UK STEEL
Powered by MAKE UK

A BARRIER TO DECARBONISATION: INDUSTRIAL ELECTRICITY PRICES FACED BY UK STEELMAKERS

TECHNICAL ANNEXE

MakeUK.org/uksteel

November 2021

1. METHODOLOGY

The UK Steel research is based primarily on the electricity prices faced by typical UK steel producers based in the UK and their sister facilities in Germany and France. Where necessary, this has been supplemented by data from international price comparison studies such as the PWC/CREG report referred to above. The intention is to provide a much-needed sector-specific view with input from steel companies operating in those countries examined. Importantly, this analysis also considers all exemptions and compensations available to those companies and therefore provides the most accurate and up-to-date picture possible.

Please note that this analysis is conducted in August every year and has therefore not taken the significant price increases of September and October into account. As such it does not reflect the situation steelmakers found themselves in autumn, but instead an estimated picture of price difference for the whole financial year.

UK wholesale prices have been constructed by using the five monthly average spot prices (from April to August) and average forecasted price for the following seven months, based on published reference data. German and French wholesale prices are based on a similar methodology. The policy prices for the Renewables Obligation, Feed-in Tariffs, Contracts for Difference, and Capacity Market are based on average reported prices from UK steelmakers and exemptions have been applied. UK network prices are similarly based on the average prices steel producers face, including balancing, distribution, and transmission costs (assuming consumption during one Triad at 70% capacity). The French and German policy and network prices are based on the PWC/CREG data. This includes the CPSE, Contribution tarifaire d'acheminement (CTA), CHP, StromNEV, Offshore, EEG-Umlage, Stromsteuer, and Konzessionsabgabe / Concession Fee. The exchange rate between 1st April to 31st August 2021 was €1:£0.8938, and the ETS prices are based on the average price for April to August 2021 and the forecasted prices for the following seven months. Compensation has been applied to this and, in the UK's case, the CPS. In all countries, we assume compensation provides 60% relief; based on the assumption of plants being at 80% of the electricity consumption efficiency benchmark and compensation provided at 75% aid intensity.

Any demand side response income or revenue from embedded benefits has been excluded from this analysis in all countries.

