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Five steps to overcome steel industry challenges

German group Badische Stahl-Engineering has complied a database which compares the technical situation and cost performance of a number of EAF steel plants across the globe. The database could help steel companies overcome the challenges which BSE predicts businesses will face. **By C Pfundstein*, Dr M Fleischer** and S Baumgartner*****

UNTIL the end of summer 2008 the steel market was booming, a consolidation process had taken place and companies were in profit. The steel industry was among the most profitable of industries. Today, almost every steel company is struggling with the impact of the financial crisis although industry analysts are confident the situation will improve in the next few months. But executives and managers will still have to face challenges in future years. We see five major challenges for the industry and each company has to cope with these.

- Lack of qualified personnel. Companies will have to fight hard to attract qualified personnel and will also have to invest in staff training to remain competitive.
- Achieving operational efficiency. It is an everlasting story, to achieve a highly efficient production with a high yield and a high productivity to fully utilise the given capacity without compromising on work safety.
- Exploiting profit opportunities. Improved return on assets by exploiting hidden profit opportunities across the company.
- Successful raw material management. Securing sufficient raw materials at the right price without negatively impacting on the production process.
- Environmental protection. Complying with politically set performance data while still being able to stay competitive.

This paper describes the challenges of the steel industry in detail and presents examples of how to overcome them successfully. The examples are based on data either from the Badische Stahl-Engineering (BSE) Best Practice Database or of BSW Badische Stahlwerke, Germany, one of the most productive EAF-steelmaking facilities in the world. The BSE Best Practice Database is a benchmarking tool, which compares the technical and cost performance of more than 80 EAF steel plants and 80 long product rolling mills around the globe. It shows best practice examples per region, steel grade or section and also gives information about the general performance of the steel industry.

Five years ago BSE started the Best Practice initiative. The intention was to gain a better understanding of how cost and productivity are linked. A database was developed to compare the technical performance and cost situation of steel plants and rolling mills from all over the world.

Understanding productivity and cost

The company wanted to understand if productivity is the sole lever for efficiency. In the past, BSW's strategy was to focus on productivity, which led to cost efficiency. Today it concentrates on productivity without forgetting the focus on cost management. This is especially important in bad economic times such as today, when strict cost and cash management is crucial for the survival of a company.

Productivity management means control of operational key figures such as consumption (energy, gas), productivity and equipment data. Cost management covers the fixed and variable conversion costs.

The results led to four types of efficiency:

- the follower;
- the midfield;
- the best performer; and
- the cost performer.

An examination of the results shows a wide range of productivity and cost. The key indicator for productivity in the meltshop is described by tonne per hour and not heats per day. By doing so neither tap weight nor transformer capacity are considered, as neither cost nor market take them into account. Fortunately BSW is among the top performers.

Also regarding conversion cost, BSW belongs to the Best Practice group. But there are also other steelmakers in the same range. For the comparison the alloys are excluded. The cost/productivity portfolio (**Fig 1**) shows the four types of performance and clearly indicates the Best Performer with highest productivity and lowest cost – and our own steel plant is also considered to be part of that group. But a group of steelmakers reach the same cost level with much lower productivity (Cost Performer).

A more detailed analysis found that plants in the Asia/Pacific region have a cost advantage compared to companies from other regions (**Fig 2**). Companies from North America have a significant cost disadvantage. Especially in times of an economic downturn this could dramatically threaten the viability of a company.

Challenges

We believe there are five challenges facing the steel industry as listed previously.

Qualified personnel

People are very important, but in most regions of the world there is a 'war for talents'. This war is caused by three reasons:

- The demography of the society in which pro duction units are based. In most industrialised countries people are not only becoming older, but low birth rates also lead to a lack of young people within the society. So the demographic factor makes it difficult to recruit beginners.
- The steel industry is unattractive as an employer. It is seen as an old economy; dirty, noisy and hot. It has a reputation of having very inflexible structures and hierarchal systems.
- There is a lack of skilled personnel, and this is also valid for all levels of hierarchy. In many countries there are not enough engineers university degree educated to meet demand, and this applies particularly to metallurgists. Countries and companies no longer provide education facilities for skilled workers. Fortunately Germany is doing this. The backbone of German manufacturing industry is certainly the high level of education of the shop floor workforce.

