The Whys and Hows in the Greening of Steel?

Steel – an energy intensive product

Steelmaking uses several energy-intensive production processes. Most of the energy needed comes from fossil fuels; this is particularly so with the blast furnace-oxygen converter, through which about two-thirds of the world's steel is currently made. Other processes using DRI and/or the EAF mini-mill route are less dependent on fossil fuels, but still quite energy heavy.

Taking a broad perspective, this dependence on fossil fuels is a major threat to the steel industry. Energy supplies and consumption are both facing enormous challenges; indeed some might say the sector is in turmoil. Critically there are concerns about carbon dioxide emissions from burning fossil fuels and the associated changes in the world's climate. Whilst the implications of rising CO2 atmospheric concentrations are now accepted by virtually all governments, to date their responses have been mixed and some might say muddled. Iron and steel is one of the largest heavy industrial sources, producing some 5-8% of the world's man-made CO2 and so has a vital stake in the way governments respond.

Other significant world energy issues include new cheaper sources of fossil fuel, such as shale gas, the costs and safety of nuclear energy, peak oil, the fragility of many oil supply chains, and the cost of renewable supplies. On the consumption side, the inefficiency with which most energy is used, whether in the home, transport or industry is also critical. Some say the cost of energy is too low; many steel producers say it is too high.

The impact of climate change is felt in different ways, by different industrial sectors, in different countries. Thus the insurance sector is gradually waking up to the ways in which global warming is contributing to more climate extremes, rising sea levels/coastal flooding, as well as perhaps more natural disasters, such as hurricanes. If nothing else, this trend will threaten many new steel mills, which are being located on the coast to reduce the cost of iron ore shipments.

Some other commentators focus on the role of transport including cars and the importance of light-weighting, whilst many are looking at technical changes, such as CCS (Carbon Capture and Storage). Most steel companies in emerging markets reflect the position of their governments and say the issue is largely one for the rich OECD countries; yet in iron and steel, the latter's role is probably declining as much of the growth in steel production in recent years has been in developing countries.

The iron and steel industry has generally stayed on the sidelines of these debates, but given the longevity of its capital investments (typically 50 years plus), it now needs to come to terms with

(1) its energy-intensive production processes
(2) the strong likelihood that the price of CO2 emissions will rise over the next decade.... and the implications for international trade
(3) its raw materials supplies
(4) the inefficient way its steels are mostly used
(5) the various ways CO2 emissions are measured (including life cycle assessments)

This conference will address these and other issues.

Governments

The recent intergovernmental conference in Durban, South Africa surprisingly agreed that the United Nations Kyoto Protocol, adopted in 1997, and which came into effect in 2005 would continue beyond 2012, whilst a successor treaty is negotiated. In this sense, it remains the international framework for addressing climate change, despite the USA, Canada, Russia and Japan saying they will not participate in the 2013-2017 extension. A few years ago, there was also talk of a global sector-wide steel agreement covering the industry's emissions, but SBB understands there were too many conflicting points of view at the time for this to be negotiated.

Many believe the Kyoto Protocol has been ineffective as global CO2 emissions have not declined and the price of CO2 allowances has halved recently. However the agreement was only intended to control emissions from industrialized countries, and to this extent it probably has achieved the desired outcome (though mainly due to the 2008 recession). The current price is around €8-9/tonne ($10-12/t) of CO2, half the level of mid-2011. Whilst some in the industry maintain that a price of €50/t is needed to bring about change, carbon analysts suggest that the price may rise to only €15-20/t by 2020.

The European Union's Emissions Trading System (ETS) provides the world's largest market for carbon. Its stated purpose is to cap the carbon emissions of the EU's 11,000-12,000 regulated companies (including around 100 or so steel companies), and give them an incentive to invest in cleaner technologies. Due to the recent slow economic growth, EU emissions have fallen. This means its power and manufacturing sectors currently do not need all the permits that are available, pushing down their price.

The EU also has separate proposals to raise the region's energy efficiency goals; if these go through, and ultimately succeed, they would further increase the oversupply of permits. Though phase 3 of the ETS, due to start in 2013, will – in theory - require EU companies to buy additional permits to emit above their cap, many of the region's steel producers have "banked" or stockpiled significant numbers of unused allowances from recent years.

To raise the carbon price, the European Parliament is currently considering a proposal to withhold or set-aside a certain volume of permits from the market, which could lift prices to €15-30/t. Steel producers are fearful that these new measures would make its finished products increasingly uncompetitive in the global market, as there is a physical limit to how much they can reduce emissions. Others note that many of the companies in the sector could still make substantial improvements in efficiency and thus lower their emissions.

To combat the loss of competitiveness some politicians have spoken about taxing finished steel imports and giving rebates on exports, perhaps along the lines of VAT. The EU steel industry has been opposed to this as it fears other governments would adopt countermeasures against its exports, as well as take an anti-subsidy case to the World Trade Organisation. The EU airline industry is at present involved in such a brawl.

More generally, other central and local governments in other parts of the world talk variously of placing a tax on carbon and/or enforcing energy efficiency reduction targets. Australia recently introduced a cap and trade system with a floor starting at A$23/t (US$24/t) in the summer. Its steel industry sought and achieved quite large subsidies to help it meet the government's emission-cutting goals.