2. OVERVIEW OF THE UK STEEL SECTOR

THE UK STEEL INDUSTRY IN NUMBERS

33,700
PEOPLE EMPLOYED DIRECTLY IN THE UK STEEL INDUSTRY

42,000
FURTHER JOBS SUPPORTED IN SUPPLY CHAIN AND LOCAL COMMUNITIES

£2.1 bn
DIRECT CONTRIBUTION TO UK GVA

£2.7 bn
INDIRECT CONTRIBUTION TO UK GVA

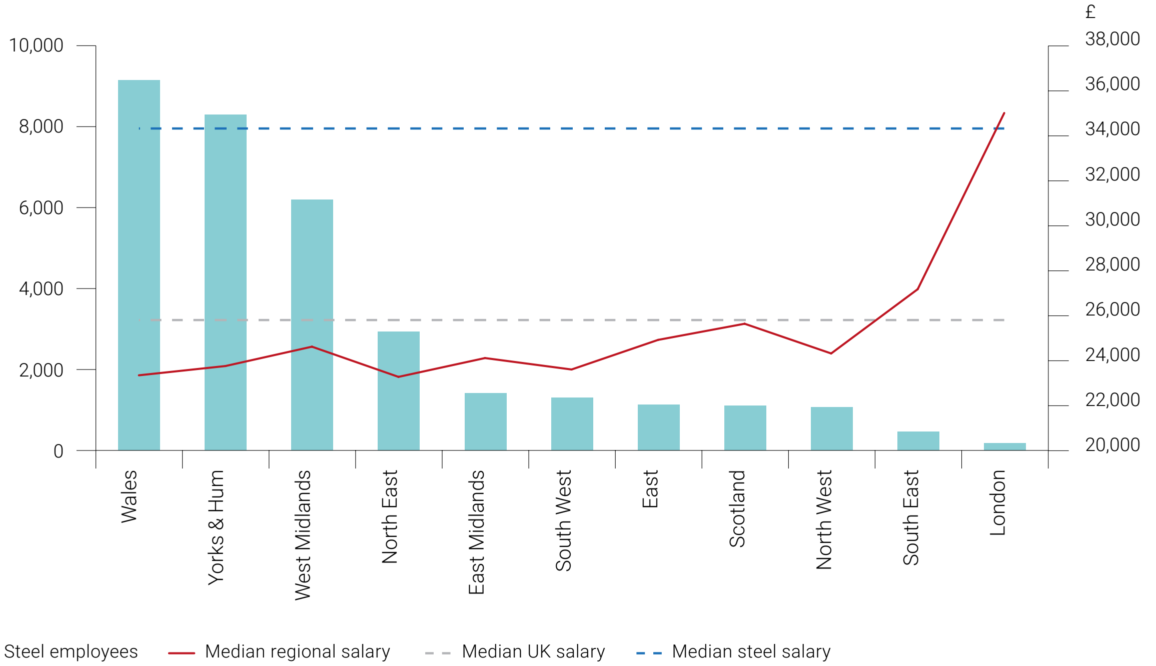
33%
HIGHER THAN THE UK NATIONAL AVERAGE SALARY

45%
HIGHER THAN THE REGIONAL AVERAGE WAGE IN WALES, AND YORKSHIRE & HUMBERSIDE WHERE JOBS ARE CONCENTRATED

7 mt
OF CRUDE STEEL PRODUCED A YEAR, AROUND 70% OF THE UK'S ANNUAL REQUIREMENT

£1.7 bn
DIRECT CONTRIBUTION MADE TO THE UK'S BALANCE OF TRADE

UK STEEL SECTOR EMPLOYMENT AND SALARIES BY REGION



Source: ONS various and UK Steel Analysis

3. STEEL PRODUCTION AND ENERGY COSTS

Steel production is an extremely energy intensive process. There are two principal methods of producing steel: by recycling scrap steel in an electric arc furnace (EAF - Cardiff and Sheffield), which requires large amounts of electricity and more modest amounts of natural gas; or from iron ore using blast and basic oxygen furnaces at an integrated site (Port Talbot and Scunthorpe), which consume large quantities of coal, electricity, and some natural gas. Beyond the steel production itself, significant volumes of energy are used in downstream processes such as rolling, plating, and drawing. Much of this will occur on the same steel site as the steel production itself, but large volumes of steel are further processed at separate locations.

The proportion of the total costs of steel production that are attributable to energy vary significantly, from site to site and from country to country. The World Steel Association has estimated a global benchmark for energy on comprising an average of 20%[2] of the cost of steel production. For integrated sites, the energy components are on average 50% coal, 35% electricity, 5% natural gas and 5% other gases[3]. For an EAF, the figures are approximately 75% electricity and 25% natural gas[4].

An alternative demonstration of energy intensity is used by the UK Government when judging eligibility for various reductions in policy costs, such as renewables levies, added to bills. This requires companies to show that their electricity costs represent at least 20% of their Gross Value Added (GVA - i.e., total economic impact in terms of profit and jobs[5]). With steel companies in the UK demonstrating electro-intensities of up to 120%[6] on this scale, it is clear the detrimental impact high electricity prices are having on profits, investment, and long-term sustainability within the steel sector.

To meet its Net Zero target, the UK needs to decarbonise its industrial production within the next decades, with the Climate Change Committee suggesting integrated steel production should eliminate its emissions by 2035. However, all options for decarbonising the steelmaking process leads to increased electricity consumption. With a sectoral switch to EAFs, the electricity consumption would more than double and increase by five times for the affected sites. Hydrogen-based steel production would more than triple the entire sector's electricity demand (assuming blue hydrogen produced offsite via natural gas steam reforming), but increase the demand of the affected sites by almost 9 times, whilst the application of carbon capture technology could be expected to increase power consumption on a steel site substantially. This makes electricity prices not just a present-day issue, but a problem that will continue to exist in the future. It is highly unlikely that the sector will be able to meet the Net Zero target while remaining profitable if electricity prices are not addressed today.