It is important to have a skilled and motivated workforce. This can also be seen from our

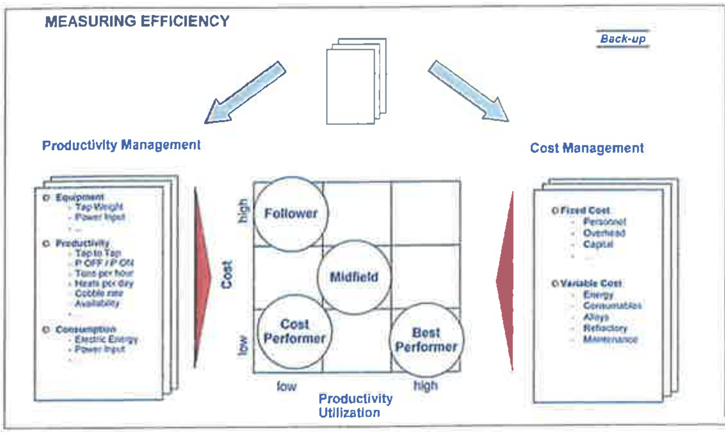

Fig 1 Cost-productivity portfolio

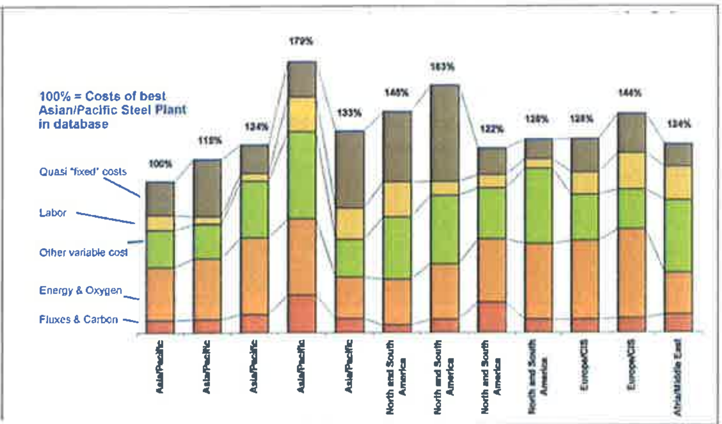

Fig 2 Cost benchmarking of meltshop within regions

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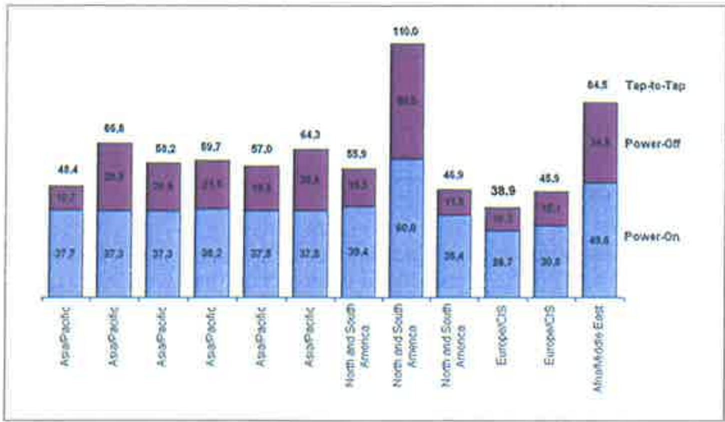

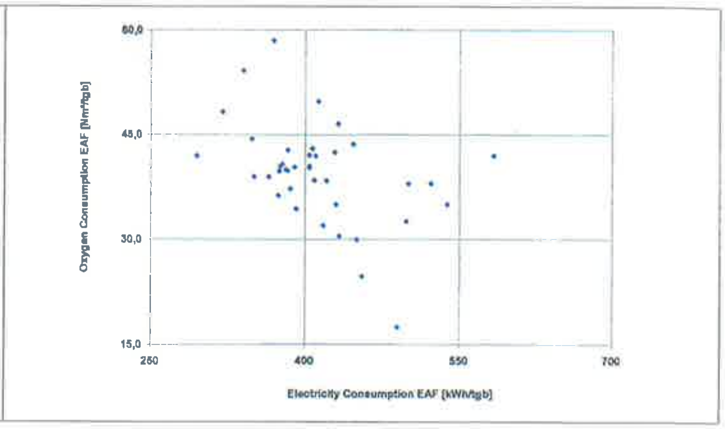

Fig 3 Tap to tap time of EAFs between 75t and 120t tap weight (min/heat)

Fig 4 Electrical and oxygen consumption

Best Practice database, in which the skill level of the meltshop is compared with the power-off times per heat. The trend is clear – the higher the skill level, the lower the power-off time.

