A brighter future for UK steel, August 2023

Methodology

Future projections of demand

Future projections of demand for steel are based on the government's own assessments published in 2017, but with some significant modifications to account for recent trends in demand and the potential for additional demand from net zero.[1]

The demand for finished steel in 2022 is taken from UK Steel statistics, and it is assumed that the relative share of demand amongst end sectors is the same as in 2015 from the government's analysis.[2] Before applying the relative share of demand, the demand for the automotive sector is modified because the government estimates were calculated based on a local content factor of 35 per cent meaning that it did not capture the UK automotive sector's actual demand for finished steel but rather how much of it was currently supplied from the UK steel sector.[3] After correction, the government's demand figures for 2015 are in line with official figures from UK Steel for that year, justifying this change.

The projected demand in 2030 is composed of this 2022 demand, modified for two growth scenarios, and an additional contribution to demand from net zero, which was not included in the original government analysis. The correction for the automotive sector is made for the 2030 demand as above, using the same local content factor. The growth scenarios, high or low, are either zero per cent year on year growth (corresponding to the average growth between 2015 and 2022 based on UK Steel) and one per cent, which is the average year on year growth in steel demand assumed in the government's analysis.[4] In the high growth scenario, because the 2022 demand is lower than in 2015 and because we assume the one per cent growth over a shorter time period, the demand in 2030 (not including net zero) is still lower than in the government's analysis (9.4 million compared to 11 million).

The additional net zero demand is based on estimates of the annual steel requirements to meet government targets for renewables, nuclear, carbon capture, utilisation and storage (CCUS) and hydrogen from the energy security strategy, with the total steel needs split equally between now and 2030.[5]

The steel intensity of renewables is taken from the EU Commission while the steel requirements for nuclear, CCUS and hydrogen are taken from industry estimates.[6,7] This additional energy demand is categorised under 'energy' except for nuclear, which is listed under 'construction' to be consistent with the categorisation in the original government analysis.[8] 'Energy' is a new category that consists of 'oil and gas' from the original analysis combined with the net zero energy demand. In addition to this, there is additional steel demand from net zero infrastructure in both the energy and transport sectors. This demand is estimated from the International Energy Agency (IEA) net zero steel roadmap (figure 2.3 in that report), assuming that the UK steel needs in this area are proportional to global needs.[9] This contribution to demand is listed under construction. Overall, there are an additional 1.1 million tonnes added to the 'energy' demand with 0.5 million tonnes added to 'construction' demand by 2030, resulting in a total demand of 11 million tonnes under the high growth scenario. The additional net zero demand we model represents the maximum level of domestic demand, assuming that UK manufacturing produces the final steel products rather than these being imported from overseas.

To these demand scenarios, the effect of material efficiency is then added (see below).

The projections for 2050 demand are based on continuing these growth scenarios forward as follows: in the low growth scenario, only the net zero demand grows at one per cent per year while rest of the demand stays the same from 2030, while in the high growth scenario, both the net zero demand and rest of the demand both grow at one per cent per year.

One per cent year growth for net zero steel requirements is justifiable because, although most of the steel will be needed in the early years of the transition as the power sector decarbonises (our modelling estimates the growth rate to be two per cent year on year between 2022 and 2030), there will still be significant need for steel up to 2050, albeit at a slower rate. This modelled reduction in steel demand compares well with the Climate Change Committee's (CCC's) estimates for the capex spend required in the power sector up to 2050 in the sixth carbon budget modelling.[10] The 2050 demand is not split by sectors because the long time scale means that the splits in demand are difficult to estimate with any certainty, but it gives an indication of the overall size of the demand.

Material efficiency impact on demand

The future demand scenarios also include the effect of material efficiency, which has been modelled based on the IEA's net zero steel roadmap, which maps out the impact of the material efficiency measures on global demand for steel in 2030 and 2050 (figure 2.3 in the IEA's report).[11] The relative impact of each of these measures is determined compared to total global demand and then these factors are applied onto the total demand calculated above for the UK in 2030, after the net zero demand has been added. The impact of building design on material efficiency is modified from the IEA roadmap estimate of three per cent to five per cent, as per the underlying data from the *Circular construction* report, which is specifically targeted at the UK and, therefore, provides a more accurate estimate.[12] It is assumed, due to its developed industrial base, that the UK is able to apply material efficiency measures at a faster rate than the global average and, therefore, it is able to reach the 2050 global rates of material efficiency in 2030. This corresponds to the 'high material efficiency' scenario in the graphics presented in the report.