The decision at Durban to extend Kyoto, with the tacit backing of countries such as India and China also means that other ancillary sources of permits such as CDMs, and JI will continue. From carbon-reducing projects in emerging markets, these generate other types of permits, which are traded alongside the ETS allowances (which are also known as EUAs).

Moreover governments are looking to reduce energy consumption in other ways. The European Commission has set clear targets for reduced car emissions. Overall EU auto manufacturers must achieve a CO2 emission target of 130g CO2/km by 2015 as an average value for new car fleets; this target is to be phased in from 2012. World Auto Steel, sponsored by many steel manufacturers, is responding by developing lighter and stronger steels. Similar policies have been introduced in other countries, such as Japan, Canada and the United States.

The SBB Berlin conference will discuss these and related issues, such as

(1) The post-Durban CO2 global emissions environment
(2) The future price of carbon emission allowances
(3) Auctions, benchmarking and offsets post 2012 in the European Union
(4) National developments in countries such as China and Australia, Korea and Japan

Companies

What are steel producing and steel using companies doing? Some are doing nothing, whilst others are investing in new technologies, raw materials and/or production locations. As the R&D into new production technologies is mostly in the OECD countries, where the steel sector is currently facing low growth and low profits, their adoption has been slow. Cost-saving approaches involving the reduced use of steel by downstream users have yet to be widely adopted.

Increased use of scrap and to a lesser extent DRI is a strategy that some OECD steel mills can and have adopted, particularly in 2011 when iron ore/molten iron/pig iron costs were very high. Scrap is seen by many as “low hanging fruit,” so that its availability may diminish and its price rise. This may well threaten EAF producers dependent on scrap, such as those in Turkey and Korea. Other integrated steel producers may be increasing the use of lump ore or pellets, as met coal sinter plants are fairly energy intensive: they are approximately responsible for 20% of the emissions from a blast furnace/BOF operation.

The EU steel producers’ ULCOS (Ultra Low CO2 Steelmaking) project focuses on the 80% of emissions that come from iron making in an integrated plant. To date, only one technology – Hisarna, at Tata Steel’s IJmuiden site in the Netherlands – has reached the pilot plant stage. ArcelorMittal is looking to set up a demonstration plant for a ULCOS-BF unit using less coke (a so-called top gas recycling blast furnace) at Eisenhüttenstadt in eastern Germany in 2013-2014. Both of these projects potentially include CCS. Companies in other regions, such as Posco in Korea and Emirates Steel in Dubai are understood to have their own projects underway.

WellMet 2050, a UK initiative, has been concentrating its research on reduced use of steel. Not only are many steel products made inefficiently, creating a large amount of scrap metal which must be re-melted to be re-used, products are also not designed to use the minimum amount of steel. Many sections for construction could be redesigned to be only about 70% of their current weight while retaining the same

mechanical properties, they estimate. Some of these products could also be reused at the end of their life without the need for energy-intensive re-melting, they say.

Half the world's steel is used in construction, with rebar as the major product. Finished steel production is estimated to be currently around 1.3-1.4bn t/y, including 200-300m t/y of rebar. Most of this is commodity grade with a low tensile strength, requiring significant tonnages to reinforce concrete. Worldwide increasing its strength to 450 MPa or higher would reduce the volumes consumed by a possible 10-15%.

The late April meeting on green steel will examine these and related issues. In particular, it will cover:

(1) New steel-making technologies
(2) Alternative raw materials
(3) New steel products for a low carbon economy eg renewable energy supplies
(4) Finance and the transition to green steel making

SBB Green Steel Strategies

The SBB/Platts' conference on Green Steel will look to the future. To what extent will the global economy 20-30 years hence be supportive for steel, given its high CO2 emissions?

To reduce the impact of global warming, the world needs to bring about a step change in both the way it produces and uses energy. As part of this process, most climate scientists and pressure groups would like to speed up the current pace of economic change, and in this they are supported by many in the European Commission, most EU governments and a number of other countries. Others reject any need to reduce CO2 emissions. These different positions make predictions on the likelihood and speed of change difficult to judge. However the cost of making changes now is seen by many as less than the cost of delayed action.

Life cycle analysis shows many high-value steel products are relatively environmentally friendly compared with competing materials in certain specific end-uses, such as automotive. But in construction which is a much larger end-user, how will steel become "green" and stay competitive?

Producers need to begin to strategize on whether their products should be modified and how the supply chain may need to be restructured. For example should the ownership of the steel be retained by the producer, which would process it according to the consumers' needs and then reclaim it at the end of its life? Thus the volumes, qualities and use of manufactured steel products will be more closely tailored to the needs of the user, as well as to the producer/recycler. In this way, steel products would also no longer be "consumed," but simply rented for a number of years.

This strategy might not benefit the world's iron ore and coking coal miners, but would encourage today's steel producers to have a greater understanding of their downstream supply chain and would reduce, at least to some extent, the industry's CO2 emissions. New production technologies, focusing on recycling, would complement such changes.