In order to cope with the situation BSE is developing the BSE Academy, which is based on experience of the demand of education on different levels of responsibility.

- The operator level is trained in some theoretical background such as basic metallurgy. But the main focus is hands-on training for better skills in the fields of productivity, operations, maintenance and teamwork – transmitted and practically shown in our plant from steelmaker to steelmaker.
- The supervisor level receives practical training in management methods. Classes on how to take over responsibility and how to coordinate within this responsibility are also provided.
- Management training contains lessons in how to apply a company's culture, or if required how to change or develop it. Leadership skills are presented in a theoretical course followed by role plays, video recording and mutual analysis.

Operational efficiency

How does a company achieve operational efficiency without neglecting a strict safety management to avoid accidents? To improve the operational performance of a mill, two factors need to be considered:

- Technology and Equipment; and
- People

Both factors need to be managed successfully. Compare the tapping weight with the achieved productivity of the furnace types in the database. A higher tap weight does not automatically lead to the best performance. The power-on time is mainly equipment- and technology-driven, whereas the power-off time depends on optimised and standardised processes and qualified personnel. As shown in **Fig 3** there are only three plants, which are able to run the EAF with a power-off time of less than 12 minutes/heat.

In order to achieve such a performance BSW applies the following factors:

- continuous qualification of the workforce by training and hiring skilled workers;
- standardisation of processes (setting standard times, as well as monitoring and improving the single process steps continuously); and
- creation of a productive working environment by applying the right human approach (on the spot management, clearly defined ambitious targets, involvement of the work force in the change process).

In our opinion it is the daily task of management to apply these factors, so that the workforce is able to perform at its best.

Other potentials for operational optimisation is investing in the right technology and fully exploiting the possibilities of the equipment. For instance, not every plant is fully using the available EAF-transformer power. Also, regarding chemical energy input eg oxygen, a large spread of different performances is observed, which shows potential for improvement. Most plants have an electricity consumption of 380-430KWh/tgb and an oxygen consumption of 35-40NM^3/tgb (**Fig 4**).

Exploiting profit opportunities

The steel industry has become financially attractive. The profit of the steel industry measured in Return on Assets is the same level as other primary industries. This was not the case five years ago.

Increased pressure from shareholders to meet profitability targets is now observed. Not only does M&A require capital, but also the nature of steel making requires a significant share of capital cost. Companies are not only in competition with other steelmakers but also in a competition for capital. And both will certainly remain the case. Fortunately there are a lot of unexploited profit opportunities in every steel company.

Most steel companies are similar: between the different departments there are 'departmental walls', which means each department follows its own interests without being aligned around a common company goal. This leads to conflict and wastes money. For example, the purchasing department should always purchase at the lowest possible price, while the production department is responsible for keeping production running a high productivity and yield. In order to achieve a high productivity the right materials in the right quality are required. If this is not the case, the impact can be tremendous eg in the performance related to lime quality (**Fig 5**).

There is another departmental wall between the production and sales departments due to different ways of measuring the efficiency of products. While sales people are only looking at the margin of products ($/t) the production people look at the productivity (t/h). Unfortunately products with an attractive margin for sales people are usually the bad performing products for the production people with a low yield and productivity. In order to overcome this problem BSE/BSW is applying an advanced approach to measure the profitability of products and customers. It is called the 'profitability performance' approach, which takes both sales and production views into consideration. The goal is to break the departmental walls and align all departments around a common goal to increase the profit of the company.