In the future demand scenarios, we model this scenario along with a 'low material efficiency' scenario that corresponds to no improvement to material compared to current practices. Note that we define material efficiency as any measure that enables the provision of the same material service with less material. Therefore, the material efficiency in this study includes both material efficiency in the steel supply chain that reduces waste in production but also efficiency improvements made by the buyers or users of the steel that enable the provision of the same service while using less steel, eg by extending the lifetimes of products or shifting to greater sharing of products.

In the graphic showing impact of material efficiency on steel demand on page 13, the material efficiency categories from the IEA analysis are combined and simplified for ease of comprehension. 'Steel making, processing and fabrication' includes both 'improved semi-manufacturing yields' and 'improved product manufacturing yields' from the IEA categorisations.[13] 'Building design and life extension' includes both 'building design' and 'longer building life'. 'Vehicle lightweighting and use efficiency' includes 'lighter vehicles' and 'reduced vehicle use'.

Overall UK material efficiency potential for the UK in 2030 is determined to be 25 per cent, and globally it is 12 per cent. The global figure is obtained by modifying the IEA estimate for 2030 slightly as per the corrections made above to building design such that the original ratio between the 2050 and 2030 values from the IEA analysis is kept the same. These are used to estimate the emissions savings potential of material efficiency (see below).

UK capacity vs future demand

The future demand from the 'high growth, low material efficiency' and 'high growth, high material efficiency' scenarios are plotted against current capacity, both in terms of crude steel and finished steel. The demand values plotted are the same in both cases, except in the case of crude steel we only plot against the total demand for the three general categories of finished steel. The relative demand for different finished steels in these scenarios is estimated based on the relative share of demand for different steel types in 2030 based on the government's original analysis in 2017.[14] Therefore, we assume that the changes we have made to the demand profile above, such as from net zero, do not significantly change the relative demand for different types of finished steels.

The current capacity figures for finished steels in the UK steel industry are taken mainly from table 1 in appendix 4 of the government report on UK steel capabilities, but with the capacities revised based on the closures of plants since then.[15] Crude steel capacity for the UK steel industry is taken from Ember data.[16] Different steel types are categorised into 'flat', 'long' or 'other' based on the definitions in the government's report, with other containing stainless steels, engineering steels, seamless steel tubes and open die forging. While crude steel can in theory make any of the finished steels, UK plants are typically set up to produce steels in one of these three general categories. It is assumed that each UK crude steel plant produces steel that falls into one of these categories eg Port Talbot produces only flat steels and Scunthorpe only produces long steels. To aid comprehension, some of the finished steel categories are combined in the final figure: 'treated coil' includes both 'coated' and 'tinplate'; 'bars and rods' includes 'rebars', 'wire rods' and 'merchant bars'; and 'sections' includes light, medium and heavy sections.

The percentage demand that can be met with current capacity is obtained from calculating the gap between capacity and demand for all finished steel types (ignoring any excess capacity), summing this up, and dividing by total demand in that scenario. The percentage demand that can be met is one minus this value. The same calculation is repeated for crude steel production based on the more general categories of finished steels.

Primary iron required to meet UK steel demand in 2030

The estimate of how primary iron would be needed relative to scrap steel to meet UK steel demand in 2030 is based on assuming that only flat steels (not 'long' or 'other') required additional primary iron, which is reasonable if following best practice; and that there is access to high quality scrap. In particular, coated and tinplate flat steel products, which are used in the automotive and packaging industries, have typically required additional primary iron when produced; industry analysts suggest that this can be up to 80 per cent metallics for these steels.

