UK STEEL
Powered by MAKE uk

The Economics of Integrated Steel Plants

Background briefing for Trade Remedies Authority visit to Port Talbot

What is an integrated steel plant?

This term refers to a plant that makes steel from virgin raw materials and produces hot rolled steel products. Hot rolling is the first stage of processing to produce products that are sold to other industries. Further downstream processing may also take place on integrated steel sites.

Why "integrated"?
The site comprises a complex set of interlinking processes. These are:

- Iron ore and coal unloading, preparation and storage facilities.
- Coke ovens, where coal is "cooked" to produce coke. "Waste" process gases are collected for combustion in other processes.
- The sinter plant, where fine particles of iron ore are heated and combined with other minerals to produce larger "lumps" of ore suitable for charging to the blast furnace.
- The blast furnaces, where the iron ore, coke and limestone are chemically reduced, using a blast of hot air at temperatures of between 1,000°C to 1,200°C, to produce liquid iron (known as *hot metal*). This is a continuous process. "Waste" process gases are collected for combustion in other processes.
- Basic oxygen steelmaking. The liquid iron is poured into a steelmaking vessel, where oxygen is blown in to remove impurities, and other minerals added, to produce liquid steel. Scrap steel is also added at this stage. "Waste" process gases are collected for combustion in other processes.
- Secondary steelmaking. The chemical composition of the liquid steel is fine-tuned through further processing and/or the addition of other minerals.
- Continuous casting. The liquid steel is cast into a machine which both shapes and cools it simultaneously to produce a solid semi-finished product (at Port Talbot, these are *slabs*.)
- Hot rolling. The slabs are re-heated to between 1,000°C and 1,270°C, and are then fed through a series of rolls to produce the first usable steel product (at Port Talbot, this is *hot rolled strip*, in coils). Controlled cooling also helps fine-tune the steel's metallurgical properties.

The site is thus “integrated” in two ways:

1. Several separate processes must knit together to form a single plant. Keeping the capacities of each of these processes in balance with the needs of the whole is key to the economics of the plant.
2. Combustible “waste” process gases are piped around the plant to be used in other processes, again optimising efficiency, but also emphasising the inter-dependence of those processes.

Downstream
The hot rolled coil may also undergo further downstream processing, although not all this processing necessarily takes place in Port Talbot. These processes include:

- Annealing. A heat treatment process to improve the steel’s ductility.
- Pickling. An acid treatment to remove impurities.
- Cold rolling. Rolling the steel without heating it to increase its strength and hardness.
- Metallic coating (such as *galvanising* or *tinplating*) – coating the steel with another metal to increase its corrosion resistance.
- Organic coating (such as painting).

Size

Economies of scale are a key consideration. The blast furnace is the cornerstone of the plant, and the size of modern, efficient blast furnaces dictates that the minimum capacity for a competitive integrated steel plant is 3 to 4 million tonnes a year.

It will also be recalled that blast furnaces run continuously. The refractory linings of both the blast furnaces and other high temperature processes (notably the coke ovens) will be destroyed if allowed to cool. The ability to adapt to changed market conditions by reducing output volumes is thus severely limited by the nature of the processes.

Capital intensity

In visiting an integrated site like Port Talbot, it is impossible not to be struck by the capital intensity of the plant. This in turn means that fixed costs are unusually high. The UK steel industry spends around £180 million a year across six plants just to keep operating. Typically, an integrated steel plant will need to run at around a 70-75% capacity utilisation rate before it will break even and begin to operate profitably.

Thus both the processes themselves, and their economics, require the plant to run at consistently high output levels.

Product range

Port Talbot makes a large number of different grades of steel, ranging from the relatively simple grades used for some construction applications, to the highly sophisticated grades needed to make automotive bodies or one-piece steel cans.

The question sometimes asked is: why doesn't Port Talbot focus just on these high added value grades? The answer is that the UK market for these grades is simply not large enough to sustain Port Talbot. (The same is true of the EU market as a whole, when account is taken of the number of competitor plants operating in Port Talbot's product range.) Also it is not feasible to make just one product all the time – switching between products will inevitably result in lower grade 'in between' products being made as during the transition from one product to another.

In order to remain competitive by maximising its output, Port Talbot must continue to sell the full range of product grades. Only by operating at close to full capacity can the plant keeps its **average** fixed and variable costs per tonne of output down at competitive levels. If it were to focus solely on its more sophisticated grades, the **average** cost of producing those grades would rapidly price it out of the market.

Effect of import competition

Non-EU imports tend to be concentrated in the lower end of the product range. This is partly because many third country producers find it more difficult to produce the more sophisticated grades. Another factor is that the logistics of importing from third countries means that importers are more likely to sell to stockholders (and thus sell only the grades that stockholders specialise in) than invest in the levels of customer support and service required for selling sophisticated steels directly to end-users.

However, this does not reduce the injury suffered from dumped or subsidised imports by plants like Port Talbot:

- The loss of lower grade sales volumes would impact on the profitability of Port Talbot's entire product range – for the reasons explained above.
- Low-priced competition in the lower end of the product range will affect the market price across the whole range – particularly in the stockholder market. (Some 60-70% of the steel consumed in the UK is sold through stockholders.) Thus the revenue impact is felt even on grades where these is little or no dumping.

Are there not alternative process routes?

The main disadvantage of the integrated route is its relative inflexibility – its inability to adapt to market developments through short term output adjustments.

The alternative steelmaking route is the electric arc furnace (EAF). This is less capital intensive, comes in smaller units, does not rely on imported raw materials, and can more easily be flexed in response to market changes. This route uses electricity to melt either pre-processed iron (e.g. *direct reduced iron - DRI*) or scrap steel. In the UK, all EAFs use scrap.

However, the EAF is not suited to producing sophisticated steels like those used for automotive bodies. The EAF process does not remove all impurities when scrap is used as its feedstock – most notably copper, which adversely impacts on ductility. This can be mitigated through very close quality control of the scrap used, which in effect means only using scrap that has come directly from a steel user's production line, where the grade of steel being used is known and documented. There are insufficient sources of such scrap in the UK to even begin to meet the needs of a plant the size of Port Talbot.

The required quality can also be secured through the use of pre-processed iron as a feedstock. The most common is DRI. The production of DRI is however only competitive where there is an abundant supply of cheap natural gas.

One further factor is that the quantity of scrap steel entering the market (when the product from which it is made reaches the end of its life) is a function of the volume of steel consumed between one and 20 or even 100 years ago. As long as global steel consumption continues to grow there will never be enough scrap available on the market to match the demand for new steel. Integrated steelmaking, of necessity, must provide the bulk of the world's steel needs, and will continue to do so for the foreseeable future.

Thus if the UK is to continue to produce the types of steel made by Port Talbot, there is no practical alternative to integrated steelmaking.

Contribution of the steel industry to the local economy

Steel industry redundancies have a disproportionate impact on the local economy compared with many other sectors.

- Steelworkers are well paid for their skills, with wages well above average levels. The average wages in the steel sector were c. £37,000/yr. last year, some 28% above the UK national average and 46% higher than the Wales average.
- For every person directly employed in a steel plant, there are many more people indirectly "employed", as contractors, suppliers and local businesses dependent on steelworkers' custom. Port Talbot site directly employs around 4,000, but a further 2-5 jobs are supported in supply chains and local communities by the site.
- Steel plants are located in some of the most deprived regions of the UK. The chances of alternative employment are slim, and of finding jobs with comparable wage levels even slimmer.

For further information contact:

Richard Warren
Head of Policy & External Affairs, UK Steel
07825 533945
rwarren@makeuk.org