Raw material management

When scrap is used as a major raw material for minimills, an increase in consumption is observed at the same time as an increase of crude steel production, which is not a surprise. But consumption of other raw materials such as iron ore, carbon or alloys also increases. Growth in crude steel production goes hand in hand with rising raw material consumption making it an even more precious goal. Coming back to the example of scrap, a huge growth has taken place in the Asia-Pacific region, which is a scrap- importing region. Consequently transportation of raw material over long distances must be managed and the transportation cost has increased tremendously too. The same is certainly valid for other raw materials. This results in differences of raw material cost in different regions of the world, meaning that the selection of raw materials for a minimill is a local issue. An advantage of the EAF route is the flexibility of raw materials fed to the process. The choice of the correct raw material is decisive for the profitability of a minimill and depends on the individual situation. As the situation can change, the correct choice of raw material needs to be adapted. Today there are four major sources for raw materials: scrap, purchased sponge iron, sponge iron produced at site and hot metal produced for example in a mini blast furnace mainly in India, Brazil, China and Taiwan. As always, each raw material has its advantage and disadvantage regarding availability, cost and impact on the process steps. Therefore it is crucial to have a deep understanding of the pro's and cons of each raw material to select the right mix concerning availability, price and impact on the process steps.

Environmental protection

A main consideration for success is the field of environmental protection. Owners and operating organisations are obliged to comply with requests for reduction of carbon dioxide, organic and inorganic compounds and heavy metals. BSW applies a two-way strategy to these topics. It applies the best available technology in order not to become subject to sudden and unexpected political pressure. There is ▸ 6

Improving business processes to cut costs and raise efficiency and Optimising corporate finance to ensure sustainable development.

Valery Draganov, First Deputy Chairman of State Duma of Russian Federation reviewed the latest activities in an improvement of the investments climate and developments on modernisation of the Russian economy.

Frank Rittner of Interpipe (Ukraine) introduced Interpipe as a producer of 1Mt of steel pipes and forged railway wheels (200kt) in 2008, which earned a total revenue of $2bn. He also spoke on vertical product integration and the system of continuous improvement (SCI) which allows Interpipe to improve the quality of products and effectiveness of production at the mills.

Andrey Emchenko, Deputy General Director of Donetsksteel (Ukraine) reported on the use of coal dust as a fuel (CDF) injected into the blast furnaces. The Donetsk Metallurgical Plant was put into operation in 1980 making it one of the first in the world and Europe's first commercial plant for preparation and injection of coal dust fuel to the blast furnace. After rebuilding the Donetsksteel blast furnace in 2002 it is in operation once again and today has achieved the following results:

- Coke consumption - 390kg/thm
- CDF = 171kg/thm, natural gas = 0.

Blast furnace productivity per 1m^3 (BF No 2) from this furnace averages 27t/m^3/day (the average across Ukraine is 1.5t/m^3/day). In Ukraine, the installation of CDF has also started at Alchevsk Plant, MK Zaporizhstal and MMK, according to Ilyich.

Sergey Sitnikov of Baker & McKenzie saw the carbon finance debate giving the ability to attract investment and improve energy efficiency in the steel sector. There are two basic mechanisms of trading greenhouse gases:

- In accordance with the Kyoto Protocol as Joint Implementation (JI);
- Outside of Kyoto Protocol Trading there are 'voluntary emission reductions' (DSVs).

In Russia, according to some official Government documents (No843, dated 28 October 2009 and No485, of 23 November 2009) the competitive selection for JI is carried out by Sberbank on the basis of applications filed. Ministry economic developments RF approves selected projects.

Prof Leonid Shevelev, Vice-President of the Russian Union of Metal Exporters, presented a report on improving the energy efficiency of steel production to reduce carbon costs. He talked about a few very effective technologies for steel melting and blast furnaces.

They include: replacement of open-hearth furnaces by EAF, replacement of solid pig iron by synticom (an ore-pig iron product) as a feed to EAFs and BOS converters, the injection of hot reducing gases to the blast-furnace for recycling and melting of cast iron in a blast furnace.

Rufat Alimardanov is a Principal Investment Officer of the International Finance Corporation. He heads IFC's business development in the manufacturing and services sectors in Central & Eastern Europe. He talked about IFC knowledge on project finance for sustainable development. IFC's priorities in Russia include: energy-efficient investments in the manufacturing and housing sectors, hi-tech post-crisis support to the banking sector and infrastructure development.