It is important to point out that when the UK steel sector talks of uncompetitive energy prices, it specifically talks about electricity prices. Coal prices are set on a world market and, excluding state-subsidised coal supplies that some steel companies may be provided with, are broadly the same everywhere. Natural gas prices vary significantly from region to region, with very low prices in the US compared to very high ones in Japan. But with gas making up a smaller proportion of energy input of steel production, and somewhat limited steel trade between the UK and these regions, gas price differentials do not currently play a significant role in the cost competitiveness of UK producers.

It is also worth noting that the common claim that the UK experiences a price advantage with the EU in relation to gas and that this helps alleviate any cost disadvantage regarding electricity, is not supported by the data. Any difference in gas prices is so insignificant that it does not offset the enormous price difference in electricity prices[7].

[2]World Steel Association (2015) *Energy use in the steel industry*
[3]Ibid
[4]UK Steel Climate Change Agreement data
[5]GVA classified as Earnings (Before Interest, Taxation, Depreciation and Amortisation) plus all employee costs
[6]As demonstrated through applications to UK's "Compensation for the indirect costs of the Renewables Obligation and Feed-in-Tariffs" scheme
[7]CREG/PWC (2020), A European comparison of electricity and gas prices for large industrial electricity consumers

4. CAUSES OF DISPARITY

Several underlying factors contribute to the price disparities between the UK and France and Germany that are worth highlighting.

4.1. NETWORK COSTS

Total network costs across all users are similar in the UK, France, and Germany at around €33–36/MWh. However, industrial consumers pay a far higher proportion in the UK, whereas the French and German Governments have chased to reduce network costs for industry[8] recognising both the importance of this to international competitiveness and the vital role large energy users play in balancing the power networks. French and German steel sites examined for this report have networks prices at around £1/MWh compared to £10/MWh in the UK.

As such, a UK transmission-connected steel site faces almost *eight times* higher network charges than their competitors, with distribution connected sites paying almost *ten times* more.

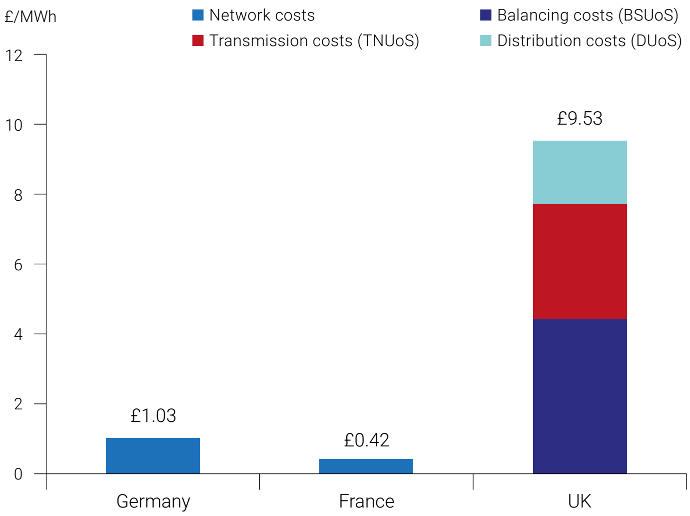
To be clear, the overall system costs for the electricity network are very similar in France, Germany, and the UK. Therefore, the problem does not lie with a more or less expensive electricity network, but how these costs are allocated to consumers.

