.

It is evident that such a campaign would be a campaign for public ownership, and for democratic planning: production according to need rather than a destructive quest to increase markets at all costs, and public funding based on public good, not obligations to shareholders. This sort of needs-led, integrated planning cannot be achieved by the market, and using subsidies to attract private investment simply siphons public money into corporate pockets.

The question is, how can the besieged workforce and community of Port Talbot be supported in the here and now, whilst holding on to the necessary demand for a wider worker-led plan within a public National Climate Service? And how can we organise proactively to plan for the needed reorganisation of the economy and build the workforce we need, leaving no-one behind?

Useful documents

A Workers Plan for Port Talbot – Unite the Union

The Multi-Union Plan for TATA Steel UK – Community and GMB

Comments on Unite Concept for Port Talbot – Community union

TATA Steel Announcement Fact Checker – TATA UK

For those who want to explore the technological issues in more depth:

Solving iron ore quality issues for low carbon steel - IEEFACost effective decarbonisation of blast furnace – basic oxygen furnace steel production through thermochemical sector coupling – (Journal of Cleaner Production)

Assessment of fossil-free steelmaking based on direct reduction applying high-temperature electrolysis - (Cleaner Engineering and Technology)

Integration of Open Slag Bath Furnace with Direct Reduction Reactors for New-Generation Steelmaking – (Metals journal)