Carla C Jakoby of West LB bank (Germany) presented a brief portrait of this bank and talked about structured finance of the mining and metals sector.

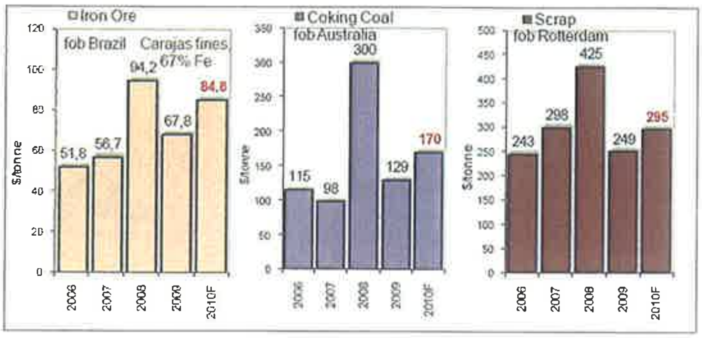

Fig 3 Global raw material costs by year (US$/t)
Source ISSB & UPE

Raw Materials

The final Session 7 chaired by Aydin Jebrailov of Macleod Dixon was on a Spotlight on raw materials: iron ore, scrap, coal. Three specialists reviewed this topic. Sergey Frolov of Industrial Metallurgical Holding reviewed key developments in the Russian raw materials markets for the steel industry covering iron ore, pig iron, scrap and coke markets in Russia. Alexander Andreev, Deputy Director of Raspadskaya coal mine, presented analysis of the Russian coking coal and coke market. Raspadskaya is a leading coke producer in Russia with a 17% share of Russia's production in 2009.

Victor Kovshevny of Rusmet reviewed the scrap market in Russia covering its history, the current situation and future development. ■

Diary date

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constant communication with the public and institutions. It also has the Environmental Management and Material Flow Management systems which report any waste.

Best practice

Benchmarking and the Best Practice database are a good starting point to compare the performance of a plant with others and to discover areas for improvement. There are five challenges, which must be managed by the steel industry:

- Qualified personnel;
- Operational efficiency;
- Exploiting profit opportunities;
- Raw material management; and
- Environmental aspects.

Being proactive was a successful strategy at BSW. BSW is a producer of reinforcing steel (bar & wire rod) and is a market leader in Germany.

The core aim of the group is in serving the European civil construction industry by producing every steel product which goes into concrete. The group is structured into three branches: steelmaking, wire processing and technology & consulting. The steelmaking facility is located in the south west of Germany delivering bar and wire to the wire processing plants, which also act as distribution centres. Their location is close to the main construction activities and consequently, close to the place of final product application.

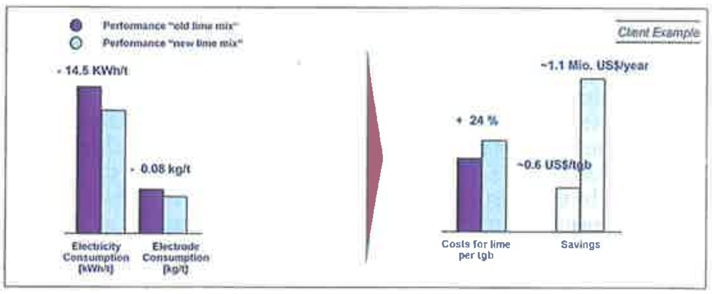

Fig 5 Purchasing strategy must take into account steelmaking requirements

BSE belongs to the consulting and technology branch. Its aim is to serve the international community of minimills by increasing their efficiency and reducing their overall operating cost.

The steelmaking facilities are made up of an EAF melt shop with two 90t EAFs equipped with 90MVA transformers, an average tap-to-tap time of 38.9 minutes per heat and a productivity of 287t/h for both furnaces, having produced over 2.2Mt of billet in 2008.

The single line bar mill is equipped with BSE multi slit rolling technology and operates with an availability of 87.7% of the production time. The finishing speed is 10m/s. In 2008 BSW reached an average productivity of 87.8t/h. The two strand wire rod mill can go up to 95m/s finishing speed and shows an availability of 89.6%, which results in an average productivity of 180.8t/h.

The company is aiming for further productivity increases in the next few years. ■

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