4.2. POLICY COSTS

UK policy costs, including levies to pay for renewables schemes like the CfD, Capacity Market costs, and carbon prices, are also an important factor in the disparity in electricity prices. Gross UK policy prices are £72/MWh, reduced by exemptions and compensations to £21/MWh. This is higher than the £17/MWh paid by steel companies in Germany and £16/MWh in France, again once compensations and exemptions are applied. The chief reasons for this difference in policy-related costs are detailed as follows:

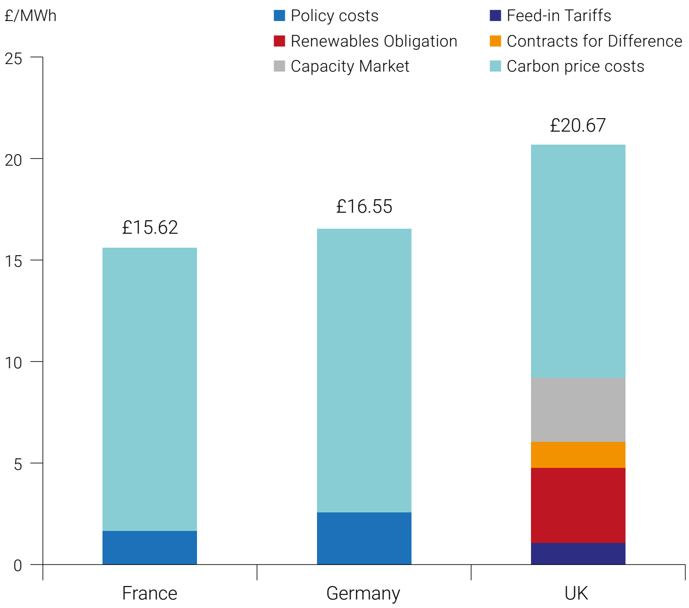
- The German Government has chosen to minimise the costs of renewables levies on its most energy intensive industry. Capping these levies at the equivalent of 0.5% of GVA, provide the equivalent of a roughly 95% exemption from renewable energy costs. UK steel companies meanwhile get a maximum exemption of 85%. Costs of renewables (after exemption) for steel companies examined in Germany are almost £3/MWh compared to £6/MWh in the UK.

Figure 8: Network prices faced by steel producers



Source: UK Steel

Figure 9: Policy Costs



Source: UK Steel

[8]Ibid

- Since 2013, the UK has chosen to have a higher carbon price than the EU – putting in place the Carbon Price Support (CPS) to increase the overall carbon price faced by UK power generators. Some compensation for these costs is provided in all three countries to energy intensive industry, but even taking this into account, the CPS adds a further £3/MWh to the disparity. (This is in addition to its impact on setting the marginal supply, as explained below.) The Government aims to consult on the current compensations provided for the indirect costs of carbon costs and the CPS.
- The UK is one of the few in the world to have a Capacity Market and a corresponding levy on energy consumers to pay for it. This adds a further £3.5/MWh to UK power costs.