Based on data from US electric arc furnace (EAF) producer Nucor that uses an average of 60 per cent scrap and 40 primary iron (either from direct reduced iron or pig iron) for flat (or 'sheet') steels, it is assumed that a future UK flat steel EAF plant can operate similarly.[17] Because flat steels correspond to 51 per cent of 2030 demand in the high growth scenario, it means that, to meet overall demand, around 21 per cent primary iron is needed, with 79 per cent of iron coming from scrap. This calculation assumes that UK and US flat steel plants produce a similar range of products and, therefore, that the share of coated and tinplate steels are similar. Based on using the 80 per cent value for metallics share of automotive steels, produced via EAF and the UK share of demand for coated or tinplate steels only in 2030 (27 per cent), you also reach a value of 21 per cent primary iron to meet total UK demand, giving good confidence in this result.

Emissions impact of material efficiency

The emissions savings impact of material efficiency is calculated both in terms of the UK consumption emissions and UK production emissions for steel. The consumption emissions include emissions in imported steel containing products and, therefore, correspond to emissions from 'true' steel demand. However, for simplicity, only scope 1 and 2 emissions are considered.

Under the partial decarbonisation scenario, it is assumed that the UK decarbonises as per the scenario in our report *Building the future* (0.9 tCO_2e/t steel in 2030) and, therefore, has replaced half of its remaining blast furnaces with EAFs by 2030.[18] It is referred to as partial decarbonisation because we do not expect the UK industry to fully decarbonise by 2030. In terms of imported steel emissions, we assume that the global steel industry decarbonises following IEA's 'sustainable development scenario' (1.5 tCO_2e/t steel in 2030) in its net zero steel roadmap.[19]

Under the 'material efficiency only' scenario, we assume that the steel emissions intensity in the UK and globally remain constant at 1.65 and 2 tCO_2e/t steel respectively.[20] Under the material efficiency scenarios, it is assumed that they have greater potential within the UK than globally on average by 2030: 25 per cent reduction in UK vs 12 per cent reduction globally (as discussed above). We assume that UK steel production remains at 2019 levels (7.2 million tonnes per annum) under business as usual in 2030 constant at to be consistent with our modelling in *Building the future*.[21] Therefore, we assume that UK steel production is not directly correlated with reductions in UK demand due to the ability of the industry to increase exports. However, because we assume that the global steel industry also faces reduced demand due to material efficiency, albeit at a slower rate, we assume that this places a limit on the UK's ability to export. Therefore, UK steel production reduces by the global material efficiency factor under the material efficiency scenarios.

The consumption emissions are based on assuming that the UK's share of true demand (including imports of steel containing products) remains constant at 21 per cent, which is the average value over the years 2015-2022, and that steel imported in products remains at 2022 levels in 2030.[22]

Endnotes

[1] Department for Business, Energy and Industrial Strategy (BEIS), 2017, *Future capacities and capabilities of the UK steel industry*
[2] UK Steel, 2023, *Key statistics guide May 2023*
[3] BEIS, 2017, op cit
[4] Ibid; and UK Steel, 2023, op cit
[5] HM Government, 2022, *British Energy Security Strategy*
[6] S Carrara, 2020, *Raw materials demand for wind and solar PV technologies in the transition towards a decarbonised energy system,* European Commission
[7] L Phillips, 30 December 2022, 'Tata Steel: "Britain will need 10 million tonnes of steel to be energy self-sufficient', BusinessLive
[8] BEIS, 2017, op cit
[9] International Energy Agency (IEA), 2020, *Iron and steel technology roadmap*
[10] Climate Change Committee, 2020, *The sixth carbon budget*
[11] IEA, 2020, op cit
[12] L Peake, et al, 2023, *Circular construction: building for a greener UK economy*, Green Alliance
[13] IEA, 2020, op cit
[14] BEIS, 2017, op cit
[15] Ibid
[16] Ember, 2020, 'UK steel production dataset 2020'
[17] Nucor, 2022, *2021 recycled content averages for Nucor steel mill products*
[18] V Viisainen et al, 2022, *Building the future: a faster route to clean steel,* Green Alliance
[19] Ibid
[20] IEA, 2020, op cit; and UK Steel, 2022, *Net zero steel – a vision for the future of UK steel production*
[21] UK Steel, 2023, op cit
[22] Ibid