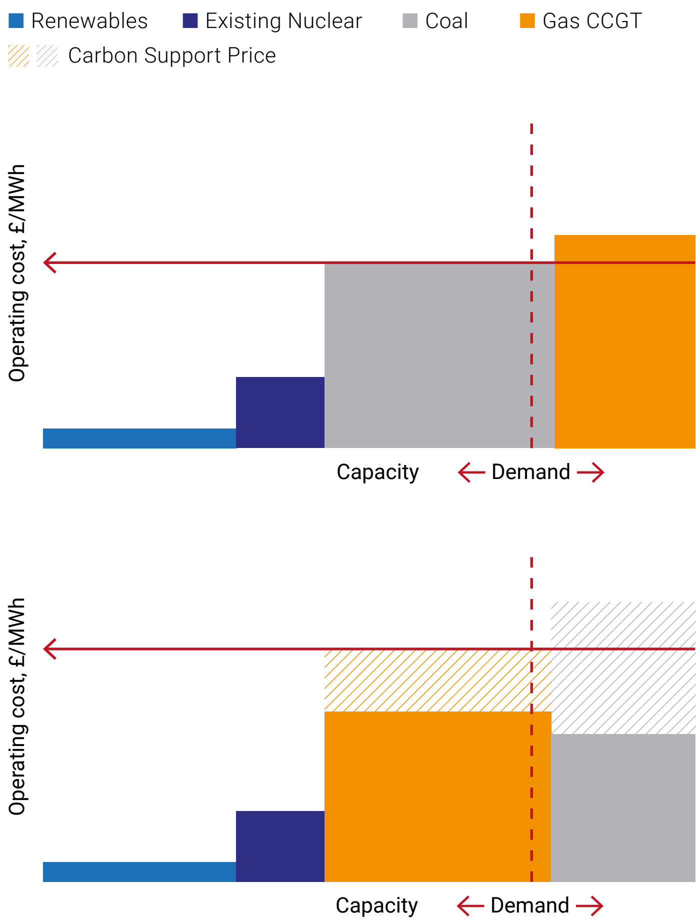
4.3. WHOLESALE COSTS

UK wholesale power prices have long been higher than in Germany and France. This is primarily due to the different power generation mixes in France and Germany, driven to a significant degree by government policy. France has a higher proportion of old nuclear power than the UK, and Germany remains heavily reliant on coal and lignite compared to the gas-dependent UK. Discounting the carbon costs, German wholesale prices this year in August are in the region of £41/MWh compared to £65/MWh for the UK, whilst French wholesale prices are around £47/MWh. It should be noted that previous years' analysis has used the ARENH price of €42/MWh, which some French steelmakers access. However, this year's analysis is based on the wholesale price available to provide a more accurate picture.

The UK's higher reliance on gas, as opposed to cheaper coal, is driven by the UK's unilaterally imposed Carbon Price Support – an additional 'top-up' carbon tax over and above the prevailing carbon price. This increases the UK wholesale costs in two ways: by directly adding to the costs of producing carbon-based power and subsequently by forcing the use of the more expensive fuel gas over coal. The "merit order" determines the power price – the sequence in which power stations contribute power to the market. The market determines that the cheapest mix of power available at any given time will be used to meet demand – the very cheapest plants will be called upon first, with progressively more expensive plants added to the mix until demand is met. The last and most costly plant required to meet demand sets the wholesale price paid to all generators in a market.

As illustrated by figure 10, where supply and demand dynamics set the price for every hour, with a lower operating price, coal is often the marginal supply in Germany, and it determines the clearing price – i.e., the wholesale price ultimately paid by consumers. The UK's introduction of the Carbon Price Support has made the typically more expensive combined cycle gas plant cheaper than coal-fired power stations, due to their lower carbon intensity. This has altered where coal and gas sit in the UK's merit order and ultimately increased the UK's wholesale prices.

Figure 10: Merit order curve, theoretical German and UK wholesale markets respectively



Source: UK Steel

Steelmakers are partially compensated for the costs of the Carbon Support Price passed through in power prices (the diagonal pattern in figure 10), but not for the costs resulting from the change in the merit order induced by the carbon price. Whilst the UK is entirely correct to have been at the vanguard of the move to phase out coal, the UK's approach should be contrasted with that now being developed by Germany. The UK has opted for a tax-based approach, significantly increasing electricity costs, and passing them all on to consumers. Germany has developed a regulated approach and will from 2023 introduce a "reasonable" annual grant for energy intensive companies for additional electricity costs to protect their international competitiveness[9].

The UK separation from mainland Europe means it also has a low level of interconnection compared to its European neighbours[10], constraining our ability to import low-cost electricity. The UK's 5GW of interconnectors is equivalent to 6.5% of domestic generation capacity[11], compared to 10% for France and Germany[12]. Several new interconnectors are currently being built and in the planning stage, this will ultimately help reduce UK wholesale prices, but it will take considerable time. In previous UK Steel reports on the electricity disparity, we have referenced virtual interconnection policies that certain EU countries have imaginatively employed.

[7]Pressemitteilung, Nummer 21/20 vom 16. Januar 2020, Bund-/Länder-Einigung zum Kohleausstieg, https://www.bmwi.de/Redaktion/DE/Downloads/B/bund-laender-einigung-zum-kohleausstieg.pdf
[8]Grubb, M., & Drummond, P. (2018). UK Industrial Electricity Prices: Competitiveness in a low carbon world. UCL Institute of Sustainable Resources, https://www.ucl.ac.uk/bartlett/sustainable/sites/bartlett/files/uk_industrial_electricity_prices_-_competitiveness_in_a_low_carbon_world.pdf
[9]BEIS 2020, Digest of UK Energy Statistics, Chapter 5 Electricity, July 2020
[10]Grubb, M., & Drummond, P. (2018). UK Industrial Electricity Prices: Competitiveness in a low carbon world. UCL Institute of Sustainable Resources, https://www.ucl.ac.uk/bartlett/sustainable/sites/bartlett/files/uk_industrial_electricity_prices_-_competitiveness_in_a_low_carbon_world.pdf

5. BENEFITS TO THE ENERGY SYSTEM

Germany and France provide lower network charges to their energy intensive industries due to their value to the energy system, which is not recognised in the UK to a similar degree. Steel producers can provide flexible electricity demand, in either two forms: Sites with batch processes can provide binary flexibility (on or off demand), whilst sites with continuous processes provide non-binary flexibility (modulating demand).

The sector reduces the need for system reinforcement through their flexibility, whilst their significant baseload demand raises average network demand and can increase demand if they receive signals of the grid requirement, supporting efficient network use. The demand management occurs due to the price signals received, whether these are wholesale market-driven, or from regulated system charges (TNUoS, DUoS, Capacity Market). However, recent decisions by the regulator, Ofgem, will remove or reduce these price signals, which may disincentivise the use of industrial flexibility and increase overall costs for EIIs.

Furthermore, steelmakers have flatter and more predictable demand profiles than domestic users. They also consume relatively more electricity in the periods it is most helpful to the electricity grid, notably overnights and summer daytime periods. In these periods, excessively low transmission system demand drives record levels of change of frequency and constraint management expenditure by the Electricity Systems Operator (ESO). Baseload steel customers help moderate this expenditure. The network charging regime should recognise the vital contribution baseload steel producers make to moderating constraint and change of frequency costs by the ESO. There is currently no recognition of this contribution in either transmission or balancing charges.

Competing jurisdictions in mainland Europe recognise that baseload electricity users entail reduced system costs compared to domestic users' higher peaking demand levels. The German Government notes that "*The high predictability of baseload electricity consumption reduce[s] the need for balancing electricity and reserves as well as the need for re-dispatching. In general, the high predictability facilitates network planning and maximises the use of the generation fleet*"[13]. The German regulators expressly recognise this system benefit in the form of lower network tariffs for large baseload users than their less predictable, peakier, domestic counterparts. Similar principles should be adopted in the charging regimes in the UK.

[11]European Commission (2018), Commission Decision Of 28.5.2018 on Aid Scheme, SA.34045 (2013/c) (ex 2012/nn), section 69, https://ec.europa.eu/competition/state_aid/cases/247905/247905_2014230_596_2.pdf

UK Steel is the trade association for the UK steel industry and champions the country's steel manufacturers.

We represent the sector's interests to government and promote our innovative, vibrant and dynamic industry to the public.

Together, we build the future of the UK steel industry.

For more information, please contact:

Frank Aaskov
Energy & Climate Change Policy Manager
faaskov@makeuk.org
0207 654 1506

MAKE uk
The Manufacturers' Organisation

MAKE VENUES UK STEEL

MakeUK.org

Make UK is a trading name of EEF Limited Registered Office: Broadway House, Tothill Street, London, SW1H 9NQ. Registered in England and Wales No. 05950172